
# City of Cortland

## Climate Action Plan

JULY 25, 2014

# A MESSAGE FROM THE MAYOR

Climate Change. Global Warming. Greenhouse Gas Emissions. Sustainability. These are terms we hear on the national news – issues that have been the topic of heated debate in recent years, across the country and around the world. Cortland is a small rural community, surrounded by dairy farms and hardwood forests. Like other cities throughout upstate New York, Cortland is facing a host of problems: aging infrastructure, limited industry, a shrinking tax base and high unemployment. At this time, our most significant environmental problem is periodic flooding. Under the circumstances, some might argue that our attention and limited resources might better be applied toward addressing issues other than those associated with changing weather patterns … that a small city like ours cannot hope to make an impact on such global problems.

It's understandable that people might think this way, but it's also shortsighted and fails to recognize the city's interdependence with our county and region. This same faulty logic might lead us to conclude that some of the other problems facing the city are beyond our ability to influence. This is simply not the case. Cortland is a small community but not one without resources. We are well positioned geographically, surrounded by beautiful countryside. We are big enough to support essential amenities, yet small enough to have escaped some of the problems associated with much larger urban centers.

Our challenge is to reject "all or nothing" thinking, capitalize on our assets and approach the problems facing our community in a forward thinking, creative and resourceful manner. We also need to be practical. Viewing climate-related issues through such a lens allows us to see our situation differently.

This document and its companion appendix reflect this positive, ambitious but practical perspective. They are rich in valuable data, gathered purposefully over an extended period, then translated into strategies applicable to Cortland. This Climate Action Plan is the product of thousands of hours of research and analysis that identified potential options for addressing climate-related issues at a local level. Ideas generated in this fashion were then reviewed and evaluated by the City's Environmental Advisory Committee, with additional input from local experts. The Plan was then reviewed by City Council, who solicited further comments from the general public.

During this same period, the City embarked on a demonstration project involving upgrades to the municipal Wastewater Treatment Plant, made possible, in part, by a creative partnership with a regional dairy that selected our area as the site of a multi-million dollar Yogurt manufacturing facility. One of the central components of this demonstration project – and the Climate Action Pan as a whole – is energy efficiency. By using less energy and getting more out of the energy we do use, the Cortland community will reduce greenhouse gas emissions; thereby, making a positive contribution to combating climate change. These same strategies will reduce costs and improve our quality of life – a Win-Win endeavor.

This Climate Action Plan contains initiatives to be taken by city government as well as others that depend on broad community participation. It is intended as a blueprint to guide policy and programs. But it should also be viewed as a work in progress – to be reviewed periodically and amended on the basis of experience and to take advantage of developing opportunities. It can and will serve as an important tool in our ongoing efforts to make the City of Cortland a vibrant, healthy and attractive place to live.

Sincerely,

Mayor Brian Tobin

1890 House, Cortland

## ACKNOWLEDGEMENTS

The City of Cortland wishes to thank the following community members, organizations, and staff for their contributions to developing this Climate Action Plan.

## CITY OF CORTLAND

Honorable Brian Tobin, Mayor

Bruce Adams, Chief Operator of Wastewater Treatment Facility

## ADVISORY COMMITTEE

City of Cortland Environmental Advisory Committee (EAC):

Anna Bennett, Adam Davison, Virginia Levine, Donna Lieberman, Frank Kelly (Chair), Judd Olshan, Nancy Rongo & former members Ralph Hesse, Denise Hotchkiss, Ron Powell, Sara Watrous

## CNY REGIONAL PLANNING AND DEVELOPMENT BOARD

Chris Carrick, Energy Program Manager

Sam Gordon, Senior Planner

Anne Saltman, Principal Planner

Amanda Sopchak, Planner

Stefan Lutter, Intern

## COVER PHOTO COURTESY OF THE CORTLAND STANDARD

# A NOTE FROM THE CENTRAL NEW YORK REGIONAL PLANNING AND DEVELOPMENT BOARD

This Climate Action Plan document was prepared for the City of Cortland by the Central New York Regional Planning and Development Board (CNY RPDB), a public agency that was established in 1966 by Cayuga, Cortland, Madison, Onondaga, and Oswego Counties under the provisions of Article 12B of the New York State General Municipal Law. The CNY RPDB provides a comprehensive range of services associated with the growth and development of communities in Central New York with a focus on the following program areas: Energy Management, Community Development, Economic Development, Environmental Management, Information and Research Services, Intergovernmental Coordination, and Transportation Planning. The CNY RPDB provided services to this project under the auspices of the United States Environmental Protection Agency's Climate Showcase Communities Program and the New York State Climate Smart Communities Program.

The purpose of this document is to: (1) gather information on emission reduction projects and programs already being undertaken in the City; (2) give public officials, community leaders, and residents the information and support that is needed to advance sustainable programs in their communities; (3) identify opportunities for new emission reduction programs and initiatives; and (4) engage and encourage local participation in greenhouse gas emission reduction strategies.

The City of Cortland Climate Action Plan is not intended to provide precise information about the potential emission reductions that can be achieved by specific recommendations, and cannot be used as a substitute for thorough project or program planning. Instead, this document provides estimates of emission reductions that are meant to help public officials, community leaders, and residents better decide which actions may be worthwhile for the community to pursue in the coming years. As such, this document is not meant to be fixed or prescriptive, but rather fluid and flexible.

# CONTENTS


2 A MESSAGE FROM THE MAYOR
3 ACKNOWLEDGEMENTS
6 ACRONYMS EXPLAINED
7 FRAMEWORK FOR LOCAL CLIMATE PROTECTION
9 INTRODUCTION
11 POTENTIAL IMPACTS OF CLIMATE CHANGE WITHIN THE CITY OF CORTLAND
19 CLIMATE ADAPTATION
20 CLIMATE ADAPTATION RECOMENDATIONS FOR THE CITY OF CORTLAND
22 WHAT CAN BE DONE IN CORTLAND?
23 WASTEWATER TREATMENT FACILITY UPGRADES AT A GLANCE
24 GHG INVENTORY SUMMARY
26 STRATEGIES OVERVIEW
30 TRANSPORTATION
32 ENERGY EFFICIENCY
34 WASTE
35 NATURAL RESOURCES
36 LAND USE
42 STRATEGY IMPLEMENTATION CHART

# Acronyms Explained

**Btu and MMBtu:** British Thermal Units and Millions of British Thermal Units. A Btu is the amount of energy needed to cool or heat one pound of water by one degree Fahrenheit, and MMBtu represents 1 million Btu.

**CAFE:** Corporate Average Fuel Economy. CAFE standards have been set by the federal government for the years 2016 and 2025.

**CAPPA:** Climate and Air Pollution Planning Assistant. CAPPA is a tool provided by ICLEI – Local Governments for Sustainability to help local communities assess the effectiveness of certain emissions reduction strategies in their communities. CAPPA is the tool that was used for all of the calculations in this document.

**CNY RPDB:** Central New York Regional Planning and Development Board. The CNY RPDB is a public agency that provides a range of services associated with the growth and development of communities in Cayuga, Cortland, Madison, Onondaga, and Oswego Counties.

**GHG:** Greenhouse Gas. Greenhouse Gases are gases in the Earth's atmosphere, such as water vapor, methane, carbon dioxide, and nitrous oxide, that allow sunlight to enter the atmosphere but also trap heat in the atmosphere, causing rises in Earth's atmospheric temperatures.

**ICLEI:** ICLEI-Local Governments for Sustainability is a non-profit organization that provides tools to local governments to assist with greenhouse gas inventories and climate action planning.

**kW:** Kilowatt. kW is a unit of power equal to 1,000 watts.

**kWh:** Kilowatt hour. A kilowatt-hour (symbolized kWh) is a unit of energy equivalent to one kilowatt (1 kW) of power expended for one hour (1 h) of time.

**$MTCO_2e$:** Metric Tons of Carbon Dioxide Equivalent. $MTCO_2e$ converts the warming potential of each greenhouse gas (i.e. carbon dioxide, nitrous oxide, methane, etc.) into one measurement.

**NYSERDA:** New York State Energy Research and Development Authority. NYSERDA is a public benefit corporation created in 1975. Its goal is to help New York meet its energy goals of reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment. NYSERDA offers a variety of incentive programs to help New York residents achieve these goals.

**PV:** Photovoltaic. Solar PV systems convert sunlight directly into electricity.

**VMT and DVMT:** Vehicle Miles Traveled and Daily Vehicle Miles Traveled. Vehicle Miles Traveled (VMT) is the total number of miles driven by all vehicles within a given time period and geographic area. It is used by regional transportation and environmental agencies for planning purposes. VMT is influenced by factors such as population, age distribution, and the number of vehicles per household. However, the greatest factor by far is how land uses are arranged. Daily Vehicle Miles Traveled (DVMT) is the total number of miles driven by all vehicles within a geographic area in one day.

# FRAMEWORK FOR LOCAL CLIMATE PROTECTION

## Climate Showcase Communities Program

The US Environmental Protection Agency (EPA)'s Climate Showcase Communities Program is designed to assist local governments in creating community-based greenhouse gas reduction projects related to energy production, residential and commercial energy efficiency, waste management, transportation, and land use. The goal of the program is to pilot projects that are replicable and cost-effective so that communities can reduce greenhouse gas emissions while improving environmental, economic, and social conditions. There are currently 50 communities throughout the US that are participating as part of the Climate Showcase Communities Program. CNY RPDB was selected as an awardee of the program, receiving $497,793 in federal funding for their Climate Change Innovation Program (C2IP).


## Central New York Climate Change Innovation Program

Through the Climate Change Innovation Program (C2IP), CNY RPDB is working with 7 municipalities to conduct GHG emission inventories, develop Climate Action Plans, host community engagement events, and implement clean energy demonstration projects. Each municipality was provided $30,000 in order to implement demonstration projects (Cortland's Wastewater Treatment Facility upgrades) or to complete feasibility studies for clean energy projects. The C2IP began in February 2010 and was completed in December 2013 with the creation of DRAFT Climate Action Plans.


In order to participate in the program, Cortland agreed to:

+ Follow the 5 Milestone Process established by the Cities for Climate Protection campaign administered by ICLEI-Local Governments for Sustainability, which includes completion of a GHG inventory and completion of a Climate Action Plan
+ Adopt the Climate Smart Communities Pledge, which is a voluntary program administered by the NYS Department of Environmental Conservation (DEC) whereby communities pledge to reduce GHG emissions and subsequently receive notification of state and federal assistance to help them adopt technologies and programs by which to do so
+ Become a Pledge Driver for the US EPA's "Change the World, Start with Energy Star" campaign, which challenges people to make energy-efficient choices in their households and communities


CENTENNIAL OFFERING OF
CORTLAND COUNTY
TO THE MEMORY OF THOSE
WHO FOUGHT IN DEFENSE
OF THE UNION.
1861. 1865.


CITY HALL

# Introduction

## What is Sustainability?

***Sustainability*** *is commonly defined as meeting the needs of the present without compromising the needs of future generations.*

Sustainability means meeting the needs of present generations without compromising the ability of future generations to meet their own needs. By following the sustainability goals outlined in this document, the City of Cortland strives to become a more sustainable community so that both present and future generations will be able to meet their needs.

Sustainability is based on the principle that water, materials, and resources necessary for survival and well-being are all dependent upon the natural environment. Sustainability allows for the social, economic, and other requirements of present and future generations to be met by creating and maintaining the conditions under which humans and nature can exist in productive harmony. [1]

### Developing the Plan

Cortland's Climate Action Plan was developed with staff resources provided by CNY RPDB, working in conjunction with the City's Environmental Advisory Committee (EAC) – a committee made up of city residents that reports to the Mayor and Council, which acted as an Advisory Committee for the project. CNY RPDB hired interns specifically to analyze energy and emissions reduction strategies for the city utilizing data from the GHG inventory report. CNY RPDB provided information and suggestions to the advisory committee as to which energy efficiency strategies would be most successful in the city, how many $MTCO_2e$ the strategies would prevent, co-benefits of the strategies, and other case studies explaining where the strategies have been implemented successfully. They also provided information about cost of implementation, possible funding sources, and payback period for the strategies. The Chief Operator of the City's Wastewater Treatment Plant – site of the City's most ambitious initiative under this plan – acted as senior staff liaison to the EAC and CNY RPDB for this project. Additional input was solicited from other sources of relevant local expertise, including SUNY Cortland. **For more information on how the strategies were developed, including assumptions, references, and possible economic savings, refer to Appendix A: Action Strategy Summary Document.**

It is anticipated that some additional refinements will be made as a result of this process. This Plan should also be viewed as a dynamic

1 http://epa.gov/sustainability/basicinfo.htm#sustainability

### Thinking Sustainably: New College at Oxford Example

**Founded in the late 1300s, New College at Oxford was built with enormous oak beams in the great dining hall. In the late 1800s, the beams were discovered to be infested with beetles. The College Council was concerned when they heard the news; where would they be able to find oak beams of that size and caliber to replace the beetle-infested ones?**

**They decided to look into what types of trees were growing on the College lands to see if there were any oaks that could be used to replace the beams. Due to sustainable forestry practices, there were.**

**Planting stands of mixed broadleaf trees, like oak, hazel, and ash, is standard practice for sustainable woodland management. The hazel and ash are harvested every 20-25 years, while the oaks are left for 150 or more years to grow large so they can be used in major construction work, such as beams for example.**

**New College was able to replace their beams using the oaks that had been growing on their lands for over 100 years for that exact purpose. They continue to grow many oaks on their land so that 150 years from now the beams can be replaced again.**

## Projected Climate Impacts in the Northeast

**Temperature:** Average temperatures across the Northeast have risen more than 1.5 degrees Fahrenheit since 1970, with even more significant changes in average winter temperatures, rising 4°F between 1970 and 2000.

**Precipitation:** The Northeast region is projected to see a 20 to 30% increase in winter precipitation, and, due to increases in temperatures, less winter precipitation will fall as snow and more will fall as rain.

Additionally, heavy, damaging rainfall events have already increased measurably across the Northeast in recent decades. For example, Hurricane Irene and Superstorm Sandy brought intense rains to the region in 2011 and 2012, causing widespread flooding.

**Drought:** Rising summer temperatures coupled with little change in summer rainfall are projected to increase the frequency of short-term (one to three month) droughts in the Northeast, therefore increasing stress on both natural and managed ecosystems.

Source: US EPA

http://www.epa.gov/climatechange/impacts-adaptation/northeast.html

"work in progress" – a serious and thoughtful blueprint for guiding both policy and projects, but one that recognizes that the science associated with climate change, energy, and GHG emissions is constantly evolving – as are local conditions. Therefore, the most effective Climate Action Plan will be one designed to take advantage of these changes and one that also allows for additional modification based on experience.

### Implementing the Plan

In order to implement the strategies in this plan and achieve Cortland's sustainability goals, the plan should be implemented with the help of the City's Environmental Advisory Committee (EAC).

Progress towards the Climate Action Plan's goals can be measured over time by conducting subsequent GHG emissions inventories. Future inventories can be compared against the baseline year of 2010 to determine progress.

### What is climate change?

Global concern with climate change is primarily focused on the amount of greenhouse gases in the atmosphere. Greenhouse gases, such as carbon dioxide, water vapor, and methane, among others, are an essential part of our atmosphere, and they serve a vital role in making our planet warm enough for life.

Greenhouse gases trap energy (in the form of long wave radiation) that is being emitted by the Earth, reflecting it back into the atmosphere to warm the planet. As the amount of carbon dioxide in the atmosphere has increased or decreased over time, the planet's temperature has changed in roughly the same proportion.

Scientists have determined this relationship by studying Antarctic ice core samples that reveal the atmospheric carbon dioxide from 400,000 years ago to present day. Right now there is more carbon dioxide in the atmosphere than at any time in history, as measured by these samples,[2] and further atmospheric testing shows that we have extended to 402ppm atmospheric $CO_2$[3], which is well above any other measure in time.[4] Scientists expect that this will lead to a gradual warming of the planet in most areas.

2 Visit http://www.antarctica.ac.uk/press/journalists/resources/science/ice_cores_and_climate_change_briefing-sep10.pdf to learn more about the Antarctic ice core findings with accompanying graphs for temperature and $CO_2$.

3 According to the Scripps Institute and NOAA, Mauna Loa Observatory

4 In January 1998, the collaborative ice-drilling project between Russia, the United States, and France at the Russian Vostok station in East Antarctica yielded the deepest ice core ever recovered, reaching a depth of 3,623 m (Petit et al. 1997, 1999). The extension of the Vostok $CO_2$ record shows the present-day levels of $CO_2$ are unprecedented during the past 420 kyr. Pre-industrial Holocene levels (~280 ppmv) are found during all interglacials, with the highest values (~300 ppmv) found approximately 323 kyr BP.

## Potential Impacts of Climate Change within the City of Cortland

### ENVIRONMENTAL SETTING

The City of Cortland is located on a plateau formed by the convergence of seven valleys. It has 3.9 square miles of land and .04 square miles of surface water. The City, with a population of approximately 19,200, is the county seat of Cortland County. It is primarily flat and elevation throughout the area averages about 1,139 feet above sea level.

Interstate Route 81 and State Route 281 are the major transportation routes in Cortland County. Land use activities along these corridors, especially agricultural practices and urban development, are influenced by potential impacts on groundwater resources and recharge areas. Most of the City is situated above the Federally-designated sole source Cortland-Homer-Preble aquifer. A high priority is placed on the protection of this groundwater resource which is used for public water systems, industry, and agricultural operations. The property called the City Water Works was designated as a NYSDEC Critical Environmental Area in 1989 in order to protect the aquifer. Groundwater withdrawals are primarily from unconsolidated aquifers consisting of sand and gravel deposited by glacial meltwater. The unconsolidated aquifers serve as drinking water supplies to the City population as well as 90% of the Cortland County population.

Primary surface water resources in the City include the Tioughnioga River, and Perplexity, Dry, and Otter Creeks which are part of the Susquehanna River drainage basin. The Tioughnioga is comprised of the East and West branches, which merge in the City. Most of Cortland is situated on rapidly permeable, well-drained soil but drainage problems exist in the northern sections of the City that are underlain by deep gravel deposits and a high groundwater table. Flooding is common occurrence along Dry and Otter Creeks.

Surface water resources in the City of Cortland are all part of the Susquehanna River Drainage Basin which is one of the most flood-prone watersheds in the nation. The basin also experiences severe droughts which occur about once every decade. The U.S. Geological Survey (USGS) maintains a network of rain, stream, and groundwater gages throughout the basin in order to monitor hydrologic conditions and provide data for flood management decisions.

Nearly 40% of the land use within the City border is classified as residential property and 16% is classified as commercial. Additional land use categories are summarized in Figure 1.

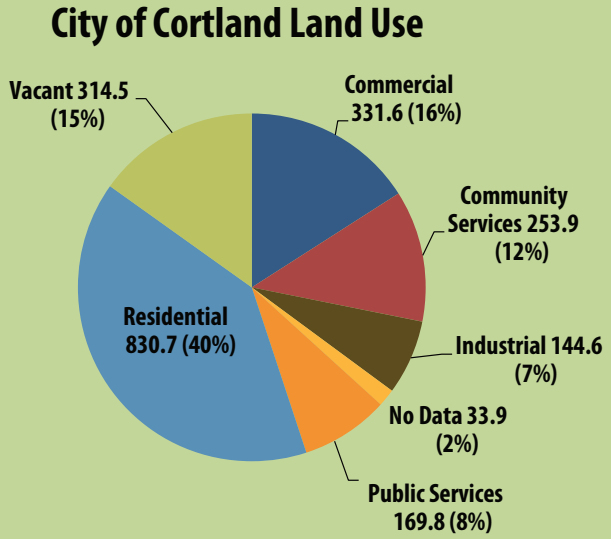



Figure 1- City of Cortland Land Use Breakdown

### GLOBAL WEATHER EXTREMES

Many areas throughout the country are experiencing dramatic weather extremes. A primary influence on wind and precipitation variability can be attributed to the natural climate cycles of El Nino and La Nina that originate in the equatorial Pacific region. The cycles influence the direction and characteristics of jet streams, causing them to meander in the northern and southern hemispheres. The heat and water vapor that enter the atmosphere influence weather patterns around the globe.

Another significant influence on weather patterns can be attributed to human activity. The long-term accumulation of greenhouse gases in the atmosphere is trapping heat and increasing temperatures in both terrestrial and water ecosystems. The average surface temperature worldwide has increased approximately one degree Fahrenheit in the past four decades . Arctic sea ice has lost approximately 40% of its summer sea ice since the 1980s and autumn ocean temperatures

have risen 3.6 to 9°F. As the ocean temperature increases, more moisture is released into the atmosphere. During the past twenty five years, scientists have measured a 4% average rise in water vapor in the air column which is increasing the potential for strong storm events.[5]

## NEW YORK STATE AND LOCAL CLIMATE CHARACTERISTICS

Central New York's climate is characterized by warm, dry summers and cold, snowy winters. The climate is influenced by topography, prevailing westerly wind direction, and proximity to Lake Ontario. Frost can be expected from early October until late May and the growing season is approximately 18 to 20 weeks long. Although serious droughts are rare, most growing seasons do experience limited periods of low soil moisture.

Flooding is a growing concern throughout New York State, especially with climate considerations and urban development. Although some areas are more prone to flooding than others, there is no area of the State that is exempt from flood hazards altogether. There are over 52,000 miles of river and streams in New York State and along their banks there are 1,480 communities that are designated as flood prone. An estimated 1.5 million people live in these flood prone areas and many more work, travel through, or use recreational facilities located in these areas.

5 National Geographic September 2012, "Weather Gone Wild"

Beaudry Park, Cortland

In 2011, the New York State Energy Research and Development Authority (NYSERDA) released a comprehensive assessment of the projected effects of climate change in New York State's critical systems and natural resources over the next century. *ClimAID: the Integrated Assessment for Effective Climate Change Adaptation Strategies in New York State* was compiled by more than 50 scientists and currently serves as an important tool for planners, policymakers, farmers, local governments and residents. According to this report, annual average temperatures in New York have risen about 2.4°F since 1970, with winter warming exceeding 4.4°F. Sea level along New York's coastline has risen about a foot since 1900. Intense precipitation and heavy downpours have increased in recent decades.

Cortland County experiences seasonable weather patterns that are characteristic of the northeastern U.S. Cyclonic system. Cold air masses affect the County's weather, often resulting in cold, snowy winters. During the summer and parts of spring and autumn, temperatures rise during the daytime and fall rapidly after sunset. Summer temperatures typically range from about 76°F to 81°F. Winter high temperatures are usually in the middle to upper 30°F, with minimum temperatures between 15 and 20°F expected. During most of the winter seasons, a temperature of -15°F or colder can occasionally be expected. Average annual snow accumulation is approximately 95 inches each year and total precipitation averages approximately 40 inches per year.[6]

Climate change will continue to influence Cortland through the gradual increase in air temperatures and an increasing frequency of extreme weather events. The increased occurrence of strong storm events will likely contribute to occasional flooding due to Cortland's flat topography in the northern portions of the City, and stormwater runoff and sediment loading remains an additional concern along local tributaries. City officials have committed to climate awareness and environmental protection by becoming a Climate Smart Community and have worked with the Central New York Regional Planning and Development Board (CNYRPDB) on projects associated with the Climate Change Innovation Program.

Local, national, and global efforts to decrease greenhouse gases such as carbon dioxide are needed now to avoid additional changes such as the increase in temperature and storm events, drought, and heat events.

6 City of Cortland All Hazard Mitigation Plan

The information found on the following pages is designed to help the City of Cortland plan for impacts on natural and economic resources, and is designed to assist decision makers in identifying opportunities to improve community resilience.

## EXTREME WEATHER EVENTS

Storm intensity is influenced by air temperature. As the air temperature rises, moisture in the atmosphere increases, which contributes to a greater intensity and frequency of precipitation events. Warming air temperatures, as seen throughout New York State, are caused by emissions of heat-trapping gasses in the atmosphere including pollution from fossil fuels. Warming air temperatures also cause higher levels of oceanic evaporation, which intensifies the water cycle throughout the globe. As a result, storm events in Cortland and around the globe are increasing in intensity and are characterized by stronger wind and higher levels of rainfall.

New York State experienced a 64% increase in extreme storm frequency between 1948 and 2011. The increased number of severe storms is expected to gradually continue, with 100-year storms likely to occur every 80 years by the end of the century. According to meteorologists, the total annual amount of precipitation has been changing, as well as the distribution and intensity of storm events.

Severe storm and severe winter storm categories received a hazard ranking of "high" in the City of Cortland's Hazard Mitigation Plan. The increasing frequency of strong storm events, localized flooding, stormwater runoff, and soil erosion will likely cause damage to roads, bridges, and other infrastructure in Cortland. The role of agencies such as the Cortland County Soil and Water Conservation District (SWCD) and the Natural Resource Conservation Service (NRCS) will become increasingly important in the coming years, especially in terms of their work with stream bank stabilization, erosion and sediment control, and stormwater management.

## RAIN AND SNOWFALL

As temperatures rise, more winter precipitation in Central New York is occurring as rain, resulting in a reduced winter snowpack. Rising temperatures and an earlier spring snowmelt is contributing to peak tributary flows that occur earlier in the year. This is expected to decrease runoff water later in the year, causing stress for ecosystems that depend on the availability of water during the summer. Much of the winter precipitation originates as snowfall and is stored as snowpack. Groundwater recharge in Cortland normally occurs during March and April snowmelt and this influx helps to maintain a high water table through early summer.

Projections for future precipitation rates are less certain, however, than projections for temperature. ClimAID analyses for New York State suggest that precipitation levels may increase, especially during the winter months, but the nature of this change is uncertain. According to climate models,

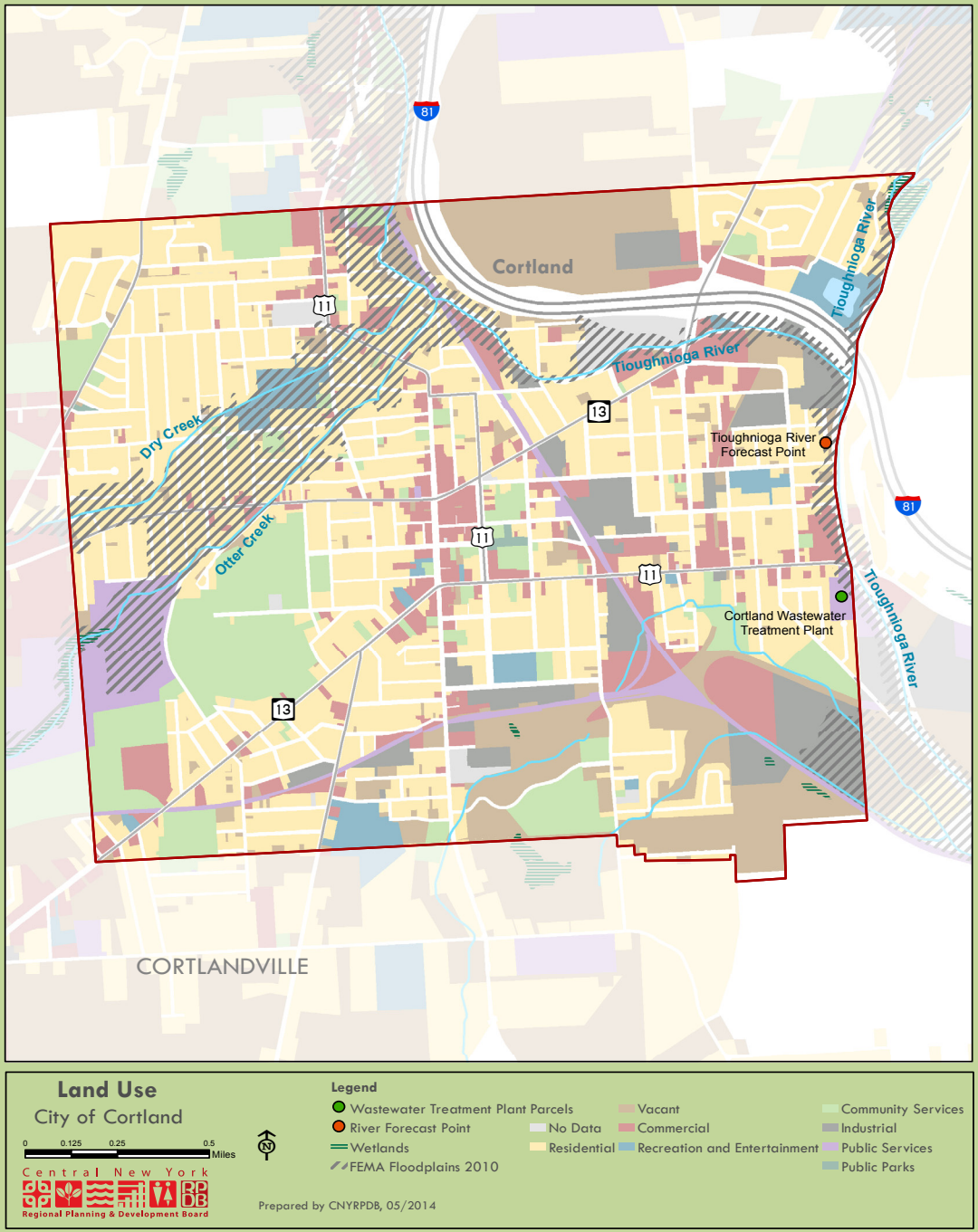
Flooding along Rt. 13, Cortland

changes in precipitation patterns may continue to produce heavier events with hotter and drier periods in between. By the end of this century, the length of the winter snow season in portions of New York State is predicted to be reduced by half.

## LAKE-EFFECT SNOW EVENTS

Cortland is influenced by lake effect snow, which is caused by a differential between cold air temperatures and warmer water temperatures found in Lake Ontario. As cold air flows over the warm water, the bottom layer of air over the surface of the water is heated from below. Since warm air is lighter and less dense than cold air, the heated air rises and cools. As it cools, the moisture from the lake condenses and forms clouds. When enough moisture condenses, snow bands develop over the region downwind of Lake Ontario. The greater the temperature contrast between the cold air and the warm water, the heavier the resulting lake effect snow fall will be. Because of the increased water temperature and reduced duration of ice cover on Lake Ontario, Cortland and other

## FIGURE 2: CITY OF CORTLAND LAND USE




areas to the east and south of the lake will continue to experience heavier and more frequent lake-effect snowfall events.

### FLOODING

Flooding in the Cortland area is influenced by weather conditions, groundwater levels, and urban development leading to impervious surfaces, compacted soils, and fewer vegetated acreage. These conditions limit groundwater recharge and increase surface runoff and flooding. According to the Federal Emergency Management Agency (FEMA), floods have caused a greater loss of life and property and have disrupted more people in the United States than the impact of all other natural hazards combined. In fact, FEMA reports that floods kill more people than any other form of severe weather with damages exceeding $3.5 billion annually. Further, with the exception of fire, floods are the most prevalent and widespread of all natural disasters. Approximately 75 percent of all presidentially declared disasters are the result of flooding.

The frequency of localized downpours in Central New York has increased over the past fifty years and this trend is expected to continue. Heavy precipitation events increase the potential for localized flooding and stormwater runoff. Heavy rain events also increase pollution loading to local water bodies and can decrease the efficiency of wastewater treatment plants. A storm in mid-March 2011 resulted in the worst flood event in Cortland County in 30 years.

The greatest potential for flooding in Cortland occurs in the early spring during periods of heavy precipitation, warming temperatures, and rapid snowmelt. Vulnerable regions in the City are located in low elevation areas along the Tioughnioga River and adjacent to Dry and Otter Creeks. Federal Emergency Management Agency (FEMA) flood zones that are displayed in Figures 2 and 3 are located in areas of moderate population density (1,500 to 15,000 persons per square mile) and high population density (greater than 15,000 persons per square mile). The designated flood zone located in the southeastern portion of the municipality creates less of a threat due to a lower population density of 150 to 500 persons per square mile.

Local flooding continues to receive federal and state attention. In response to severe flooding, President Obama signed the New York Disaster Declaration with federal aid to supplement state and local recovery efforts in Cortland and eleven other counties affected by severe storms and flooding from June 28th to July 4th, 2013. FEMA funds were made available to local governments and some nonprofit organizations on a cost-share basis. Funding was also made available for hazard mitigation measures across the state.

Assessed value refers to the dollar value assigned to a home or property by local government in order to calculate property taxes. According to tax parcel data from 2012, the total assessed value of property located within designated FEMA flood zones in the City of Cortland represents 16% of the total assessed value of parcels throughout the City. Of the 5,062 land parcels in the City, 17.6% are located in FEMA flood zones (Figure 2).

Cross Country Skiier, Cortland

## RECREATION

Climate change has the potential to negatively impact the area's outdoor recreation and may reduce recreational income generated for the local economy. In New York State, close to 15,000 people are employed in a field supported by winter tourism, and about $846 million dollars are added to the state economy each year by the winter tourism industry. [7]

Local ski areas in Central New York will be impacted by the shorter length of the winter season and the increasing variability of temperatures. If the duration and quality of the ski season declines, local retail stores and other businesses related to skiing, such as hotels used by visiting skiers, will be negatively affected.

Specifically in Cortland, there are 4 ski areas that could be negatively affected by climate change. In response to changing weather, these ski areas are already investing more heavily in snow production equipment as well as the energy used to run the equipment. This could increase operational costs and lift ticket prices for skiers, which may deter skiers from visiting local ski areas and decrease economic profits for the ski industry and Cortland as a whole.

New York State has an 8,000 mile snowmobiling trail system that also contributes to the local economy. Snowmobiling relies on natural snowfall which is forecasted to decrease with climate change. This has the potential to reduce business generated from retail stores and associated snowmobiling industries.

Fishing and canoeing (especially along the Tioughnioga River and its tributaries) are popular water-based activities in the Cortland area during the summer months. Higher air temperatures and a shorter duration of winter ice cover may increase surface water temperatures, which will likely cause a shift in coldwater fisheries. According to researchers at Cornell University, warming water temperatures may already be contributing to fish species modifications in Oneida Lake. Climate modification is thought to be causing an increased production of largemouth and smallmouth bass, gizzard shad, and other species near the northern extent

7 http://www.nrdc.org/globalwarming/files/climate-impacts-winter-tourism-report.pdf

of their range. Additionally, at the southern edge of their range, Burbot may be in decline. Brook trout, commonly found in New York State tributaries, are at risk due to changes in habitat resulting from climate change and the presence of invasive species.

The local warming trend is providing a longer growing season for agricultural crops and backyard gardens and is providing a boost to water-based recreation such as boating and swimming. However, the combined effect of warmer air and water temperatures and decreasing ice coverage will likely cause an increase in the growth of nuisance aquatic plants and algae which could cause recreational impairments.

## PUBLIC HEALTH

Changes in climate conditions are affecting human health. Health impacts of warming temperatures that have been documented throughout the country include increased illnesses and deaths from heat events, injuries and deaths from extreme weather events, and respiratory illnesses such as asthma due to changes in air quality.

Indirect health impacts of climate change include illnesses and deaths that result from climate related changes in ecosystems and infectious agents. Food, water, and animal-borne diseases affecting humans, livestock, and wildlife are governed by environmental conditions. Anticipated projections of warmer winters, hotter summers, and unpredictable precipitation patterns can cause increases in certain types of diseases. For example, climate change in the Northeast is expected to result in the increased population rates of mosquitoes and ticks. As the population of these insect increases, it could result in more frequent outbreaks of West Nile Virus and Lyme disease-causing bacteria.

## INVASIVE SPECIES

While insects and diseases are a natural part of the aquatic and terrestrial ecosystems, climate change is shifting pest populations and aggressiveness of some invasive as well as native species. Some warm-weather species that previously could not survive the cold are now able to establish themselves, threatening populations of native species. This is already occurring with increasing invasive species populations throughout New York State.

Early detection and a rapid response of new infestations of invasive species is the most effective way that the Cortland community can address this problem. The Hemlock Woolly Adelgid, Asian Longhorn Beetle and Emerald Ash Borer are invasive tree pests that are currently threatening Central New York. They have the potential to damage local tree populations and the communities and industries that rely on them. The destruction of hemlock in New England forests affects recreational activities such as fishing. As pests kill trees along cold water streams, shade is no longer provided, and stream water temperatures increase beyond what is ideal for trout.[8]

## RESPONDING TO STORM EVENTS IN THE CITY OF CORTLAND

**Hazard Mitigation:** In addition to weather patterns, impacts of future climate hazards in the City of Cortland will be influenced by geography, land use, and the dependability of green infrastructure and natural buffers. New York State communities have been encouraged to conduct vulnerability assessments in order to inform municipal officials of vulnerable populations, businesses, infrastructure and natural resources. Assessments also help to identify the best locations for future development or land acquisition. Cortland's assessment, *The Cortland County All-Hazard Mitigation Plan*, was completed in 2011 with assistance from national, state and local agencies. By identifying vulnerabilities and assessing local risks, the City of Cortland increased its capacity for planning for hazard avoidance and mitigation.

**Federal Assistance:** Federal assistance is occasionally available to Cortland County after major storm events. When major flooding occurred in New York State during July 2013, President Obama declared that a major disaster existed. The declaration meant that public assistance was available to state and local governments and certain private nonprofit organizations on a cost-sharing basis. The financial assistance covered emergency work and the repair or replacement of facilities damaged by the severe storms and flooding in Cortland and eleven additional counties. The declaration also made Hazard Mitigation Grant Program assistance

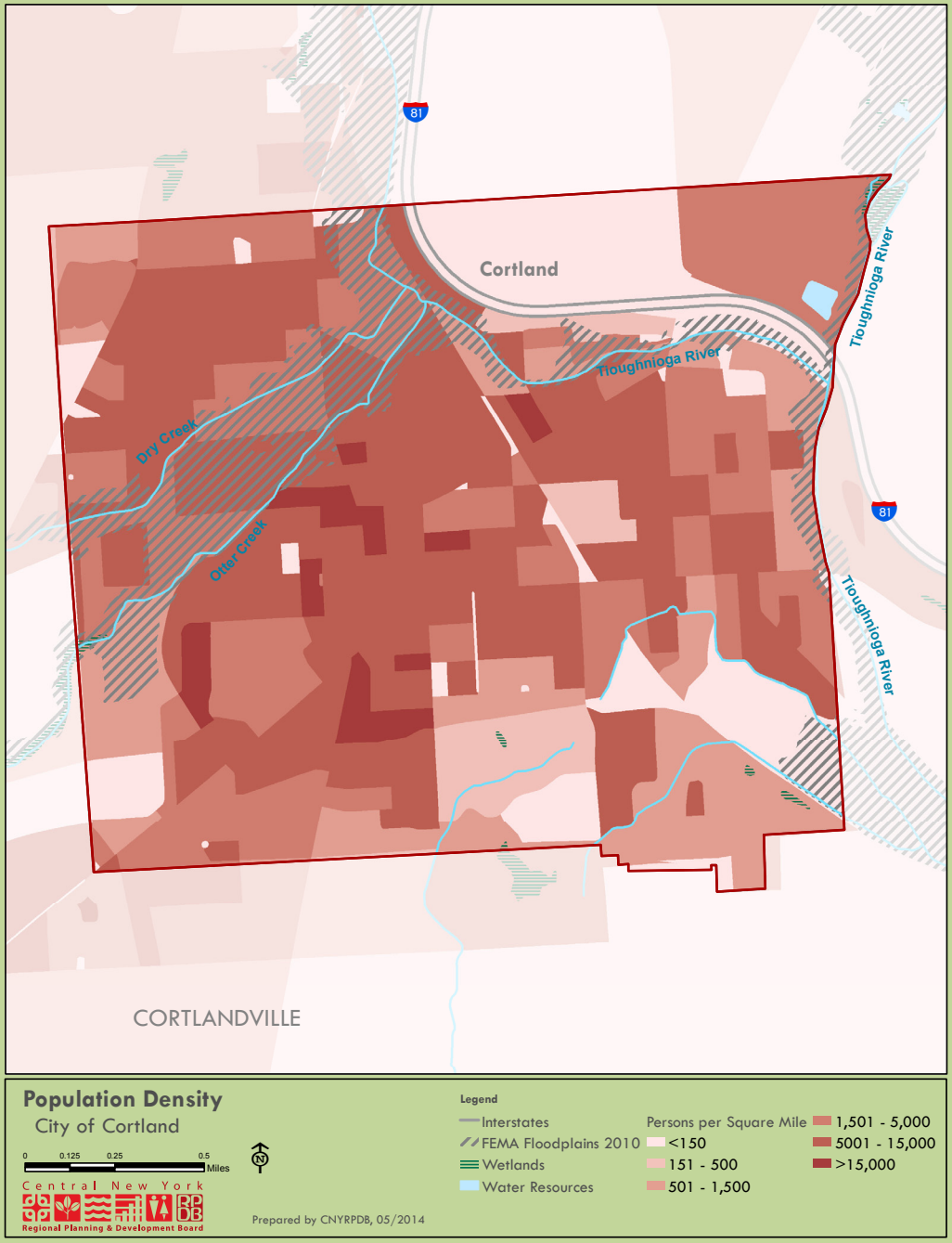
8 http://www.northeastclimateimpacts.org/pdf/miti/moser_et_al.pdf, p. 14

requested by the Governor available for hazard mitigation measures statewide.

**Legislation:** In response to the flood damage to homes, businesses, and infrastructure during 2013, Senator James Seward initiated plans for new legislation to address long-term flood recovery and mitigation in Cortland and neighboring counties. The proposal includes establishing a state flood and emergency relief fund, creating income tax credits when homes and businesses are damaged, a state task force to address flood concerns, and quicker reimbursement of state funds to local governments. His goal is to provide better preparations for future flooding, to avoid major destruction when possible, and to devise more effective response strategies when needed.

**Trees, Vegetative Cover, and Open Space:** The City of Cortland has maintained a municipal tree planting program since 1988 and has been designated as a Tree City USA. Trees provide a valuable benefit to the Cortland community by reducing flooding and erosion, providing wildlife habitat, creating carbon sinks, lowering temperatures in downtown areas during the summer months, and blocking wind during storm events. Trees and vegetative cover also provide valuable services related to soil stabilization, stormwater management, groundwater recharge, and pollution filtration. In addition, trees provide an economic benefit to Cortland and other municipalities, as they contribute to the overall aesthetic of the community, contribute to the character of the City, and make the streets more walk-

## FIGURE 3: CITY OF CORTLAND POPULATION DENSITY



able by shielding pedestrians from the sun, wind, and noise.

The Cortland County Soil and Water Conservation District sponsors two programs that promote tree plantings and maintenance. They hold a tree and shrub sale each year and provide seedlings to the public at a reduced cost. In addition, the Spruce Up America program brings teachers, students, parents, and community organizers together to improve the local environment by planting trees and encouraging forest management on community owned property.

**Local initiatives:** The Cortland County Soil and Water Conservation District (SWCD) develops erosion and sediment control plans, assists with stormwater facility permitting, works on streambank restoration to reduce erosion and sedimentation, and provides assistance in the identification of green infrastructure opportunities in the City of Cortland. Each year the SWCD sponsors erosion and sediment control courses that meet the requirements described by the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity.

The Natural Resource Conservation Service administers the Emergency Watershed Protection (EWP) program designed to help communities deal with watershed impairments that threaten lives and property. Most EWP work is for the protection of infrastructure from stream erosion.

Church Street, Cortland

The Tioughnioga River Local Waterfront Revitalization Plan contains information on the natural and built environment along the river. The document includes recommendations for a riverfront trail and water resource clean-up and preservation.

A flood control structure was installed to reduce the frequency and duration of flooding of Otter Creek in the City of Cortland. A hydrologic and hydraulic analysis was conducted to determine the feasibility of enhancing natural floodplain storage to accomplish this. The results indicated that a relatively simple approach could significantly reduce flooding for some flooding conditions. Additional information is found here.

**Proposed Initiatives**: *The Northeast Gateway and Clinton Avenue Corridor Enhancement Initiative*- Written by C&S Companies in 2013 – proposed project; status pending .

*Tioughnioga River Urban Headwaters Green Infrastructure Plan*- In August 2013, Skeo Solutions and the City of Cortland submitted a technical assistance grant proposal to the National Fish and Wildlife Foundation, focused on developing an urban green infrastructure approach to reducing water quality impacts in the Chesapeake Bay headwaters. The grant was not accepted in the latest round of awards but NFWF liked the proposal and requested that a grant be resubmitted with a broader focus on improving water quality across the Tioughnioga River watershed.

The objectives of this proposal included, but were not limited to, the identification and implementation of best management practices for stormwater capture, infiltration, and treatment, and the development of open space areas that integrate urban green infrastructure solutions to reduce stormwater impacts. These projects will benefit to the City of Cortland as it prepares for climate adaptation. City-wide efforts to develop green infrastructure solutions will reduce the impacts of flooding and wind from major storm events. For additional information, check with Mack Cook, Director of Administration and Finance, (607) 756-7312 mcook@cortland.org. Also: Matt Robbie, Senior Planner, Community Planning & Revitalization Group, Skeo Solutions, www.skeo.com, (434) 975-6700 x278.

# CLIMATE ADAPTATION

According to climate researchers, "Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions." These are the key conclusions from an assessment by the Intergovernmental Panel on Climate Change (IPCC) that was released in January 2014. 259 scientists from 39 countries around the world further stated that, "Warming of the climate system is unequivocal and since the 1950s, many of the observed changes are unprecedented over decades to millennia."

Yaman Park Boat Launch, Cortland

The findings discussed above are based on numerous independent scientific analyses and observations of the climate system, paleoclimate archives, theoretical studies of climate processes and simulations using climate models. The Summary for Policymakers of the IPCC Working Group I assessment report was approved in September 2013 by the member governments of the IPCC meeting in Stockholm, Sweden. The U.S. Environmental Protection Agency refers to the term "adaptation" as the adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.[1] A reduction of greenhouse gas emissions can be achieved through an increased understanding and endorsement of climate adaptation strategies. Community responses to extreme weather (early storm warning systems, air-conditioned cooling shelters, and policies that discourage people from building in flood prone areas) will require comprehensive, community-wide planning that addresses all risk factors.

A primary goal for Central New York, as presented in *Vision CNY: Central New York Regional Sustainability Plan*, is to adapt to a changing climate and improve the resilience of the region's communities, infrastructure, and natural systems. A gradual increase in high and low temperature extremes, coinciding with an increase in the frequency and intensity of storm events are expected to impact transportation infrastructure, human health, agricultural practices, forest diversity, and migratory patterns of invasive species. Adapting to climate change will provide opportunities for Cortland to improve the health and resilience of the community and will provide long-term protection of the natural environment.

The policy recommendations for climate adaptation that are presented in the following table (pages 20 and 21) are designed to help the Cortland community prepare for current and anticipated changes in climate conditions and to assist decision-makers in identifying opportunities to improve community resilience.

The table provides a summary of actions that the community can take to protect people, homes, buildings and natural systems by reducing risks from environmental hazards such as extreme heat and storm events. The recommendations also provide ways to reduce the City's energy costs and to improve the quality of life for City residents.

Planning for future weather impacts will enable Cortland to be better prepared and resilient. Long-term monitoring and evaluation of adaptation efforts is also important in order to document the efficiency of different strategies and how they can be improved. In addition, the City is encouraged to build climate adaptation into existing planning documents.

1 EPA 2012: http://epa.gov/climatechange/glossary.html

# CLIMATE ADAPTATION RECOMMENDATIONS FOR THE CITY OF CORTLAND

| Focus Areas and Recommendations | Actions |
|---|---|
| **Monitoring, Assessment and Data Collection:** Provide for the routine collection of temperature, precipitation, and storm event data and public health information | •Assess the condition of local infrastructure and document climate vulnerabilities in the areas of energy, water, transportation, and telecommunications<br>•Support the Cortland County Health Department in efforts to monitor climate impacts on human health such as asthma and heat-related illnesses<br>•Assess the economic impacts of climate change on tourism and recreation<br>•Work with Project Watershed to document annual invertebrate populations in Otter and Dry Creeks and along the Tioughnioga River<br>•Identify priority river and tributary segments and promote flood studies in these areas<br>•Assess public perceptions of climate change through measured outcomes |
| **Infrastructure Design and Maintenance:** Protect local infrastructure to facilitate stormwater and flood control | •Work with the Cortland County Soil and Water conservation District to improve the capacity of stormwater collection systems and maximize soil infiltration/groundwater recharge<br>•Install green infrastructure measures (rain gardens, porous pavement, and rain barrels) especially along Otter and Dry Creeks and the Tioughnioga River, as appropriate<br>•Encourage downspout disconnection, bioinfiltration, and rainwater harvesting in Cortland's residential and business communities to reduce stormwater runoff<br>•Remove paved surfaces in vacant lots along the Tioughnioga River and convert the land to public green space with tree plantings to facilitate infiltration/reduce stormwater runoff<br>•Develop hiking and biking trails to enhance open space preservation, reduce reliance on vehicular modes of transportation, and to cut greenhouse gas emissions<br>•Bury power lines, as appropriate |
| **Public Health:** Establish mechanisms to reduce or eliminate the negative effects of climate change on public health | •Improve local capacity for health preparedness, response, and recovery programs such as extreme-heat response plans that include community centers with air conditioning<br>•Expand the City's capacity for monitoring, disease surveillance, and disease outbreak investigation and control<br>•Provide alerts for the public regarding heat events and other potential health risks |
| **Communications:** Ensure that internal emergency operations are current and maintain open lines of communications among local agencies | •Update Cortland's inventory of emergency operations and responsibilities for cleanup crews<br>•Notify State and Federal agencies of the location and telephone numbers of the emergency personnel operators for Cortland's water system operations<br>•Reconfirm lines of communication with local police and fire departments, the local power utility, and media outlets |
| **Community and Regional Collaboration:** Develop and support regional partnerships that promote research, public awareness of climate change issues, and strategies that enhance the resiliency of the region, its residents and its institutions | •Update land hazard maps and inventories of infrastructure and at-risk communities in the City<br>•Review the City of Cortland's Hazard Mitigation Plan to evaluate the efficiency of communication channels and regional preparedness during extreme weather events<br>•Provide public access to Cortland's Hazard Mitigation Plan by adding it to municipal and agency websites and update Cortland's Hazard Mitigation Plan every five years<br>•Evaluate measures to reduce dependency on individual vehicle use and research opportunities to expand public transit<br>•Collaborate with national, state, and local agencies to facilitate data collection, sharing, and synthesis of flood and storm event preparedness information |

| Focus Areas and Recommendations | Actions |
|---|---|
| **Local Laws and Planning:** Modify local laws to incorporate measures for adaptation to climate change | •Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community<br>•Evaluate potential participation in the FEMA Community Rating System to further manage flood risk and reduce flood insurance premiums for NFIP policyholders<br>•Modify zoning to discourage/prevent new development in flood-prone and high hazard areas<br>•Establish/maintain strong building codes regarding energy use, including movement to performance-based codes<br>•Draft landscape ordinances to accommodate the use of heat and drought tolerant plants , and identify and remove local barriers to green infrastructure<br>•Incorporate climate adaptation into the City of Cortland's Comprehensive Plan |
| **Natural Resources:** Ensure the resilience of natural systems and resources through open space conservation and smart growth strategies | •Protect open space through conservation land grants, incentives, regulation, fee acquisition, purchase of conservation easements, and support of smart growth principals<br>•Protect wetlands, floodplains, and wildlife habitat to strengthen capacity of natural systems to respond to weather events, stream flow changes, and potential flooding<br>•Update local maps that display low elevation areas that are susceptible to flooding. Include varying levels of flood hazard potential. Display maps on the City website with preparedness guidelines. |
| **Woodlands:** Protect and expand woodland ecosystems to increase climate change mitigation potential | •Enhance and expand the Community Forest Management Plan, including street trees and the Water Works property<br>•Continue to support the Cortland County Soil and Water Conservation's Spruce Up America program<br>•Work with the US Forest Service and Cortland County Cooperative Extension to monitor changes in woodland composition and health<br>•Plant low pollen tree species in Cortland's conservation properties, recreation areas, and public parks in order to minimize health issues. Plant local, native species with a tolerance for higher temperatures<br>•Manage tree density throughout the City to reduce overcrowding and susceptibility to stress and disease. Remove dead or dying trees and replace them with heat and invasive tolerant species |
| **Invasive Species:** Protect local trees by controlling the introduction and spread of invasive species | •Educate the public and elected officials on the value of prevention and early detection of invasive species and the maintenance of tree health<br>•Work with the Cortland Soil and Water Conservation Service and the Natural Resource Conservation Service to monitor the introduction and spread of invasive species<br>•Participate in Cornell Cooperative Extension's Emerald Ash Borer control strategy and in the New York State Invasive Species Task Force |
| **Public Engagement and Education:** Implement comprehensive public outreach and stakeholder engagement campaigns to build awareness of climate change impacts | •Develop and enhance climate education programs for all grade levels in the Cortland Central School District<br>•Train local building officials, planning boards, and elected official on flood hazards, risk reduction strategies, implementation of floodplain development regulations, post-flood reconstruction, and how to address flood hazards during planning board review<br>•Train local building official and the construction industry on flood proofing techniques for retrofitting existing flood prone development<br>•Provide topographic maps and information about flood preparedness to the public; distribute brochures, fact sheets, and posters that show ways in which municipalities and homeowners can prepare for and adapt to climate change<br>•Incorporate climate adaptation principals on City and agency websites and local planning documents such as the Comprehensive Plan. This will increase the awareness of severe weather risks, provide information on the benefits of preserving and restoring floodplain functions, recommend improved flood and storm preparedness, and promote safety practices for homes and businesses<br>•Provide flood preparedness guidelines on the City website. Include recommendations for people living and working in flood prone areas, actions to take if a flash flood warning is issued, relevant emergency websites and information sources, items to include in a disaster/flood supply kit, how to protect your property from flood damage, and guidelines for developing a Family Disaster Plan<br>•Sponsor workshops to teach homeowners, local planning boards, elected officials, code enforcement officers, federal and state agencies, businesses, citizen associations and real estate agents about local hydrology, storm preparedness, watershed land use influences, and floodplain management |

# What can be done in Cortland?

The City of Cortland has chosen to adopt the NYS Department of Environmental Conservation (DEC)'s Climate Smart Communities Pledge, and municipal operations have already begun reducing their energy use and GHG emissions.

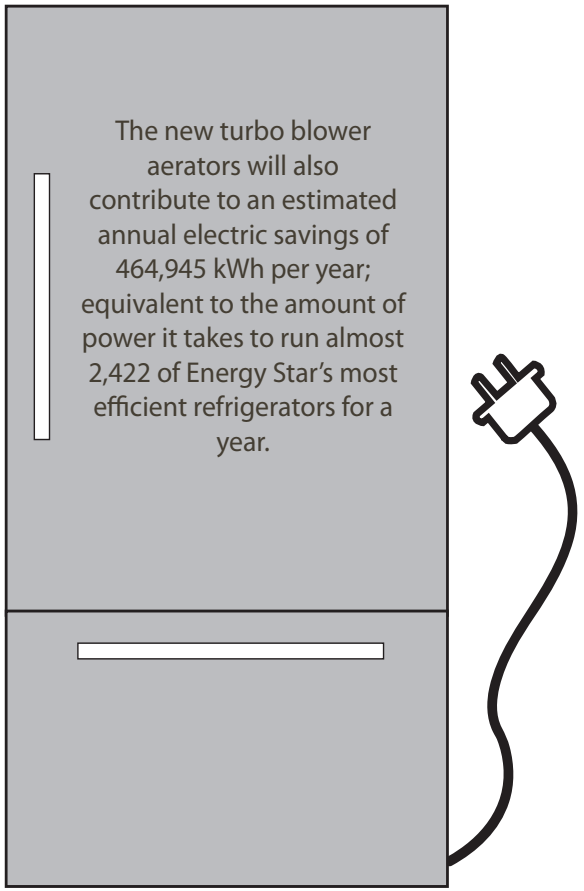
In 2010, the Central New York Regional Planning and Development Board (CNY RPDB) selected the City of Cortland as a participant in the Central New York Climate Change Innovation Program (C2IP) funded through a grant from the US Environmental Protection Agency (EPA)'s Climate Showcase Communities Grant Program.

The CNY RPDB provided the City with $30,000 of grant funding towards the development of a clean energy demonstration project. With additional technical assistance from the CNY RPDB, Cortland will be able to complete an upgrade to their municipal wastewater treatment facility, including replacing outdated aerator systems with new turbo blower aerators that are anticipated to reduce GHG emissions significantly saving over 450,000 kWh of electricity per year.

While Cortland's wastewater treatment facility upgrades are commendable, the strategies noted in this document represent further efforts that can be made by the municipality as well as by the community members to reduce energy use and GHG emissions even further.

In 2012, a GHG inventory report was compiled to detail energy use and the sources of emissions in Cortland in 2010. This Climate Action Plan uses the data provided in the GHG inventory report to address strategies that both government operations and community members can take to reduce energy use and GHG emissions by 2025. Specifically, using 2010 as the base year, the emissions reduction target for Cortland municipal operations is 20%, and the emissions reduction target for community emissions is 15%.

Guided by the strategies explored in this Climate Action Plan, Cortland has the potential to reduce energy use and GHG emissions significantly. By implementing the strategies noted in this document, community members will not only be able to reduce GHG emissions, they will also be able to reduce their overall energy costs, be more comfortable in their own homes, reduce reliance on non-renewable, foreign sources of energy, and conserve Cortland's resources for the future.



# WASTEWATER TREATMENT FACILITY UPGRADES

## AT A GLANCE


The City of Cortland's wastewater treatment facility has begun an upgrade process that will both decrease its total energy utilization and generate electricity from methane produced in anaerobic digesters. Taken together, these measures will dramatically reduce the facility's carbon footprint, reducing municipal emissions significantly.

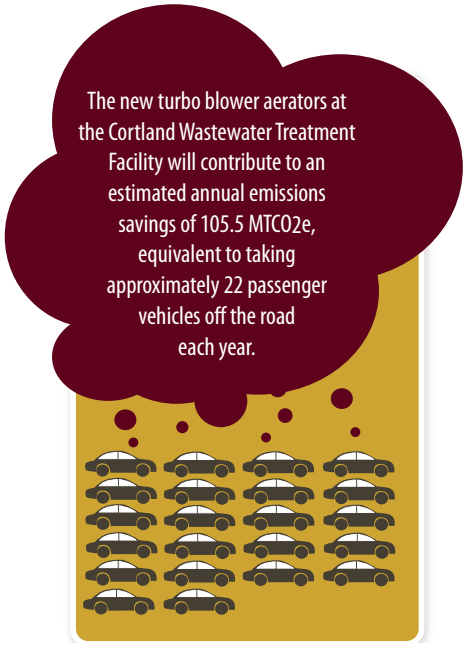
The facility's dual-fuel boiler has already been converted from fuel oil and biogas to natural gas and biogas. This was accomplished by rehabilitating and converting a long-abandoned fuel oil boiler to natural gas, which produces considerably lower carbon and particulate emissions than fuel oil.

Multi-stage centrifugal blowers, used to provide air to a biological process at the facility, have also been converted to high-speed turbine blowers. These blowers are not only more efficient, they also have a better turn-down ratio, meaning that they can be run at a lower setting when process needs are met. The conversion to high-speed turbine blowers has already resulted in a significant reduction in electrical use at the facility.

There are plans for other emissions reductions projects at the facility as well; for example, a digital control system will be installed on the main building's HVAC system that will not only optimize the system's efficiency, it will also enable implementation of usage setbacks. Because the building is only occupied 8 to 9 hours per day but is climate-controlled 24/7, this action may result in a 30% to 45% reduction in energy used to heat and cool the building.

The most substantial action that is planned at the facility is building a combined heat and power (CHP) project fueled mostly by a new anaerobic digester dedicated to treating acid whey waste from a Greek yogurt producer that is building a new factory in the Cortland area. Acid whey has few beneficial uses, but it is readily amenable to anaerobic digestion, and the resultant methane can be used to generate heat or electricity.

Once the yogurt manufacturer reaches their currently projected full production, it is estimated that the new anaerobic digester may be producing 60% to 75% of the facility's entire electrical needs in addition to significantly curtailing the need to use natural gas for heating.




There are still technical hurdles in determining how to best maximize utilization of generated electricity. One idea that is currently being considered is a demand management system that will actively manage the total load at any given time, improving the ability of the generators to meet process needs.

Overall, the upgrades made at the wastewater treatment facility will cost approximately $13.5 million but are expected to contribute to an annual energy savings of $85,000 in electricity costs alone, with even further annual savings in natural gas costs. The upgrades are also expected to reduce Cortland's municipal emissions by close to 70%, which equals a reduction of about 2,989 $MTCO_2e$.

# GHG Inventory Summary

As part of the Climate Change Innovation Program, an inventory of Cortland's municipal and community GHG emissions was conducted in 2012 with the assistance of a student team from the State University of New York College of Environmental Science and Forestry with additional oversight and technical review by CNY RPDB staff. The 2012 inventory report examined emissions generated in Cortland in 2010, which serves as the baseline year for the Climate Action Plan.

The inventory report found that in the 2010 base year, Cortland government operations generated a total of 4,270 metric tons of carbon dioxide equivalent ($MTCO_2e$), which were broken up into 6 sectors: buildings and facilities (595 $MTCO_2e$, 14%), streetlights and traffic signals (281 $MTCO_2e$, 7%), vehicle fleet (618 $MTCO_2e$, 14%), water delivery facilities (498 $MTCO_2e$, 12%), wastewater facilities (2,199 $MTCO_2e$, 51%), and wastewater treatment processes (79 $MTCO_2e$, 2%).

Cortland community emissions totaled 144,265 $MTCO_2e$, which were broken up into 5 sectors: residential energy use (36,873 $MTCO_2e$, 25%), commercial energy use (49,157$MTCO_2e$, 34%), industrial energy use (13,035 $MTCO_2e$, 9%), transportation (32,690 $MTCO_2e$, 23%), and waste (12,510 $MTCO_2e$, 9%).

Cortland's Climate Action Plan uses the data gathered in the 2012 GHG inventory report as a baseline for analyses to determine which energy efficiency strategies will be most effective in the city. The strategies suggested in this document can help Cortland to further reduce emissions, energy use, and dollars spent on municipal and community operations by 2025.

**1 $MTCO_2e$ =**

- $CO_2$ emissions from 112 gallons of gasoline consumed
- $CO_2$ emissions from 2.3 barrels of oil consumed
- $CO_2$ emissions from 41.7 propane cylinders used for home barbeques
- Carbon sequestered by almost 1 acre of U.S. forests in one year

Figure 4- Cortland Municipal Emissions by Sector $MTCO_2e$ (2010 Baseline)

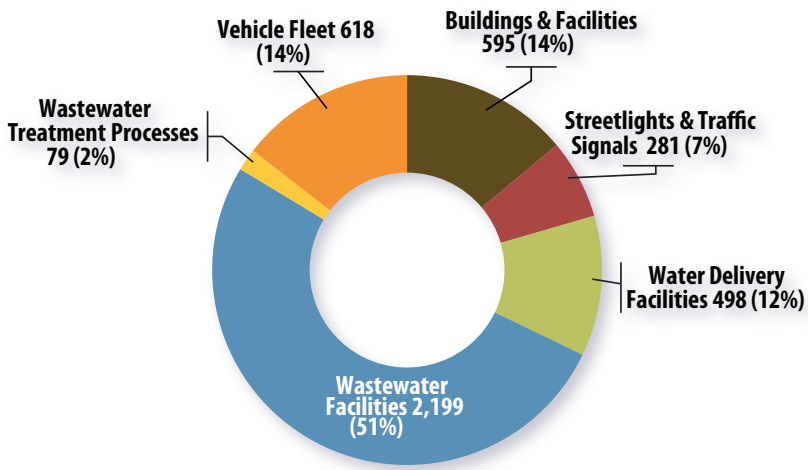



Figure 5- Cortland Community Emissions by Sector $MTCO_2e$ (2010 Baseline)

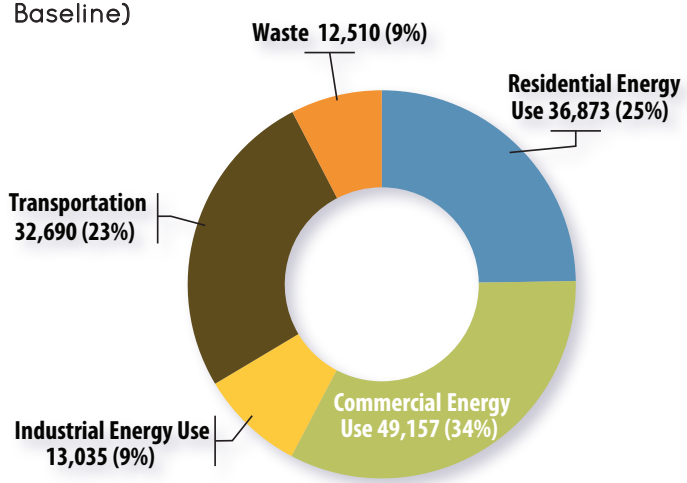
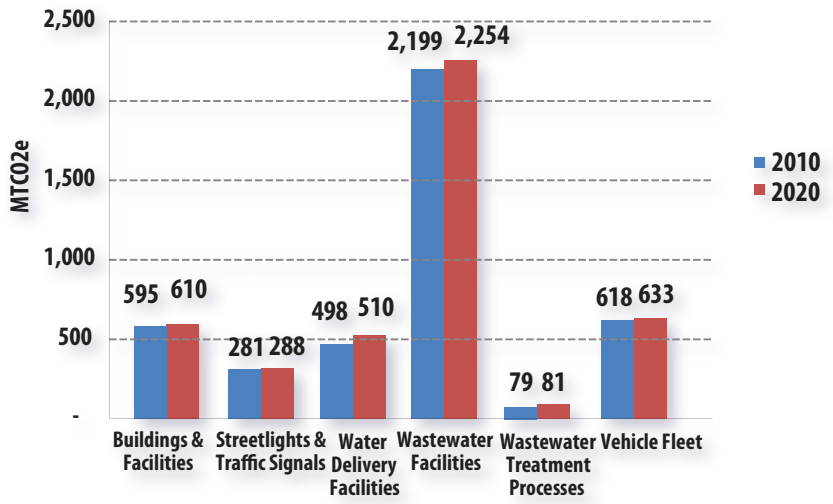


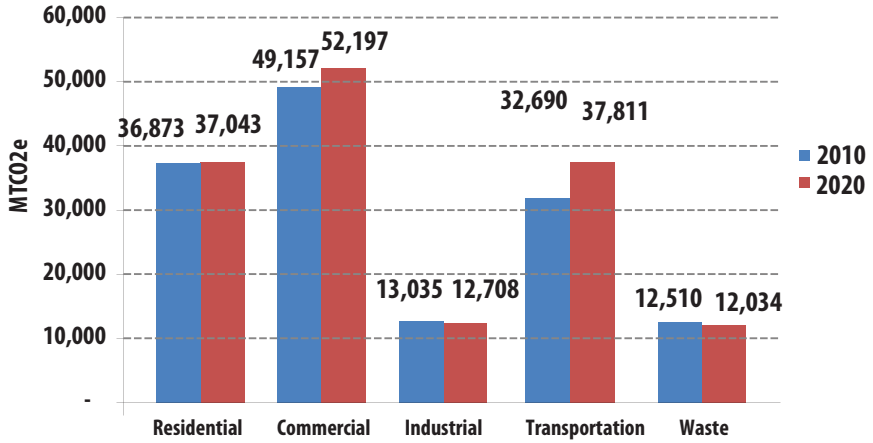
FIGURE 6- EMISSION FORECAST:
MUNICIPAL OPERATIONS




The GHG inventory report also forecasted emissions for Cortland in 2020. The report explained that Cortland government emissions were expected to total 4,377 $MTCO_2e$ in 2020, with 15 $MTCO_2e$ increase in buildings and facilities emissions, 7 $MTCO_2e$ increase in streetlights & traffic signals, 12 $MTCO_2e$ increase in water delivery facilities, 55 $MTCO_2e$ increase in wastewater facilities, 15 $MTCO_2e$ increase in vehicle fleet emissions, and 2 $MTCO_2e$ increase in wastewater treatment processes.

The community forecast showed only slight changes, and were expected to total 151,793 in 2020, with 170 $MTCO_2e$ increase in residential energy use, 3,040 $MTCO_2e$ increase in commercial energy use, 327 $MTCO_2e$ decrease in industrial energy use, 5,121 $MTCO_2e$ increase in transportation, and 476 $MTCO_2e$ decrease in waste.

FIGURE 7- EMISSION FORECAST:
COMMUNITY



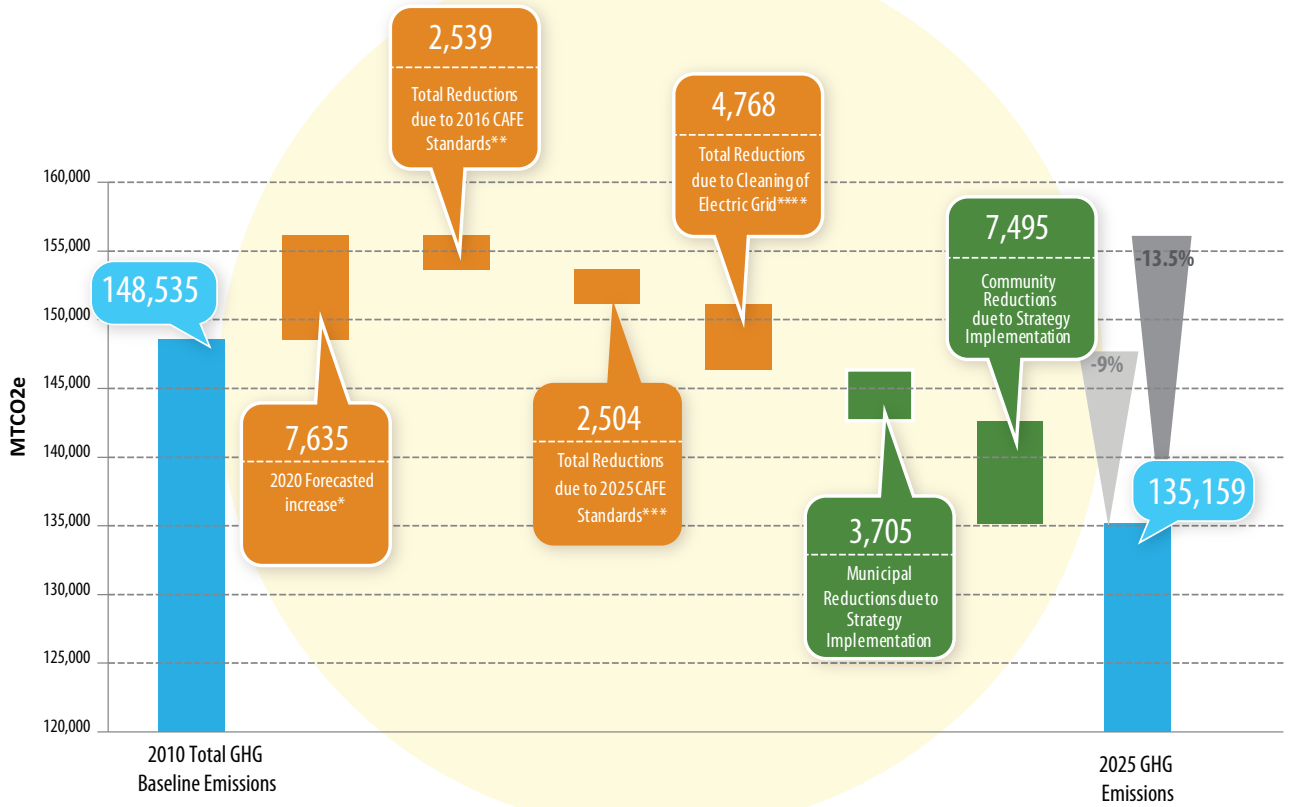
# Strategies Overview

CNY RPDB staff worked with a team of interns throughout the spring and summer of 2013 to analyze potential strategies for reducing the City's emissions for both municipal operations as well as at the community-wide scale. The team utilized a software tool developed by ICLEI-Local Governments for Sustainability known as CAPPA (Climate and Air Pollution Planning Assistant) version 1.5 to calculate potential GHG reductions as well as cost savings for each strategy. CAPPA is an Excel-based decision-support tool designed to help U.S. local governments explore and identify potential opportunities to reduce greenhouse gas emissions and other air pollution emissions. CAPPA provides a starting point for two major tasks: determining an achievable emissions reduction target and selecting strategies to include in a local municipal–operations or community-scale emissions-reduction plan, commonly called a climate action plan. CAPPA users can compare the relative benefits of a wide variety of emissions reduction and clean air measures, and identify those most likely to be successful for their community based on its priorities and constraints.

Utilizing CAPPA, a variety of strategies were identified and analyzed to determine their potential for achieving emissions reductions either at the municipal operations level or the community scale. The analysis team also explored the potential impacts of two external large scale factors on the city's emissions profile: New Federal CAFE Standards that will increase the average fuel economy of vehicles sold in the U.S. through 2025 and changes taking place within the electric generation sector that are leading to overall emissions reductions, including the decommissioning of coal fired power facilities, fuel switching to natural gas, and increased investment in renewable or alternative energy generation (i.e., solar and wind). The results of these analyses are summarized in Figures 8-10. In most cases, if there were multiple potential strategies addressing a singular target area (e.g. vehicle fuel sources: electric, diesel, hybrid, natural gas), the strategy that was the most cost effective with the largest emissions reduction impact was chosen to be included in the final summary.

Community Garden, Cortland

## FIGURE 8: TOTAL POSSIBLE REDUCTIONS BY 2025

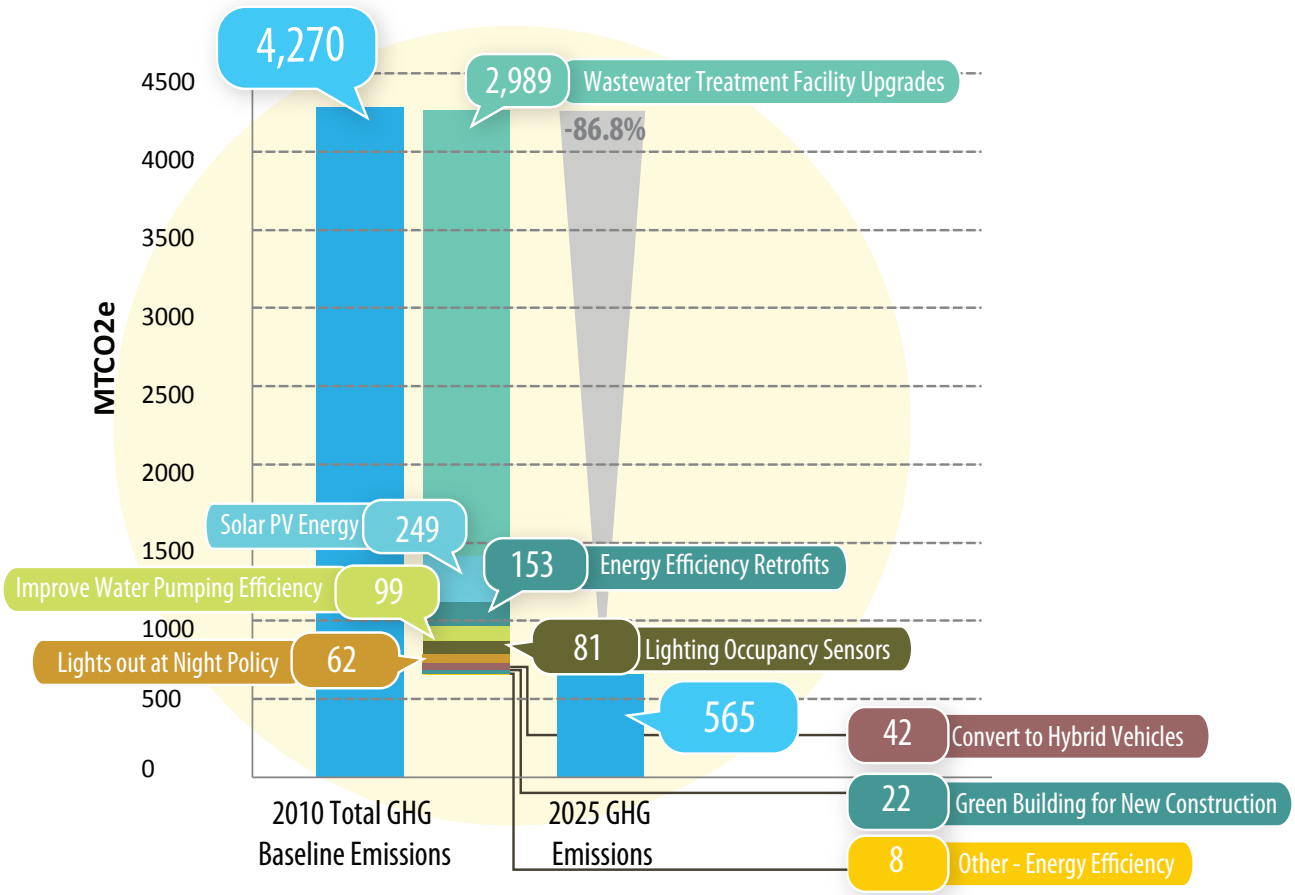



### Figure 8- Total Possible Reductions by 2025

Figure 8 summarizes the results of the Cortland GHG inventory, a 2020 emissions forecast based on current trends, impacts from the strengthening of Federal CAFE standards, the cleaning of the electric grid in Upstate New York, as well as the reductions associated with the Climate Action Strategies that were analyzed for the City separated into community-wide measures as well as municipal operations measures. Reductions due to Cortland actions are shown in green while changes in emissions that will occur regardless of this Plan are shown in orange. It is projected that Cortland's total GHG emissions in 2025 could be reduced by 9% if the City implements all of the recommended community-wide and municipal operations measures, which is a reduction of13.5% compared to the 2020 forecasted emissions.

*2010 GHG inventory reported a forecasted increse of 7,635 $MTCO_2e$ due to increases in population and commercial energy usage.
**2010 Federal CAFE (Corporate Average Fuel Economy) standards have been set at 34.1 miles per gallon by 2016.
***2012 Federal CAFE standards raises average fuel economy to up to 54.5 mpg for the model year 2025.
****Since the 2010 base year, the electric grid for Upstate New York has become cleaner by using a higher percentage of cleaner burning and/or renewable energy sources. Therefore, since 2010, the changes in the electric grid alone have caused reductions of 4,768 $MTCO_2e$.

## FIGURE 9: POTENTIAL MUNICIPAL REDUCTIONS FROM STRATEGY IMPLEMENTATION




Key:

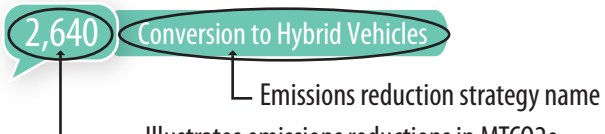
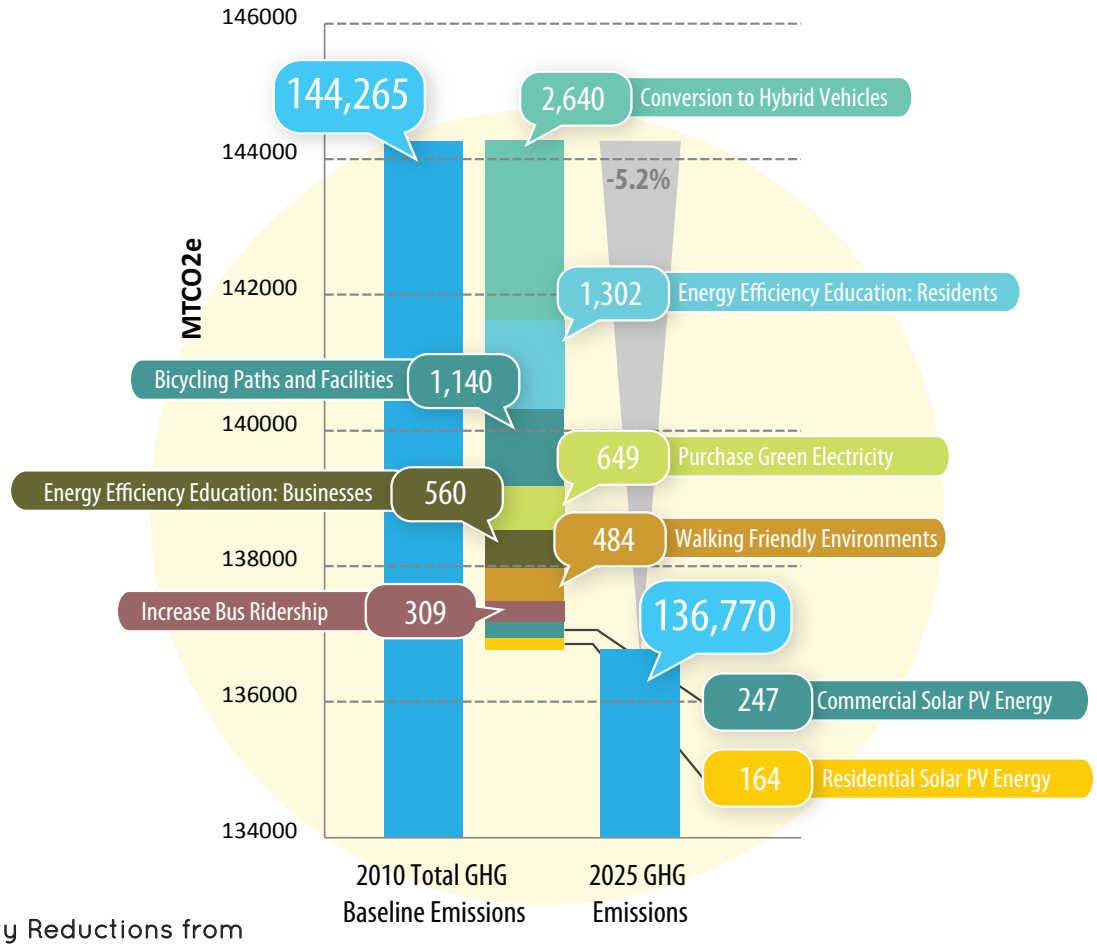



Figure 9- Potential Municipal Reductions from Strategy Implementation

Cortland's 2010 baseline municipal emissions as recorded by the GHG inventory report, potential reductions due to suggested strategies, and potential emissions in 2025 should each of the suggested strategies be implemented. It is estimated that there will be a 86.8% reduction in municipal emissions if all suggested strategies are implemented.

## FIGURE 10: POTENTIAL COMMUNITY REDUCTIONS FROM STRATEGY IMPLEMENTATION




### Figure 10- Potential Community Reductions from Strategy Implementation

Cortland's 2010 baseline community emissions as recorded by the GHG inventory report, potential reductions due to suggested strategies, and potential emissions in 2025 should each of the suggested strategies be implemented. It is estimated that there will be a 5.2% reduction in community emissions if all suggested community reduction strategies are implemented.

# TRANSPORTATION

According to Cortland's GHG Inventory Report, transportation accounted for 14% of government emissions and 23% of community emissions in Cortland in 2010.

This Climate Action Plan addresses two main transportation emissions reduction goals: increase use of alternative fuel options; and increase options for low-carbon transportation.

Bicycle Racks, Cortland

## Increase use of alternative fuel options

**Promote conversion of community vehicle fleet to hybrid vehicles through community education and outreach:** 2,640 $MTCO_2e$ annual reductions

This strategy assumes that 20% of the community vehicle fleet is converted to hybrid.

**Municipal conversion of fleet vehicles to hybrid vehicles:** 42 $MTCO_2e$ annual reductions

This strategy assumes that 50% of the municipal vehicle fleet is converted to hybrid.

## Increase Options for Low-Carbon Transportation

**Expansion of bicycling paths and facilities:** 1,140 $MTCO_2e$ annual reductions

This strategy assumes 25% of weekly trips of less than 2 miles in length are switched from car to bicycle.

**Expansion of walking-friendly environments:** 484 $MTCO_2e$ annual reductions

This strategy assumes 5% of weekly trips less than 1 mile in length are switched from car to walking.

**Increase bus ridership using information provided by Regional Transportation Study:** 309 $MTCO_2e$ annual reductions

This strategy assumes there an additional 315 daily bus passengers.

## Increase use of alternative fuel options

According to Cortland's GHG Inventory Report, gasoline and diesel fuels accounted for 14% of the total municipal emissions, while they also accounted for 26% of community emissions. These fuels are not only non-renewable fossil fuels; they also produce significantly more carbon emissions than alternative fuel options, such as hybrid vehicle technology. Conversion to alternative fuels can therefore be extremely effective when trying to reduce emissions from the transportation sector.

Not only will using alternative fuels reduce greenhouse gas emissions, it will also reduce US dependence on imported fuels and reliance on fossil fuels in general. Hybrid vehicles are also less expensive to operate and have significantly lower fuel costs than conventional gasoline-powered vehicles. Increasing the use of alternative fuels would greatly reduce Cortland's emissions and provide other benefits to community members as well.

## Increase Options for Low-Carbon Transportation

Increasing options for low-carbon transportation would reduce the amount of vehicle miles traveled (VMT), reducing gasoline and diesel use, which would therefore reduce Cortland's emissions, fuel costs, and reliance on foreign fossil fuels.

Cortland's Gateway project is an example of where improvements in pedestrian infrastructure and bicycling paths and facilities can be implemented successfully. The purpose of the Gateway Project "is to address a perceived unsightliness and lack of character of the area; the confusing intersection of Route 13, River Street, and Pomeroy Street; and the lack of visual cues to direct travelers from Interstate 81 toward the downtown." Inserting bike lanes and pedestrian infrastructure in this corridor are some of the design ideas that are being addressed for the Gateway Project.

The Ithaca-Tompkins County Transportation Council (ITCTC) completed a Regional Transportation Study (RTS) for Tompkins, Tioga, Cortland, Chemung, Cayuga, Seneca, and Schuyler Counties. The study will result in a strategic plan of programmatic and policy solutions to address transportation infrastructure, systems and/or operational improvements, and enhancements needed to accommodate projected transportation needs. It is a regional mobility study which will:

1. Increase the efficiency and effectiveness of existing mobility services across all modes,

2. Develop and market real mobility choices to the public, and

3. Enable coordination among counties to provide the best possible cost effective transportation.

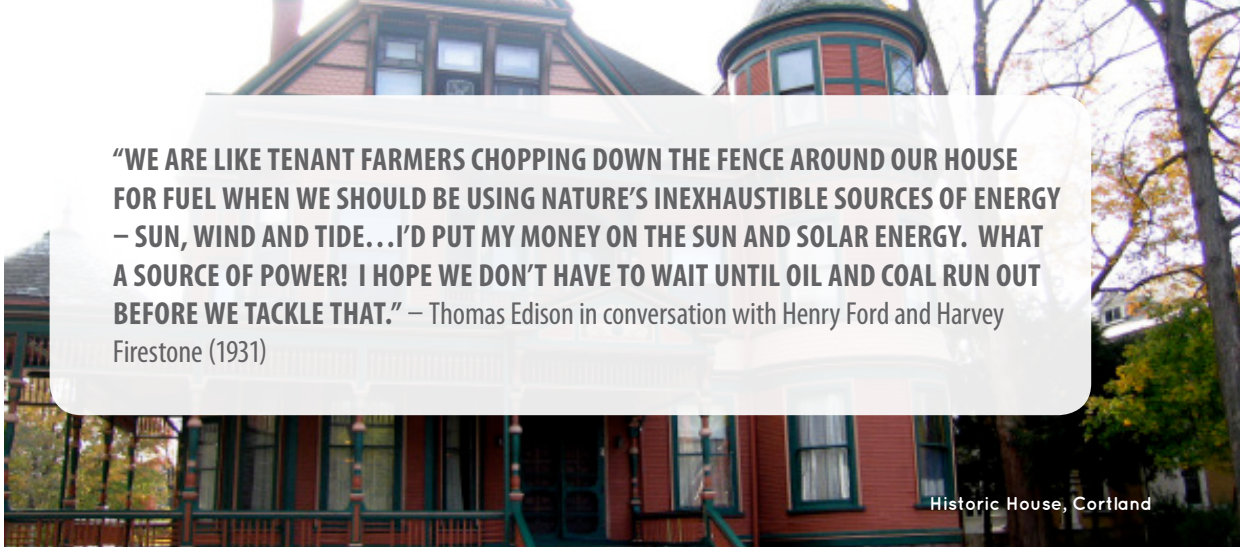
The RTS process will examine existing services and needs, project future demands, incorporate stakeholder input and develop a series of recommendations in a phased implementation plan and a sustainable process that will address: alternatives to reduce drive-alone automobile trips and to provide realistic options to persons who are unable to or choose not to drive; reductions in commuter traffic on the highway network; potential expansion of bus transportation, including commuter bus and intercity services; incorporation of coordinated mobility programs, such as van pools, guaranteed ride home, ridesharing, and human service transportation; and improvements in communication and technology to improve customer information and agency interaction.

Also, the State University of New York (SUNY) College at Cortland has recently introduced three new propane-fueled buses to their vehicle fleet with the goal of reducing carbon emissions and increasing bus ridership in the University area.

There are many possible low-carbon transportation options that could be successful in the City of Cortland. These low-carbon transportation options can benefit community members in a variety of ways, including reducing greenhouse gas emissions, fuel costs, and reliance on foreign fossil fuels, improving physical well-being, and revitalizing the community.

# ENERGY EFFICIENCY

According to Cortland's GHG Inventory Report, emissions from government buildings/facilities accounted for 14% of total government emissions, while residential energy use accounted for 25%, commercial energy use accounted for 34%, and industrial energy use accounted for 9% of the community's total GHG emissions in Cortland in 2010. This Climate Action Plan addresses two main energy/efficiency emissions reduction goals: increase energy efficiency in buildings; and increase use of renewable energy.



**"WE ARE LIKE TENANT FARMERS CHOPPING DOWN THE FENCE AROUND OUR HOUSE FOR FUEL WHEN WE SHOULD BE USING NATURE'S INEXHAUSTIBLE SOURCES OF ENERGY – SUN, WIND AND TIDE…I'D PUT MY MONEY ON THE SUN AND SOLAR ENERGY. WHAT A SOURCE OF POWER! I HOPE WE DON'T HAVE TO WAIT UNTIL OIL AND COAL RUN OUT BEFORE WE TACKLE THAT."** – Thomas Edison in conversation with Henry Ford and Harvey Firestone (1931)

Historic House, Cortland

## Increase energy efficiency and reduce emissions from buildings

**Municipal Water Treatment and Delivery Upgrades:** 3,294 $MTCO_2e$ annual reductions for wastewater treatment upgrades; 99 $MTCO_2e$ annual reductions for delivery upgrades

This strategy assumes the Wastewater Treatment plant upgrades reduce municipal emissions by 70%. It also assumes a 20% energy savings from water delivery upgrades.

**Energy efficiency education for residents through CNY Energy Challenge Team program:** 1,302 $MTCO_2e$ annual reductions

This strategy assumes 10% of households participate.

**Establish an energy efficiency education program for businesses:** 560 $MTCO_2e$ annual reductions

This strategy assumes that 10% of businesses participate.

**Energy efficiency retrofits of existing municipal facilities:** 153 $MTCO_2e$ annual reductions

This strategy assumes all 114,354 square feet of existing municipal facilities undergo retrofits.

**Improve water pumping efficiency:** 99 $MTCO_2e$ annual reductions

This strategy assumes 20% energy savings are achieved from upgrades.

**Power down at night policy for municipal facilities:** 62 $MTCO_2e$ annual reductions

This strategy assumes all municipal facilities participate.

**Require green building for new construction of municipal facilities:** 22 $MTCO_2e$ annual reductions

This strategy assumes 11,500 square feet of new buildings are built 'green'.

**Replace City-owned streetlights with LEDs:** 4 $MTCO_2e$ annual reductions

This strategy assumes all 32 City-owned streetlights are converted.

**Reflective roofing on municipal facilities:** 3 $MTCO_2e$ annual reductions

This strategy assumes 10,000 square feet of reflective roofing are installed.

**Green roof on City Hall building roof:** 1 $MTCO_2e$ annual reductions

This strategy assumes City Hall installs a green roof.

**Hire Sustainability Planner for the City***

## Increase use of renewable energy

**Encourage community purchase of renewable electricity:** 649 $MTCO_2e$ annual reductions

This strategy assumes 5% of community electricity is purchased 'green'.

**Municipal solar PV installation:** 249 $MTCO_2e$ annual reductions

This strategy assumes installation of 1,000 kW solar PV.

**Commercial solar PV installation:** 247 $MTCO_2e$ annual reductions

This strategy assumes installation of 992 kW solar PV.

**Residential solar PV installation:** 164 $MTCO_2e$ annual reductions

This strategy assumes installation of 661 kW solar PV.

***This strategy is included as an informational item and therefore does not have associated emissions reductions or strategy implementation levels listed.**

**"THERE CAN BE NO SUSTAINABLE DEVELOPMENT WITHOUT SUSTAINABLE ENERGY DEVELOPMENT."**
–Margot Wallstrom, European Union Environmental Commissioner (2004)

## Increase energy efficiency and reduce emissions from buildings

The most significant emissions reductions for the City will result from the planned upgrades to the wastewater treatment facility, described previously. Energy efficiency retrofits to other buildings and facilities in the City, including households, could be beneficial as well. The initial cost of energy efficiency retrofits may seem daunting; however, the local government and the CNY Regional Planning and Development Board can offer assistance and support to make retrofits easier by providing educational materials, low-interest loans, and guidance on where to find potential grants or incentives to help cover costs. The City can also take smaller steps to make buildings more efficient, such as installing lighting occupancy sensors, replacing city-owned streetlights with LEDs, or instituting a "lights out at night" policy for government buildings. Hiring a Sustainability Planner for the City would also provide an extra avenue for assistance and support in energy efficiency endeavors.

## Increase use of renewable energy

By installing renewable energies like solar at the local level, Cortland can ensure that their energy is provided by clean and local renewable energy sources, therefore reducing greenhouse gas emissions, energy cost, and reliance on fossil fuels. Where solar installations are not feasible, community members can choose to purchase renewable energies through their local utility company.

Many residents or businesses would like to use renewable energies, but the large up-front cost is an obstacle. The local government can help overcome this barrier by offering low-interest loans or organizing group buying programs to negotiate lower prices, such as the Solarize Madison program in Madison County. These programs are an effective way of combining public and private funds for renewable energy. The New York State Energy Research and Development Authority (NYSERDA) provides incentives for the installation of solar PV based on system size. Additionally, there are state and federal tax credits for residential and commercial solar PV installations. Educational and technical assistance programs can also promote renewable energies. Local governments can offer information clearinghouses and connect consumers with renewable energy installers.

An increasingly popular way for a local government to overcome the financial hurdles of installing a photovoltaic system is through the "solar services model" also known as a Power Purchase Agreement (PPA). Through this type of arrangement the owner of a property can provide the space for a power producer to install the system. The property owner then agrees to buy the power produced from that system at a set rate that is competitive with grid electricity. Since the power producer retains ownership of the equipment, there are no installation and maintenance costs to the consumer of the electricity produced. This is particularly attractive to government entities that are unable to take advantage of tax-based incentives for renewable energy.

The Town of Preble has installed a 9 kW solar PV rooftop system as part of their Town Hall retrofit.

### National DSIRE Database

Because incentives available for renewable energies are constantly changing, it is important to remain familiar with which incentives are currently available. The Database of State Incentives for Renewables & Efficiency, or DSIRE, is a website that offers comprehensive information on incentives and policies that support renewables and energy efficiency in the United States. Established in 1995, DSIRE is currently operated by the N.C. Solar Center at N.C. State University, with support from the Interstate Renewable Energy Council, Inc. DSIRE is funded by the U.S. Department of Energy. Visit dsireusa.org to learn more about current incentive opportunities.

The Town Hall building has eliminated its need for fossil fuel combustion on site and now produces more renewable, locally-produced energy than it uses. Similarly, the Town of DeWitt completed the installation of a 51kW photovoltaic system on its Town Hall Building in November 2011. This installation cost $239,000 and was paid for by grants. It is expected to save 55,000 kWh of electricity per year which accounts for approximately 12-13% of the building's annual electricity use, and will save 13 $MTCO_2e$ annually. Similar initiatives have begun take place in the City of Cortland as well, such as the recent installation of solar PV on the YWCA building.

Increasing the use of renewable energy reduces emissions while also providing clean, locally-produced energy that will save money spent on utility bills over time. Where installation of renewable energies is not possible, community members can choose to reduce emissions through purchasing electricity produced by renewable sources.

# WASTE

In 2010, 9% of the community's GHG emissions came from waste. When organic matter like wood, paper, food, and yard wastes is placed in landfills, it decomposes anaerobically, producing methane. Methane is a greenhouse gas 21 times as powerful as carbon dioxide. Collecting and composting this organic waste prevents the emissions it would have produced in a landfill.

Organics Composting

## Promote composting

**Encourage and educate community about organics and yard waste composting:** **12** $MTCO_2e$ reductions

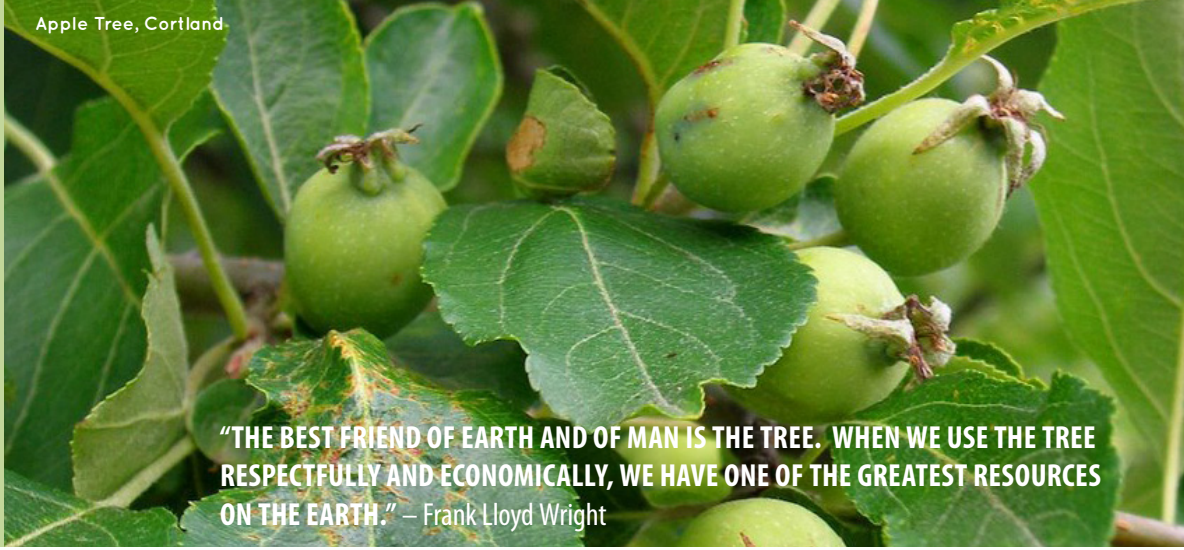
This strategy assumes 50 lbs. of waste per person per year is diverted.

Composting produces fertilizer that can be used for farms or gardens, returning nutrients to the soil that were removed with food production and reducing the need for synthetic fertilizers. Composting also reduces the volume of material sent to landfills, reducing disposal costs.

Composting is something that can be done at individual households or at the community scale. New York State's "Beyond Waste" Plan advances food scrap recycling as a key environmental strategy to help communities increase their waste diversion rates, and community composting sites, such as the Amboy Compost Site in Camillus, New York, have effectively composted yard and food waste for years.

# NATURAL RESOURCES

Planting trees in strategic ways to shade buildings can reduce energy used to cool buildings. Trees that are properly planted with energy savings in mind can reduce the amount of energy (electricity, natural gas, or other fuel) used to cool and heat buildings. This not only reduces associated emissions, but also saves money.


Apple Tree, Cortland

**"THE BEST FRIEND OF EARTH AND OF MAN IS THE TREE. WHEN WE USE THE TREE RESPECTFULLY AND ECONOMICALLY, WE HAVE ONE OF THE GREATEST RESOURCES ON THE EARTH."** – Frank Lloyd Wright

## Promote tree planting for carbon storage and heat mitigation

**Encourage community tree planting:** **5** $MTCO_2e$ annual reductions

This strategy assumes 15% of households plant one tree each year.

The shade from a single well-placed mature tree reduces annual air conditioning use from two to eight percent (in the range of 40-300 kWh), and peak cooling demand from two to ten percent (as much as 0.15-0.5 kW), therefore reducing GHG emissions. The Arbor Day Foundation provides information on its website explaining how to plant trees to conserve energy most effectively.

Tree planting can also reduce storm water runoff, decreasing the amount of water that needs to be treated at wastewater treatment facilities. Finally, tree planting increases the aesthetic appeal of homes, increasing property values.

The Cortland County Soil and Water Conservation District offers an annual Spring Tree Seedling and Ground Cover Sale, generally beginning in January and ending in April. New-York grown conifers, hardwoods, shrubs, and ground covers can be purchased at low-costs during the sale, and the planted greenery helps to prevent erosion and provide shading of homes.

# LAND USE

There is a growing acknowledgement by scientists and policy analysts that a substantial part of the global warming challenge may be met through the design and development of cities and towns. The form and function of human settlements can either reduce or increase the demand for energy, and can also influence how energy is produced, distributed, and used. Planning and urban design measures can substantially reduce the number and distance of vehicle trips by organizing human activity in compact communities with a range of housing types, providing reliable transit to and from employment, and placing services within easy walking distance of home.


Downtown Cortland

## BACKGROUND

Unprecedented human intervention will be required in the coming decades to reduce the extent of climate change and, thereby, avoid its worst potential consequences (referred to as mitigation), or make changes to accommodate those effects that are unavoidable (adaptation). Much of the mitigation policy discussion to-date has centered on reducing greenhouse gas (GHG) emissions through fuel substitution and fuel efficiency for vehicles and on energy efficiency for buildings and industries. The scale of intervention required to reduce and adapt to the effects of climate change will require action at all levels of government and society. International accords to limit overall carbon emissions will involve national governments. Setting carbon emission targets and standards by industry or sector, or fuel efficiency standards for vehicles, falls within the traditional purview of federal and state governments. New York State, for example, has set aggressive energy and climate goals, including meeting 30% of the state's electricity needs with renewable energy sources by 2030, and reducing greenhouse gas emission by 80% below 1990 levels by 2050.

At the same time, there is a growing acknowledgement by scientists and policy analysts that a substantial part of the global warming challenge may be met through the design and development of cities and towns. The form and function of human settlements can either reduce or increase the demand for energy, and can also influence how energy is produced, distributed, and used. Planning and urban design measures can substantially reduce the number and distance of vehicle trips by organizing human activity in compact communities with a range of housing types, providing reliable transit to and from employment, and placing services within easy walking distance of home. For example, research has shown that miles driven are reduced by between 20 and 40 percent in compact urban development compared to miles driven in the auto-dependent suburbs that have predominated in North America since the Second World War.

Transportation activity of all forms contributes about 33 percent of energy-related GHG production in the United States, and single-occupant automobile travel makes up about half of that activity. The vast majority of vehicles now burn carbon fuels and will continue to do so for some time (even with aggressive fuel substitution and efficiency measures), so strategies that reduce travel by limiting low-density development and encouraging more compact,

walkable, full-spectrum living and working environments can potentially make a significant contribution to overall climate change mitigation. Studies indicate that a GHG reduction of up to 10 percent may result from a change in land use approach alone, and additional reductions will result from employing other strategies such as investments in transit, encouraging development around transit stops, and parking charges. By one estimate, approximately two-thirds of all development in 2050 will be new or will have been redeveloped since 2007, suggesting that combined land use and transportation strategies could be quite powerful in mitigating the increases in GHGs.

The way that land uses and transportation infrastructure are arranged within a community has a strong influence on whether residents choose to walk, bike, use public transit, or drive. These travel choices directly affect the amount of transportation-related GHG emissions produced in Cortland.

Single-passenger automobile trips generate substantially more GHG emissions per mile than public transit and carpooling. Walking and biking are GHG-free transportation alternatives. Transportation and land use strategies provide a variety of measures that strive to increase resident use of alternative travel modes and reduce automobile dependence in Cortland.

Additional carbon reductions could come from exploiting other aspects of land use planning and redevelopment. Using the critical mass of buildings and activities at the district scale, it is possible to develop practical and efficient heating and cooling systems (district energy systems). This approach shows great promise in reducing the carbon footprint of urban development. Other energy conservation benefits may result from common-wall and vertical living structures typical of multifamily urban locations. It has been reported that per capita energy consumption and GHG emissions are 2 to 2.5 times higher in low-density developments than in high-density areas.

Urban design also offers the potential for cities to claim some of the attributes now associated primarily with rural living, including green infrastructure, such as natural systems that handle storm water and reduce heating loads, and localized food production and farmers markets that reduces shipping, storage, and packaging needs. These and other strategies that exploit the non-transportation aspects of urban form may contribute significantly to overall GHG mitigation.

## LAND USE ANALYSIS AND RECOMMENDATIONS

There were approximately 8,738 jobs in Cortland in 2011 and according to the American Community Survey 2008-2012 data, there were 7,995 Cortland residents who were workers. Of the total number that drove vehicles, approximately 67% drove alone and 11% carpooled.  1% rode public transit, 14% walked, 2% biked or used taxi, motorcycle or other means to work. 5% worked from home. While alternative travel modes make up a notable share of commute trips in Cortland, single-passenger automobile trips constitute the vast majority. Combined commuting and shopping trips constitute the majority of a household's annual vehicle trips and generate a large portion of the community's transportation-related GHG emissions.

In 2010, there were 6,946 households in the City of Cortland and 2.77 households per acre. Examining Cortland's existing land use pattern and transpor-

tation infrastructure provides insight into ways the community can reduce GHG emissions. A variety of land use, transportation, and urban design factors affect travel behavior. By making subtle land use changes and improving transportation infrastructure, Cortland can increase walking, bicycling, and transit use. Factors most directly influencing travel behavior in Cortland include: diversity of uses, proximity of uses, density, pedestrian and bicycle conditions, transit accessibility, parking, and streetscape design. Each of these is discussed in detail below.

***Diversity of uses – The degree to which residential, commercial, industrial, institutional, and recreational uses are located together.***

Increasing the diversity of neighborhood-serving, and specifically job-rich, uses within Cortland could help reduce the community's transportation-related GHG emissions. Increased diversity reduces travel distances and facilitates more walking and cycling trips. Improving the mix of uses within Cortland can also reduce commute distances, particularly if affordably priced housing is located in areas with a high number of jobs and employees can commute to work using alternative modes.

SUNY Cortland Campus, Cortland

A jobs/housing ratio is commonly used to evaluate the diversity of land uses within a community by describing the relationship between employment opportunities and housing supply. A ratio of 1.0 describes a balance between jobs and housing. A ratio above 1.0 indicates that there are more jobs than housing, while a ratio below 1.0 describes an undersupply of jobs relative to housing. In 2011, there were approximately 8,738 jobs and 6,946 households in Cortland and the jobs/housing ratio was approximately 1.3. This demonstrates that there were considerably more jobs than housing opportunities within the City.

***Proximity of uses – The distance between neighborhood commercial services and residents' homes.***

Urban design research demonstrates that most people will walk to destinations that are within ¼ mile or a 5-minute leisurely walk. Neighborhoods are considered to be pedestrian-friendly if residents' homes are within ¼ mile of a diverse array of commercial and civic uses. Two methods of spatial analysis were used to evaluate the proximity of residences to commercial uses in Cortland and support the development of CAP measures. The first measured proximity of residences to commercial centers and the second measured proximity of residences to a diversity of uses.

The first method examined how many residential parcels are located within ¼ mile of commercial districts and provides insight into the effectiveness of the City's existing zoning and land use pattern from the pedestrian perspective. Although some residential portions of Cortland are distant from commercial services, overall, the City's existing land use pattern creates many opportunities for pedestrian and bicycle travel. Of the 3,933 total residential parcels, 3,924 (99.7%) are located within ¼ mile of a commercial district.

The second method of proximity analysis identified eleven categories of

neighborhood services (schools, libraries, drugstores, grocery stores, medical facilities, post offices, nursery schools, parks, nursing homes, hardware stores, and restaurants), mapped all the locations of these services within Cortland and then examined how many of these distinct uses are within a ¼ mile walking distance of individual residential parcels.

This analysis determined that 89% of the residential parcels are located within ¼ mile of three or more amenities. Residents with low levels of pedestrian access to neighborhood-serving uses are more likely to drive to purchase their daily goods and services. City-directed land use and zoning changes, small business loans and other incentives could help improve the proximity to diverse uses. These actions could encourage pedestrian travel and reduce automobile dependence in Cortland.

***Density – The number of housing units, people, or jobs in a given area***

Higher densities tend to increase the number of services, shops, schools, and public buildings located within a neighborhood and increase the availability of transit and pedestrian infrastructure. These conditions tend to reduce the need for vehicle ownership and increase the use of alternative modes.

**Residential Density:** Residential density is normally measured in terms of housing units per acre. Cortland has a relatively high/moderate residential density for a predominantly residential suburban community. Of the total number of residential parcels in the City (3,933), there are 3,084 single family residential parcels. The single family residential density (the number of single-family parcels divided by the acreage of all residential parcels) is 4.66.

The average residential density of households per acre is approximately 2.77. There are 748 two and three family (or multiple residential) parcels, with an average density of 5.20 units per acre. Apartment buildings are located on 99 parcels, with an average density of 2.29 apartment buildings per acre.

Approximately 7% of the City's residential land use is classified as low-density, 66% as medium density, and 27% is classified as high density. The most populated areas in Cortland are the residence halls on the SUNY Cortland campus and an area on the west side of Main Street, between the intersection of Argyle Place and Frederick Avenue.

**Infill Development:** Infill development refers to the use of vacant land within a built-up area for additional construction. This term is often associated with community redevelopment or growth management programs or as a component of smart growth. Infill development focuses on the reuse of underutilized buildings and sites where buildings are constructed on vacant property or between existing buildings. Within the City of Cortland, 329 parcels (315 acres) are classified as vacant. Infill development potential exists within the commercial district from I-81 exit 11 to Cortland, along State Route 13 (Clinton Ave) and County Route 222 (Groton Ave). The City can consider ways to encourage such development through overlay zoning and other techniques that can be included in an update to the City's Comprehensive Plan and zoning codes.

**Commercial Intensity:** Commercial building intensity is measured using a floor-area ratio (FAR), which is obtained by dividing a building's floor area by the underlying parcel's area. The City's current zoning codes discourage com-

pact and mixed-use development by requiring large street setbacks for multi-story buildings, which disrupts the streetscape and makes walking and bicycling difficult. The City can consider revising its Comprehensive Plan and zoning codes to allow for greater commercial intensity by establishing a higher floor-area ratio allowances for mixed-use buildings than for other buildings. Such allowances can be provided for targeted commercial districts from Interstate 81 exit 11 to Cortland, along State Route 13 (Clinton Ave) and County Route 222 (Groton Ave).

***Pedestrian and bicycle conditions – The quantity and quality of sidewalks, crosswalks, paths and bike lanes, and the level of pedestrian security.***

Well-developed pedestrian and bicycle infrastructure and pedestrian-friendly design are essential if walking and biking are to be important travel modes in a community. Highly connected sidewalks and bicycle infrastructure reduce travel distances between destinations and improve access and safety. Pedestrian and bicycle infrastructure includes sidewalks, crosswalks, traffic calming devices, bike lanes, and racks/storage facilities.

**Pedestrian and Bicycle Infrastructure:** The City of Cortland has a well-connected and complete network of sidewalks and the overall condition is considered by most to be satisfactory. The City has maintenance and replacement responsibility for the sidewalks that are located along municipally-owned City properties. The remainder of the sidewalks in the City is the responsibility of the landowners along whose frontage the sidewalk is located. Occasional problems arise when the sidewalks become unsafe and impassible due to poor maintenance. In severe cases, poorly maintained walkways cause people to walk in the roadway. The City currently has a Sidewalk Program to assist homeowners in replacing deteriorated walks.

Striped crosswalks are present on arterials and streets near schools, but there is little use of traffic calming devices such as curb extensions (known as bulb outs), refuge islands (a small section of pavement where pedestrians can stop before finishing crossing a road), and chokers (build-outs added to a road to narrow it). 79 pedestrian accidents and 56 bicycle collisions occurred between January 1, 2002 and December 31, 2011. The highest concentration of pedestrian accidents (most incidents at any one point) occurred on Port Watson Street, from Main Street to Franklin Street (12 accidents) and three took place at the intersection of Port Watson Street and Pomeroy Street.

With the exception of walkways in City parks, there are no trails located within the City but the multi-use Tioughnioga River Trail is currently in the planning stage. The Millennium Trail, created through the Cortland County Bicycle Coalition, is the only officially designated bike route along the City streets. There are no off-road trails specifically for bicycle use, other than pathways in City parks. Bike racks can be found in various parts of the City, but shortages exist near civic and commercial uses, which may limit residents' desire to bike to these locations. Additionally, bike racks are often not provided in conjunction with bus stops. Availability of biking and hiking routes and installation of bike racks in Cortland are encouraged in order to promote alternative forms of transportation. Biking and hiking lead to better health and reduce au-

tomobile pollution, and trails increase property values.

***Transit accessibility – The ease with which people can access transit service and the quality of that service.***

Residents and employees are more likely to use transit if traveling by bus or train is relatively time-competitive with driving, if transit stations are accessible to pedestrian and cyclists, and if the transit experience is pleasant. People are generally willing to walk ½-mile to a light rail station or ¼-mile to a bus stop. A ¼-mile walk takes the average person around 10 minutes.

The Cortland Transit Company provides a bus service in the City and also operates a Dial-A-Ride system whereby the public can arrange for transportation to any location. According to the Cortland Comprehensive Plan, the bus service is not a reliable or convenient mode of transportation for most people because of its limited schedule. There are also private transportation companies, as well as the College, that provide transportation services to SUNY Cortland students. An analysis of the transit bus service with a goal of improved scheduling is recommended.


Bicycle parked outside of the Blue Frog, Cortland

Trailways and Greyhound bus services provided long-distance bus service to the community. However, there is no bus station, and both companies pick up and drop off passengers on Central Avenue near the County Office building. Passengers need to wait outside for the bus or under an open shelter with no available restrooms. A new, more convenient bus station with protection from the weather would help to encourage the use of alternate forms of transportation.

***Parking – The supply, price, and regulation of parking facilities.***

Inexpensive and abundant parking increases automobile ownership and use. Large parking lots also disperse destinations and reduce walking and public transit convenience and use. Limiting the availability of parking spaces and imposing fees can reverse the equation, reducing the number of cars on the road and increasing use of alternative modes of transportation.

***Streetscape design – The scale and design of streets, sidewalks, and adjacent uses.***

Urban design research demonstrates that people walk more and drive less in pedestrian-oriented commercial districts than in automobile-dominated commercial centers. Street designs that reduce vehicle traffic speeds, improve walking and cycling conditions, and enhance the pedestrian experience encourage use of alternative modes.

Recommended improvements in the City of Cortland would include pedestrian-friendly design features such as wider sidewalks, street trees, benches, decorative street lights, and bulb-out pedestrian crossings. Coordination with NYS Department of Transportation would be required to make such improvements.

## STRATEGY IMPLEMENTATION CHART

| Issue | Strategy | Ballpark Rankings (see key below) | | | Possible Implementation Methods | | | | Additional Benefits | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Costs (1-5) | GHG Reductions (1-5) | Payback (1-5) | Policy | Program | Capital Projects | Education/ Outreach | Green Job creation | Quality of Life | Water Conservation | Other |
| Transportation: Municipal | 1. Conversion to hybrid vehicles | 1 | 1 | 2 | x | | x | x | | x | | x |
| Transportation: Community | 2. Conversion to hybrid vehicles | 3 | 1 | 3 | x | | x | x | x | x | x | x |
| | 3. Improved bicycling paths and facilities | 1 | 1 | 4 | | x | | x | x | x | | x |
| | 4. Increase bus ridership | 1 | 1 | 1 | | x | | x | | x | | x |
| | 5. Walking friendly environments | 3 | 1 | 3 | | | x | x | x | x | | x |
| Energy/Efficiency: Municipal | 1. PV Solar production | 3 | 3 | 4 | | x | x | | x | | | x |
| | 2. Energy efficiency retrofits to existing facilities | 3 | 2 | 5 | | | x | x | x | x | x | x |
| | 3. LED streetlights | 1 | 1 | 1 | | x | x | x | | x | | x |
| | 4. Power Down at Night policy | 1 | 1 | 1 | x | | | x | | | | x |
| | 5. Require green building for new construction | 1 | 1 | 1 | x | x | x | x | x | x | x | x |
| | 6. Green roofs | 1 | 1 | 5 | | | x | x | | | x | x |
| | 7. Reflective roofing | 1 | 1 | 1 | | | x | x | | x | | x |

### Key to Ballpark Rankings

| Est. Total Costs | Est. Total GHG Impact | Est. Payback |
|---|---|---|
| 1 = Less than $250,000 | 1 = 0-9.9% of goal | 1 = Less than 1 year |
| 2 = $250,000-$999,999 | 2 = 10-24.9% of goal | 2 = 1-4.9 years |
| 3 = $1 million-$24,999,999 | 3 = 25-49.9% of goal | 3 = 5-9.9 years |
| 4 = $25 million-$99,999,999 | 4 = 50-74.9% of goal | 4 = 10-19.9 years |
| 5 = $100 million or more | 5 = 75-100% of goal | 5 = 20 years or more |

| Issue | Strategy | Ballpark Rankings (see key below) | | | Possible Implementation Methods | | | | Additional Benefits | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Costs (1-5) | GHG Reductions (1-5) | Payback (1-5) | Policy | Program | Capital Projects | Education/ Outreach | Green Job creation | Quality of Life | Water Conservation | Other |
| Energy/Efficiency: Community | 8. Energy efficiency education for residents | 1 | 1 | 1 | | x | | x | | x | | x |
| | 9. Purchase green electricity | 1* | 1 | N/A | | x | | x | | | | x |
| | 10. Commercial Solar | 3 | 1 | 4 | | x | x | x | x | x | | x |
| | 11. Residential Solar | 3 | 1 | 4 | | x | x | x | x | x | | x |
| | 12. Energy efficiency education for businesses | 1 | 1 | 1 | | x | | x | | x | x | x |
| Waste | 1. Organics composting program | N/A | 1 | N/A | | x | x | x | | | | x |
| Other | 1. Tree planting | 1 | 1 | 2 | | x | x | x | | | | x |

***While there is no initial implementation cost of purchasing green electricity, it will cost the community $62,881 annually.**


CLIMATE SMART COMMUNITIES
NEW YORK STATE

Central New York Regional Planning & Development Board

Central New York
c2ip climate change innovation program

CNY Energy Challenge

CITY OF CORTLAND
25 COURT STREET, CORTLAND, NY 13045