



CONTRA COSTA COUNTY

CLIMATE ACTION PLAN



Los Vaqueros Reservoir, Contra Costa County

**CONTRA COSTA COUNTY
CLIMATE ACTION PLAN
PUBLIC HEARING DRAFT
DECEMBER 2015**



Acknowledgements



Cover and section break photos courtesy of Kristin McCleery.

U.S. DEPARTMENT OF ENERGY



This material is based upon work supported by the Department of Energy under Award Number DE- EE0000888.

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Acknowledgements

PREPARED BY:



Contra Costa County
Department of Conservation and Development
Community Development Division
30 Muir Road
Martinez, CA 94553
www.cccounty.us/dcd

AND

Michael Baker International
500 12th Street
Suite 250
Oakland, CA 94607
www.mbakerial.com

WITH ASSISTANCE FROM

ESA
350 Frank H. Ogawa Plaza
Suite 300
Oakland, CA 94612
www.esaassoc.com

Fehr and Peers
1330 Broadway
Suite 833
Oakland, CA 94612
www.fehrandpeers.com

Acknowledgements

CONTRA COSTA COUNTY BOARD OF SUPERVISORS

John Gioia*, District I

Candace Anderson, District II

Mary Nejedly Piepho, District III

Karen Mitchoff, District IV

Federal Glover*, District V

*Denotes Ad Hoc Sustainability Committee Members

Participating County Departments

Department of Conservation and Development

John Kopchik, Director

Catherine Kutsuris, Director (Retired)

Jason Crapo, Deputy Director/Chief Building Official

Aruna Bhat, Deputy Director

Maureen Toms, Deputy Director

Steve Goetz, Deputy Director (Retired)

Will Nelson, Principal Planner

Deidra Dingman, Principal Planner

John Cunningham, Principal Planner

Patrick Roche, Principal Planner (Retired)

John Osborne, Senior Planner

Demian Hardman, Planner

County Administrator's Office

Lara Delaney, Senior Management Analyst

Public Works Department

Julia Bueren, Director

Brian M. Balbas, Deputy Director

Stephen Kowalewski, Deputy Director

Joe Yee, Deputy Director

Jerry Fahy, Supervising Civil Engineer

Health Services Department

Wendel Brunner, MD, Public Health Director (Retired)

Michael Kent, Hazardous Materials Ombudsman

Abigail Kroch, Director of Epidemiology

Will Dominie, Built Environment Program Specialist (Former County Employee)

Special acknowledgment for providing assistance to the health co-benefit evaluation goes to Jennifer Lifshay, Martin Lynch, Joanne Genet, and the members of the Public and Environmental Health Advisory Board (PEHAB)

Department of Agriculture/Weights and Measures

Chad Godoy, Agricultural Commissioner/Director of Weights and Measures

Matthew Slattengren, Assistant Agricultural Commissioner

Table of Contents

Chapter 1 – Introduction	1
Purpose and Scope	1
Plan Area	2
Local Setting	5
CAP Challenges for Contra Costa County	7
Preparation of the CAP	9
Using this CAP	10
Chapter 2 – Scientific and Regulatory Setting	13
Climate Change Overview	13
Climate Change Impacts	13
Climate Change and Public Health	17
Regulatory Setting	20
Chapter 3 – GHG Inventory and Forecast	27
Introduction	27
Inventory Background	27
Data Collection Methods and Analysis	29
2005 Baseline Inventory Results	29
2013 Inventory Update	31
GHG Emissions Forecast	33
Existing State GHG Reduction Programs	34
GHG Reduction Targets	37
Chapter 4 – GHG Reduction Strategy	39
Reduction Strategy Structure	37
Healthy Community Strategies	43
Existing Local Actions	47
GHG Reduction Strategies	49
GHG Reduction Summary	74
Chapter 5 – Implementation	77
Implementation Policies	77
Implementation Matrix	82
Glossary	89

Table of Contents

Works Cited	99
Appendix A - Health Co-Benefit Evaluation	A-1
Appendix B - BAAQMD Appendix	B-1
Appendix C - Inventory & Forecast Report	C-1
Appendix D- GHG Reduction Tech Appendix.....	D-1
Appendix E – Development Checklist	E-1

TABLES

Table 1.1. Unincorporated Places in Contra Costa County	2
Table 1.2. Largest GHG Emitting Stationary Sources, Unincorporated Contra Costa County.....	8
Table 1.3. Unincorporated Contra Costa GHG Emissions including Stationary Sources and Major Industrial Energy Use	8
Table 2.1. Human Health Effects of Climate Change in California	17
Table 2.2. Criteria Air Pollutants	19
Table 2.3. California Regulatory Framework.....	22
Table 3.1. 2005 Activity Data and GHG Emissions by Sector and Subsector	30
Table 3.2. 2013 Activity Data and GHG Emissions by Sector and Subsector	32
Table 3.3. Comparison of 2005 and 2013 GHG Emissions by Sector	32
Table 3.4. ABAG Projections for Unincorporated Contra Costa County, 2005–2035	33
Table 3.5. GHG Emissions by Sector, 2005–2035.....	34
Table 3.6. Expected GHG Reductions from State Policies, 2020 and 2035.....	35
Table 3.7. GHG Emissions with State Reduction Actions, 2005–2035	36
Table 3.8. Baseline GHG Emissions, Forecasts, and Reduction Goals.....	38
Table 4.1. Example Measure Quantification	42
Table 4.2. GHG Reduction Summary by Topic (MTCO ₂ e)	74

FIGURES

Figure 1.1. County Map	3
Figure 1.2. Race and Ethnic Composition of Unincorporated Contra Costa County, 2014.....	6
Figure 1.3. Age Composition of Contra Costa County Residents, 2010	6
Figure 2.1. Climate Change Impacts, 2070-2099.....	14
Figure 3.1. 2005 GHG Emissions by Sector.....	30

Table of Contents

Figure 3.2. 2013 GHG Emissions by Sector..... 31

Figure 3.3. Baseline GHG Emissions, Forecasts, and Reduction Goals..... 38

Figure 4.1. GHG Reduction Measure Development Process..... 40

Figure 4.2. GHG Quantification Sources and Tools 41

Figure 4.3. GHG Reduction Summary (MTCO₂e) 75



PURPOSE AND SCOPE

Climate change is expected to have significant adverse impacts locally, throughout California, and worldwide unless considerable steps are taken to reduce greenhouse gas (GHG) emissions. This Climate Action Plan (CAP) demonstrates Contra Costa County's (County) commitment to addressing the challenges of climate change by reducing local GHG emissions while improving community health. Additionally, this CAP meets the California Environmental Quality Act (CEQA) requirements for developing a qualified GHG reduction strategy, and is consistent with the Bay Area Air Quality Management District's (BAAQMD) guidance on preparing a qualified GHG reduction strategy. A qualified reduction strategy provides CEQA tiering, or streamlining, benefits to subsequent development projects that are consistent with the CAP. **Appendix B** outlines BAAQMD's guidance and describes how this CAP is consistent.

Assembly Bill (AB) 32

The California Global Warming Solutions Act of 2006 represents California's effort to reduce GHG emissions and combat global climate change.

This CAP identifies how the County will achieve the AB 32 GHG emissions reduction target of 15% below baseline levels by the year 2020, in addition to supporting other public health, energy efficiency, water conservation, and air quality goals identified in the County's General Plan and other policy documents. In addition to reducing GHG emissions, this CAP includes actions that improve public health and result in additional benefits to the community such as lower energy bills and enhanced quality of life. The CAP also lays the groundwork for achieving long-term state GHG reduction goals for 2035. Specifically, this CAP:

- Provides the scientific, regulatory, and public health framework for addressing climate change and GHGs at the local level (**Chapter 2**).
- Identifies sources of GHG emissions within the unincorporated areas of the county and estimates how these emissions may change over time (**Chapter 3**).

Introduction

- Provides energy use, transportation, land use, water use, and solid waste strategies to reduce community-wide GHG emissions consistent with AB 32, BAAQMD guidance, and Public Resources Code Section 21083.3 (CEQA) (**Chapter 4**).
- Proposes an approach to addressing climate change-related public health issues, which increases the county's resiliency to climate change, establishes priorities for improving public health, and identifies public health benefits that are expected to result from implementing the CAP (**Chapter 4**).
- Presents an implementation program to assist with monitoring and prioritization of the reduction strategies and public health goals through 2020 (**Chapter 5**).

PLAN AREA

This CAP inventories emissions from, provides GHG reduction measures for, and is applicable to all unincorporated areas of Contra Costa County, including the unincorporated communities identified in **Table 1.1**. Incorporated cities are responsible for preparing and implementing their own climate action plans.

Table 1.1. Unincorporated Places in Contra Costa County

Acalanes Ridge	Clyde	North Gate
Alamo	Contra Costa Centre	North Richmond
Alhambra Valley	Crockett	Pacheco
Bay Point	Diablo	Port Costa
Bayview	Discovery Bay	Reliez Valley
Bethel Island	East Richmond Heights	Rodeo
Blackhawk	El Sobrante	Rollingwood
Briones	Kensington	San Miguel
Byron	Knightsen	Saranap
Camino Tassajara	Montalvin Manor	Shell Ridge
Canyon	Mountain View	Tara Hills
Castle Hill	Norris Canyon	Vine Hill

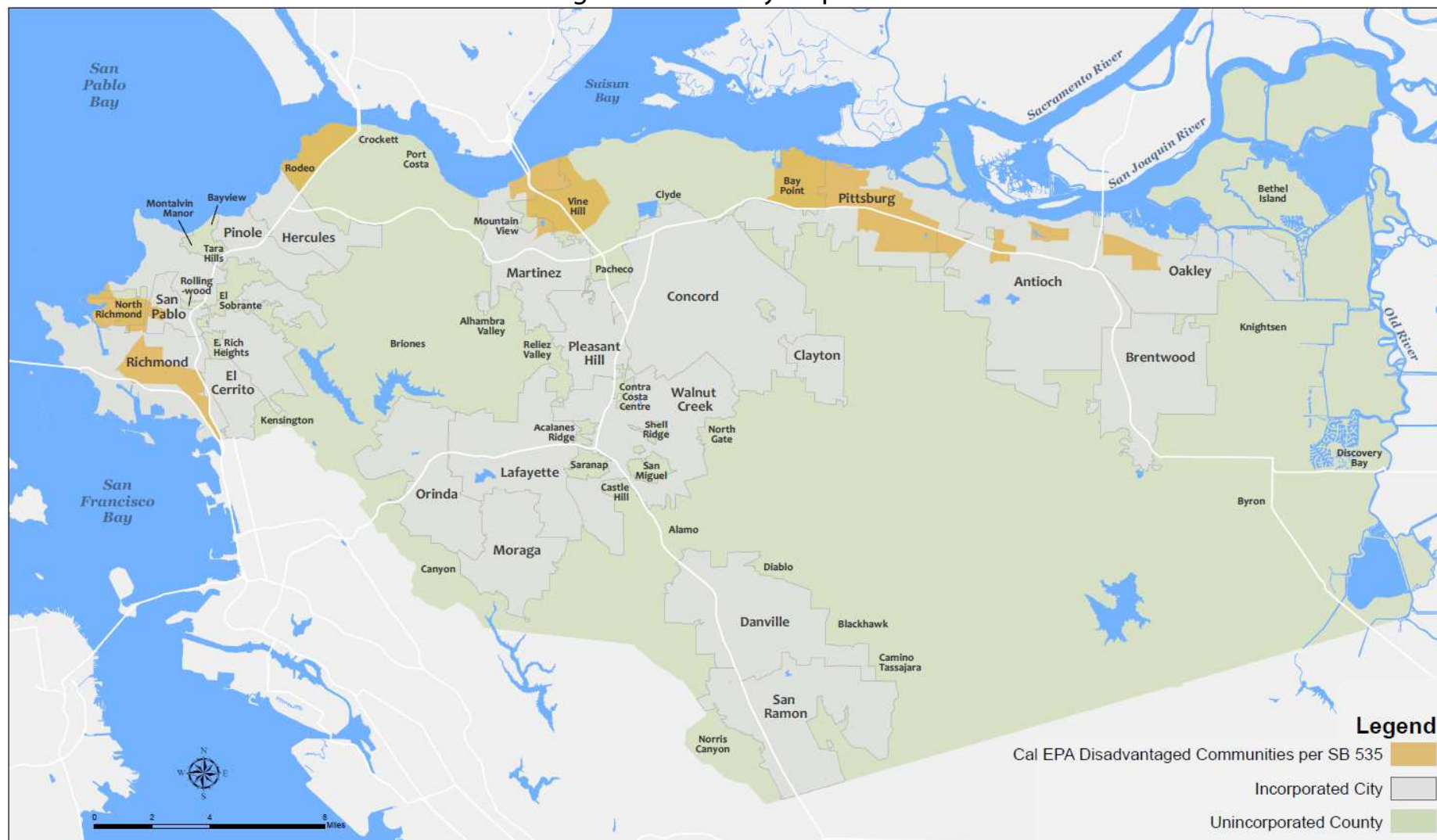
Source: Contra Costa County General Plan Housing Element

Figure 1.1 displays the jurisdictional boundaries of Contra Costa County, its incorporated cities, and the unincorporated area. In cases where the County lacks direct regulatory authority to require GHG emissions reductions, staff will collaborate with local, county, state, and/or federal agencies to promote the emission reduction goals in this CAP beyond the unincorporated area. **Figure 1.1** also displays disadvantaged communities, which are eligible for climate change–related funding. For more information, see the Public Health section in this chapter.

Introduction

#1

Figure 1.1. County Map



LOCAL SETTING

Contra Costa County is one of the original 27 counties in the state of California, incorporated in 1850 with the City of Martinez as the county seat. The county is located in the East Bay region of the San Francisco Bay Area. It is bounded on the northwest and north by the San Pablo Bay and the Sacramento-San Joaquin Delta, respectively; on the east by the Middle River and San Joaquin County; on the south by Alameda County; and on the west by Alameda County and the San Francisco Bay.

PHYSICAL GEOGRAPHY

Contra Costa County's physical geography is dominated by its extensive waterfront on the San Francisco and San Pablo Bays and the Sacramento-San Joaquin Delta. These waterfront areas are home to heavy industry, including active oil refineries and power plants. The other dominant geographic feature is Mount Diablo, a 3,849-foot peak near the county's geographic center. The summit of Mount Diablo is the origin of the Mount Diablo Meridian and the basis for many of the California and western Nevada surveys. Lesser topographic features, such as the Diablo Range and the Oakland/Berkeley Hills, are also important elements of the natural landscape.

LOCAL CLIMATE

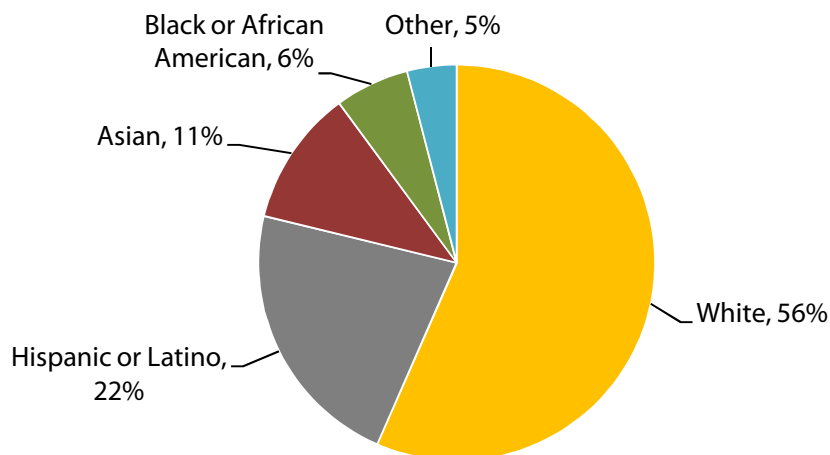
The climate varies greatly depending on location in the county. Areas closer to the coast have moderate temperatures year-round with mild, wet, and frostless winters and fog conditions in the cool summer months. Along the bay shore, the fog and marine air create a moderate climate with mild winters and summers. Inland valleys have less humidity and tend to experience colder winters and hotter summers.

DEMOGRAPHICS

According to the Association of Bay Area Governments' (ABAG) 2013 regional projections, in 2010, the unincorporated portion of Contra Costa County had approximately 159,780 residents living in approximately 57,706 households. As reported in the 2014 General Plan Housing Element, and illustrated in **Figure 1.2**, approximately 56% of the population was white, 22% was Hispanic or Latino, 11% was Asian, 6% was black or African American, and 5% were "other." Racial composition varies greatly by community in the unincorporated county.

Introduction

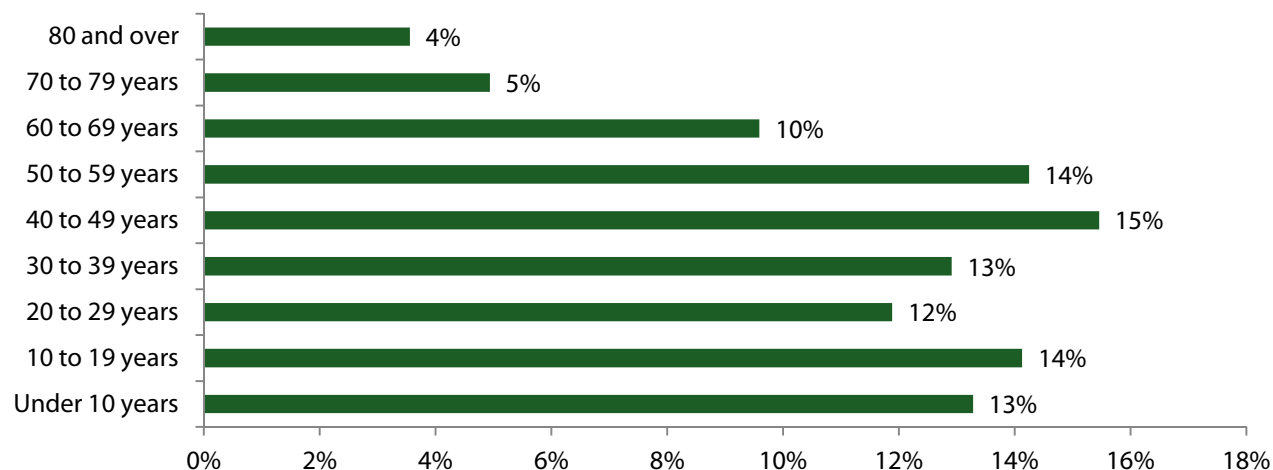
Figure 1.2. Race and Ethnic Composition of Unincorporated Contra Costa County, 2014



Source: Contra Costa County General Plan 2014

As shown in **Figure 1.3**, the majority of Contra Costa County's residents are working adult age. Children and young adults age 19 and younger make up approximately 27% of the population and seniors (70 and older) make up approximately 9% of the population. Like race and ethnicity, the general population age characteristics belie the great diversity in age compositions that exist across the different communities in the county.

Figure 1.3. Age Composition of Contra Costa County Residents, 2010



Source: US Census 2010

The US Department of Housing and Urban Development establishes median incomes annually. In 2015, the median household income in the Oakland – Fremont HUD Municipal Area (which includes Contra Costa County) was \$92,900, down slightly from the 2012 median of \$93,500 but up from the 2014 median of \$88,500 (HUD 2015). Contra Costa’s median income is higher than California statewide averages and higher than neighboring Alameda and Solano Counties.¹

HOUSING

As noted by the 2014 Contra Costa Housing Element, single-family homes are the dominant housing type in the county. In unincorporated areas of the county, single-family units comprise nearly 80% of the entire housing stock. Multifamily units and mobile homes comprise 14% and 6% of total housing units, respectively. Adequate affordable housing is a challenge in the county, with an estimated 45% of households (74% of extremely-low income, 65% of very low-income, and 48% of low-income households) spending more than one-third of their incomes on housing. Both rental costs and home prices have increased in recent years due to low vacancy rates and increasing regional housing demand (Contra Costa County 2014).

CAP CHALLENGES FOR CONTRA COSTA COUNTY

Contra Costa County is home to emissions from refineries, power plants, and other stationary source facilities. Although these emissions are largely regulated at a state and federal level, Contra Costa County is working to understand these sources and to address public health-related climate change issues stemming from these facilities.

STATIONARY SOURCES

As illustrated in **Table 1.2**, Contra Costa County is home to some of the largest GHG-emitting stationary source facilities in the state of California. Stationary sources are non-moving, fixed-site producers of pollution such as power plants, chemical plants, oil refineries, manufacturing facilities, and other industrial facilities (EPA 2010). In 2013, the unincorporated areas of Contra Costa County had 20 stationary source facilities that were required to report emissions to the California Air Resources Board (CARB), including the second, ninth, thirteenth, and fifteenth largest emitters in the state. Emissions from stationary source facilities and from the energy used by those facilities and other major industrial sites accounted for 93% of all emissions within the unincorporated county in the baseline year of 2005 and 92% in 2013. **Table 1.3** illustrates the 2005 baseline GHG inventory and the 2013 GHG inventory update with stationary source emissions included. Acknowledging that local governments have little influence or control over energy use at or emissions from large stationary sources, the state of California has developed a market-based program created through the AB 32 2006 Scoping Plan, often referred to as the “cap-and-trade” program, designed to reduce those emissions. In order to identify a GHG reduction target attainable through local action, stationary source emissions and emissions from energy used at stationary source facilities were excluded from the baseline GHG inventory and forecasts used in this CAP.

¹ According to the 2014 Housing Element, the income profile of the unincorporated county is similar to the incorporated cities in the county; therefore, countywide data is used as a proxy for the unincorporated county.

Introduction

Table 1.2. Largest GHG Emitting Stationary Sources, Unincorporated Contra Costa County

Facility	Total 2005 Emissions (MTCO ₂ e)	Total 2013 Emissions (MTCO ₂ e)	Facility Type
Shell Oil Products US, Martinez Refinery	3,619,640	4,190,690	Refinery
Tesoro Refining and Marketing Co., Golden Eagle Refinery	2,097,140	2,443,970	Refinery
Philips 66 (Conoco Phillips) Refinery at Rodeo	1,866,110	1,363,290	Refinery
PG&E Gateway Generating Station	0	1,238,540	Power Plant
Air Liquide	0	884,930	Gas Manufacturing
Crockett Cogeneration Plant	678,010	735,330	Power Plant
Martinez Cogen Limited Partner	412,100	386,220	Power Plant
GWF Power Systems, LP (site 5)	200,690	0	Power Plant
GWF Power Systems, LP (site 4)	190,640	0	Power Plant
GWF Power Systems, LP (site 3)	181,520	0	Power Plant

Source: Environmental Protection Agency 2012

Table 1.3. Unincorporated Contra Costa GHG Emissions including Stationary Sources and Major Industrial Energy Use

	Total 2005 Emissions (MTCO ₂ e)	Total 2013 Emissions (MTCO ₂ e)
Stationary sources	13,983,030	11,873,500
Energy use of major industrial facilities	3,344,000	5,026,560
Total of excluded sectors	17,327,030	16,900,060
Emissions from included sectors	1,403,610	1,392,450
Total of included and excluded sectors	18,730,640	18,292,510
Percent of emissions from excluded sectors	93%	92%

Source: Michael Baker International 2015

PUBLIC HEALTH

Stationary source emissions have a significant impact on public health in Contra Costa County. Although the County has limited power to influence stationary source emissions, public health impacts may be partially mitigated through cap-and-trade funding. Some of the revenue generated through the cap-and-trade program is designated to be returned to communities where the emissions occur to fund climate change- or pollution-related projects. In addition to reducing GHG emissions, the County is also using this CAP to support public health goals. The Contra Costa County CAP includes:

- Indicators that examine the public health benefits of GHG mitigation strategies.
- Healthy community strategies that support County efforts to address potential public health impacts from climate change.
- Recommendations to further public health goals during CAP implementation.

Chapter 4 provides a summary of public health recommendations.

PREPARATION OF THE CAP

The CAP has built upon early work of the County to plan for climate change, including the *Contra Costa County Climate Protection Report* released in 2005, which provided an initial GHG inventory, reported existing County operations and projects to reduce GHGs emissions, and recommended County operations and actions that could reduce GHGs emissions in the future.

In 2009, the County was awarded a \$3.57 million Energy Efficiency and Conservation Block Grant (EECBG) from the US Department of Energy. In 2011, the County dedicated a portion of its EECBG funds to prepare a CAP. In support of this effort, the County updated its GHG inventory and forecasts and developed draft measures to achieve a Year 2020 GHG reduction target consistent with AB 32.

The 2011 effort relied on a comprehensive public participation strategy to engage residents, business owners, and other stakeholders in identifying and refining goals, programs, activities, and projects to reduce emissions. The public participation process included two rounds of County-sponsored community workshops. The first round was hosted in Rodeo, Oakley, and Richmond in June and July 2012, and the second round was hosted in Richmond, Concord, and Oakley in September 2012. The County maintained a project website to provide access to all workshop and meeting notices and materials, links to resources, and a forum to submit comments and questions to staff. The County

Disadvantaged Communities

Funds received by the State from the distribution of emissions allowances as part of the cap-and-trade program are deposited in the Greenhouse Gas Reduction Fund. Upon appropriation by the Legislature, this fund must be used to further reduce emissions of greenhouse gases. Senate Bill 535 (Leon 2012) directed that, in addition to reducing greenhouse gas emissions, a quarter of the proceeds from the Greenhouse Gas Reduction Fund must also go to projects that provide a benefit to disadvantaged communities and a minimum of 10% of the funds must be for projects located within those communities. The legislation gives the California Environmental Protection Agency responsibility for identifying those communities. As previously mentioned, Figure 1-1 illustrates the areas identified as disadvantaged communities in Contra Costa County.

Introduction

released the public draft CAP for public review in December 2012; however, budget and staffing constraints at the time prevented a final CAP from being adopted by the Board of Supervisors.

In January 2015, the County reengaged the CAP project. County staff and the project consultant assessed the 2012 public draft CAP for consistency with state regulations and guidance, current County operations and procedures, and industry best practices for GHG emissions inventories and climate action plans. The County also convened an interdepartmental staff working group to assist with review and update of the draft CAP. The working group included representatives from departments that ultimately would be responsible for implementing the CAP. The group met three times between April and August 2015 to review preliminary drafts of the CAP to ensure that it was representative of current community needs, consistent with existing local actions, and feasible for implementation across County departments.



Participants provide feedback on reduction measures during the first round of open houses at public outreach events.

On September 14, 2015, County staff presented a draft CAP to the Board of Supervisors Ad Hoc Committee on Sustainability. Comments from the committee were incorporated into the public draft CAP released in October 2015.

The County conducted an environmental review of the 2015 draft CAP pursuant to CEQA and the results are presented in the initial study and negative declaration that were circulated for public review with the draft CAP from October 29, 2015, to November 30, 2015. The draft CAP and CEQA document were submitted to the State Clearinghouse for distribution to state agencies and a notice of the documents' availability was mailed to a list of nearly 130 recipients including, but not limited to, government agencies, utility providers, business interests, and environmental organizations.

On November 3, 2015, County staff presented the draft CAP to the Board of Supervisors so that board members could familiarize themselves with the document and provide comments prior to the CAP coming before the board for adoption. The final CAP, incorporating comments received at the November 3 hearing, was adopted by the Board of Supervisors on December 15, 2015.

USING THIS CAP

This CAP serves as the County's qualified GHG reduction strategy. This CAP provides a GHG emissions inventory, GHG forecast, GHG reduction target, and a set of strategies to respond to local contributions to climate change. The CAP focuses especially on the beneficial effects of reducing GHG emissions on public health. The primary objective of this CAP is to identify the County's strategy for addressing climate change locally.

GHG REDUCTION MEASURES

The GHG reduction strategy consists of GHG reduction measures and actions to reduce GHG emissions from community-wide sources. Reduction measures are organized by key issue or goal area. Each reduction measure is presented with a set of actions, a summary or description of the measure, an implementation table, and a summary of reductions and co-benefits.

Emissions reduction measures have been quantified to indicate the contribution that a measure will have on overall GHG reductions. This number is presented in metric ton equivalents of carbon dioxide (MTCO₂e) reduced per year. In some cases, the GHG reduction benefit is included in another strategy. In other instances, measures may not have a direct GHG reduction benefit, but are critical to the success of other reduction strategies. In addition to reducing GHG emissions, many measures will provide numerous co-benefits to the community while furthering the sustainability goals of the County. The ancillary public health benefits of CAP measures are analyzed in Chapters 4 and 5, and Appendices A and D.

What Is a Metric Ton?

The international reporting standard for carbon dioxide (CO₂) emissions is in metric tons. There are 2,204 pounds per metric ton.

Reducing 10 metric tons (MT) CO₂ is equivalent to:

- Saving 1,125 gallons of gasoline
- Taking 2.1 passenger vehicles off the road
- 1.4 homes' worth of electricity for one year

Implementation details are compiled in a summary implementation table in **Chapter 5**. The implementation table identifies the GHG reduction of each measure. In addition, the table includes:

- **Responsible Department(s):** Responsible departments are identified for each measure. In some cases, involvement from multiple departments may be required to effectively implement the measure.
- **Implementation Time Frame:** The implementation time frame indicated for each measure will assist with budgetary and decision-making processes and ensure that measures are implemented in a logical order and timely manner.
- **Performance Indicators:** Indicators provide a quantitative measurement of the progress of each reduction measure. The progress indicators in the implementation plan are used to demonstrate how participation in a particular program is related to reaching the GHG reduction target. The progress indicators used in this CAP rely on data that is already tracked by the County through annual reporting or would be readily available through partner agencies or data requests to utility providers.

Introduction

This page has been intentionally left blank.



In order to make meaningful and effective decisions regarding greenhouse gas (GHG) reductions, it is important to understand the scientific and regulatory framework under which this Climate Action Plan (CAP) has been developed. This chapter provides a brief summary of climate change and its implications, as well as an overview of federal, state, regional, and local regulations that provide guidance and inform the development of this CAP. This chapter also explains climate change-related public health impacts; **Chapter 4, GHG Reduction Strategy**, provides a path to a more resilient and healthy Contra Costa County through CAP measures.

CLIMATE CHANGE OVERVIEW

Scientific consensus holds that human activity is increasing atmospheric GHG concentrations to levels far above what would be expected given natural variability. These gases are released as byproducts of fossil fuel combustion, waste disposal, energy use, land use changes, and other human activities. GHGs, such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), create a blanket around the earth that allows light to pass through but traps heat at the surface, preventing its escape into space. While this is a naturally occurring process known as the greenhouse effect, human activities have accelerated the generation of GHGs beyond natural levels. The overabundance of GHGs in the atmosphere has led to an unexpected warming of the earth and has already started impacting the earth's climate system.

CLIMATE CHANGE IMPACTS

GLOBAL IMPACTS

The Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report summarizes current scientific understanding of global climate change and projects future climate change using the most comprehensive set of recognized global climate models (2013). As asserted in the IPCC Fifth Assessment Report, if trends remain

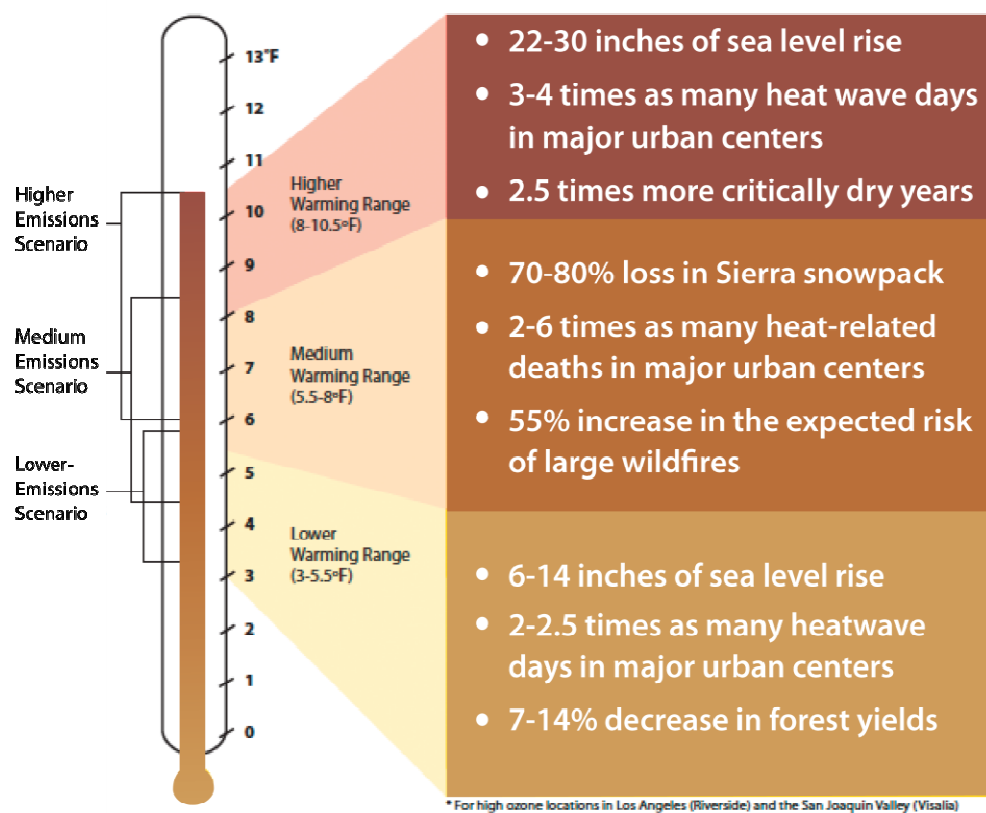
Scientific & Regulatory Setting

unchanged, continued GHG emissions above current rates will induce further warming changes in the global climate system and pose even greater risks than those currently witnessed.

CLIMATE CHANGE IMPACTS IN CALIFORNIA

Research suggests that as a result of climate change, California will experience hotter and drier conditions, reductions in winter snow, increases in winter rains, sea level rise, significant changes to the water cycle, and an increased occurrence of extreme weather events. Such compounded impacts will affect economic systems throughout the state. The California Climate Adaptation Strategy estimates that failing to take action to address the potential impacts of climate change will lead to economic losses of “tens of billions of dollars per year in direct costs” and “expose trillions of dollars of assets to collateral risk” (California Natural Resources Agency 2009). An abridged list of potential impacts in California due to climate change is presented in **Figure 2.1**.

Figure 2.1. Climate Change Impacts, 2070-2099



Source: California Energy Commission

CLIMATE CHANGE IMPACTS IN CONTRA COSTA COUNTY

Due to the diverse geographical conditions of California, potential impacts to ecosystems, the built environment, and human activities will vary. This CAP focuses on impacts that are most relevant to Contra Costa County, particularly as they relate to public health. The county will likely experience more extreme heat events, reduced air quality, changes in sea level, less predictable water supply, and increases in storm severity and frequency of flood events. Even with significant efforts to mitigate GHG emissions today, future climate projections anticipate significant effects on California and Contra Costa County's precipitation, temperature, and weather patterns, which in turn will have dramatic impacts on public health.

More Extreme Heat

The State of California Climate Action Team Biennial Report predicts that higher temperatures will increase in frequency (2009). Higher temperatures can decrease the water supply through increased evaporation rates and irrigation demand, and lead to an increased incidence of wildfires.

Extreme heat events also have dramatic human health impacts. For example, a heat wave in 2006 directly resulted in over 140 deaths in California and may have been indirectly responsible for upwards of 600 deaths in the 17-day period following the event (Margolis et al. 2008). Although the majority of casualties occurred in high temperature areas, there are health affects due to heat waves in both inland and coastal areas, demonstrating that Contra Costa County as a whole is at risk. During the 2006 heat wave, residents of Contra Costa County experienced negative health outcomes (CCHS 2015). According to the Centers for Disease Control and Prevention (CDC), increased temperatures and more frequent and severe heat events produce increased risks of heat-related illness and death. Extreme temperature can exacerbate the following health risks:

- Heat aggravating chronic cardiovascular and respiratory disease.
- Heat increasing lung injury due to higher ground-level ozone concentrations and increasing the severity of respiratory diseases (e.g., asthma and chronic obstructive pulmonary disease).
- Higher temperatures leading to increased demand for energy, which can strain the electric grid and increase energy prices. Increases to cost of living can negatively impact the ability of low-income residents to adapt to higher temperatures, especially from reduced access to air conditioning.

Air Quality

According to Mahmud et al. (2008), the warming climate will increase ozone levels in California's major air basins, leading to upwards of 6 to 30 more days per year with ozone concentrations that exceed federal clean air standards. Cost-effective measures to reduce GHG emissions and protect public health are important for local governments. The Mahmud study also provides evidence of what is becoming known as the "climate penalty," where rising temperatures increase ground-level ozone and airborne health-damaging particles, despite the reductions achieved by programs targeting smog-forming emissions from cars, trucks, and industrial sources. This is especially true in eastern Contra Costa County, where ozone levels are highest due to regional wind patterns.

Scientific & Regulatory Setting

Decreased Supply of Fresh Water

The state's water supply is already under stress and is anticipated to shrink under even the most conservative climate change scenario. Warmer average global temperatures cause more rainfall than snowfall, making the winter snowfall season shorter and accelerating the rate at which the snowpack melts in the spring. The Sierra snowpack is estimated to experience a 25-40% reduction from its current average by 2050. With rain and snow events becoming less predictable and more variable, the rate of flooding could increase and California's ability to store and transport fresh water for consumption could decrease. Furthermore, warmer weather will lead to longer growing seasons and increased agricultural demand for water (California Natural Resources Agency 2009).

The East Bay Municipal Utility District (EBMUD) and Contra Costa Water District (CCWD) are the main providers of water to unincorporated Contra Costa County. EBMUD's primary water supply comes from the Mokelumne River watershed on the western slope of the Sierra Nevada; CCWD's primary water supply comes from the Central Valley Project, which is supplied by the Sacramento-San Joaquin Delta. Both sources of water have the potential to be impacted by climate change.

Increased Storm Severity and Frequency of Flood Events

Climate change models predict more intense rainfall events, more frequent or extensive runoff, and more frequent and severe flood events. Localized flood events may increase in periods of heavy rain. As explained by the Climate Adaptation Strategy, California's water system is structured and operated to balance between water storage for dry months and flood protection during rainy seasons (California Natural Resources Agency 2009). Although climate change is likely to lead to a drier climate overall, risks from regular, more intense rainfall events can generate more frequent and/or more severe flooding that upsets this managed balance between storage and protection. Additionally, erosion may increase and water quality may decrease as a result of increased rainfall amounts.

Rising Sea Levels

Sea level rise occurs as a result of rising average ocean temperatures, thermal expansion, and melting of snow and ice. While many different climate change effects will impact Contra Costa County, sea level rise has been extensively researched and quantified, allowing for a clearer geographic understanding of its effects. The rate and amount of sea level rise will be influenced by rising average temperatures and the speed of melting glacial ice. There is a degree of uncertainty in many projections, and the present rate of sea level rise is faster than many previous projections have estimated. On average, it is projected that Contra Costa County will experience a 40% increase in acreage vulnerable to a 100-year flood event between 2000 and 2100 (Cal-Adapt 2015).

CLIMATE CHANGE AND PUBLIC HEALTH

The climate change impacts detailed above are likely to have a substantial negative effect on public health outcomes, including respiratory illnesses from decreased air quality, communicable disease from new vectors, and heat stroke from extreme heat events, demonstrated in **Table 2.1** (California Natural Resources Agency 2009). While climate change is likely to impact the health of all Contra Costa residents, many aspects will affect some vulnerable groups—such as low-income people, older people, children, agricultural workers, and others already suffering from poor health—more than others. Many communities with high concentrations of these vulnerable groups already suffer an increased burden of chronic disease and are especially vulnerable to the negative health effects of climate change. For a more extensive discussion on the public health impacts of climate change and how this CAP addresses those impacts, refer to **Appendix A, Health Co-Benefit Evaluation**.

Table 2.1. Human Health Effects of Climate Change in California

Climate Change Impacts	Health Impacts	Population Most Affected
All Impacts	<p>Mental health disorders (e.g., depression, anxiety, post-traumatic stress disorder, substance abuse) and other conditions caused by:</p> <ul style="list-style-type: none"> • Disruption, displacement, and migration • Loss of home, lives, and livelihood <p>Healthcare impacts:</p> <ul style="list-style-type: none"> • Increased rates of illness and disease, emergency room use, and related costs borne by employers, health plans, and residents • Damage to health facilities 	<p>All populations</p> <p>Low income</p> <p>Healthcare staff</p>
Agricultural Changes	<p>Changing patterns and yields of crops, pests, and weed species, resulting in higher prices for food and food insecurity, hunger, and malnutrition</p> <p>Changes in agriculture/forestry, leading to lost or displaced jobs and unemployment</p>	<p>Agricultural workers</p> <p>Rural communities</p> <p>Low income</p> <p>Elderly</p> <p>Children</p>
Air Quality/Air Pollution	<p>Increased asthma, allergies, chronic obstructive pulmonary disease (COPD) and other cardiovascular and respiratory diseases</p>	<p>Children</p> <p>Elderly</p> <p>People with respiratory diseases</p> <p>Low income</p> <p>Those active outdoors</p>
Drought	<p>Hunger and malnutrition caused by disruption in food and water supply and increased costs</p> <p>Food- and water-borne disease</p> <p>Emergence of new contagions and vector-borne disease</p>	<p>Low income</p> <p>Elderly</p> <p>Children</p>

Scientific & Regulatory Setting

Climate Change Impacts	Health Impacts	Population Most Affected
Extreme Heat	Premature death Cardiovascular stress and failure Heat-related illnesses such as heat stroke, heat exhaustion, and kidney stones	Elderly Children Diabetics Low-income urban residents People with respiratory diseases Agricultural workers Those active outdoors
Increased Average Temperature	Cardiovascular disease Increased number and range of: <ul style="list-style-type: none"> • Vector-borne disease, such as West Nile virus, malaria, hantavirus, or plague • Water-borne disease, such as cholera and E. coli • Food-borne disease, such as salmonella poisoning • Allergies caused by pollen, and rashes from plants such as poison ivy or stinging nettle • Vulnerability to wildfire and air pollution 	Children Elderly Agricultural workers Those active outdoors People with respiratory disease People with acute allergies
Severe Weather, Extreme Rainfall, Floods, Water Issues	Population displacement, loss of home and livelihood Death from drowning Injuries Damage to potable water, wastewater, and irrigation systems resulting in decrease in quality/quantity of water supply and disruption to agriculture Water- and food-borne diseases from sewage overflow	Coastal residents and residents in flood prone areas Elderly Children Low income
Wildfires	Injuries and death from burns and smoke inhalation Eye and respiratory illnesses due to air pollution Exacerbation of asthma, allergies, COPD, and other cardiovascular and respiratory diseases Risk from erosion and land slippage after wildfires Displacement and loss of homes	People with respiratory diseases

Source: California Department of Public Health

All of these climate change impacts are important public health issues in Contra Costa County. Due to industrial activity in the county and high-volume transportation corridors, air quality is a particularly pressing public health issue. The following section provides an expanded discussion on air quality and its relation to climate change and public health.

AIR QUALITY AND CRITERIA POLLUTANTS

As noted in the Bay Area 2010 Clean Air Plan (BAAQMD 2010), air quality and GHG emissions are closely related. Many of the activities that produce GHGs, including vehicle use, electricity production, burning natural gas, and industrial processes, also produce what the Environmental Protection Agency (EPA) and Bay Area Air Quality Management District (BAAQMD) refer to as criteria air pollutants.

Criteria air pollutants include particulate matter smaller than 2.5 microns (PM_{2.5}), particulate matter smaller than 10 microns (PM₁₀), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO₂), and ground-level ozone. Ground-level ozone is created when NO_x and reactive organic gases interact with sunlight. Although ozone levels in the Bay Area have been steadily declining, the nine-county San Francisco Bay Area region is designated as a nonattainment area for ozone as well as for PM_{2.5}—meaning that the region does not meet state and federal standards. **Table 2.2** explains the public health problems and source of each criteria air pollutant.

Table 2.2. Criteria Air Pollutants

Criteria Air Pollutant	Explanation and Health Impact	Source
PM _{2.5} and PM ₁₀	Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles that are small enough to pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects.	Dust, motor vehicles, combustion processes, industrial processes
CO	CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues.	Combustion processes, motor vehicles
NO _x	NO _x is the sum of nitric oxide (NO) and nitrogen dioxide (NO ₂). In addition to combining with TOG to contribute to the formation of ground-level ozone and fine particle pollution, NO ₂ is linked with a number of adverse effects on the respiratory system. Studies also show a connection between breathing elevated short-term NO ₂ concentrations, and increased visits to emergency departments and hospital admissions for respiratory issues, especially asthma.	Electricity production, industrial processes, motor vehicles (near-roadway [within about 50 meters] concentrations of NO ₂ have been measured to be approximately 30 to 100% higher than concentrations away from roadway)
SO ₂	Current scientific evidence links short-term exposures to SO ₂ , ranging from 5 minutes to 24 hours, with an array of adverse respiratory effects including broncho-constriction and increased asthma symptoms. Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.	Industrial processes, motor vehicles
Ozone	Ground-level ozone is created by chemical reactions between reactive organic compounds and NO _x in the presence of sunlight. Breathing ozone can aggravate asthma and other respiratory diseases, irritate the eyes, reduce visibility, and damage vegetation.	Industrial facilities, electric utilities, motor vehicle exhaust, chemical solvents, gasoline vapors

Scientific & Regulatory Setting

Ozone is at the center of the climate change, air quality, and public health issue. Children, the elderly, people with lung diseases such as asthma, and people who work or exercise outside are at risk for adverse effects from ozone. These effects include reduction in lung function and increased respiratory symptoms as well as respiratory-related emergency department visits, hospital admissions, and possibly premature deaths. These effects may lead to increased school absences, medication use, visits to doctors and emergency rooms, and hospital admissions. Research also indicates that ozone exposure may increase the risk of premature death from heart or lung disease.

Ozone is more likely to reach unhealthy levels on hot sunny days in urban environments. However, ozone can also be transported long distances by wind; even rural areas can experience high ozone levels. The warming climate will increase ozone levels in California's major air basins, causing 6 to 30 more days per year with ozone concentrations that exceed federal clean air standards (Mahmud et al. 2008). It is estimated that in 2020, California will have nearly 443,000 additional annual cases of acute respiratory symptoms leading to a \$729 million increase in healthcare expenditures as a result of climate change exacerbating ground-level ozone (Perera and Sanford 2011).

Populations at Risk

While climate change will impact the health of all Contra Costa residents, its effects are likely to affect some groups—such as low-income people, older people, children, agricultural workers, and others already suffering from poor health—far more than others (CCHS 2015). Due to longstanding inequities in health risks and resource distribution, these vulnerable groups also have the fewest resources to adapt to a changing climate. Attention, strategies, and resources are required to address the disproportionate impacts of climate change in vulnerable communities.

REGULATORY SETTING

California established itself as a national climate leader when it adopted GHG emissions reduction targets in 2006 under Assembly Bill (AB) 32. Although AB 32 is the key piece of legislation guiding this CAP, there are numerous other state and local influences. This section highlights the state and local legislative framework guiding the preparation and implementation of this CAP.

California Framework

California legislation related to climate change includes AB 32 and Senate Bill (SB) 375, which direct the state and relevant local agencies to reduce GHG emissions. In addition, state agencies are guided by executive orders that direct GHG emissions reductions statewide, prioritize climate change adaptation, and provide an overarching executive framework to address climate change.

California Global Warming Solutions Act (AB 32)

AB 32, known as the California Global Warming Solutions Act, requires the California Air Resources Board (CARB) to develop regulatory and market mechanisms that will reduce GHG emissions to 1990 levels by 2020 (BAAQMD 2010). Actions include:

Scientific & Regulatory Setting

#2

- Items that can be quickly implemented to achieve GHG reductions through regulating landfill operations, motor vehicle fuels, car refrigerants, and port operations.
- A Scoping Plan that identifies the most technologically feasible and cost-effective measures to achieve emissions reductions. The Scoping Plan employs direct regulations, alternative compliance mechanisms, incentives, voluntary actions, and market-based approaches like a cap-and-trade program, and must be updated by CARB every five years. The Scoping Plan identifies local governments as strategic partners to achieving the state goal and translates the reduction goal to a 15% reduction of current emissions by 2020.
- Regulations to require the state's largest industrial emitters of GHG to report and verify their GHG emissions on an annual basis.

CARB issued its first Scoping Plan in 2009, and the first Scoping Plan update in 2014. This most recent update identifies progress made to date, recommends additional actions to meet the statewide reduction goal, and states the need for establishing a GHG emissions reduction goal beyond 2020, although a post-2020 goal is not set by this update. The updated Scoping Plan also revises the method used to quantify GHG emissions, relying on more recent scientific data concerning the potency of different GHGs by determining their global warming potential (GWP).

Sustainable Communities Strategy (SB 375)

SB 375 aims to reduce GHG emissions by linking transportation funding to land use planning, with an aim to minimize vehicle miles traveled. It requires metropolitan planning organizations, like the Association of Bay Area Governments (ABAG), to create sustainable communities strategies (SCS) in their regional transportation plans for the purpose of reducing urban sprawl. Each SCS is required to demonstrate how the region will achieve the GHG emissions reduction target set by CARB for 2020 and 2035. In 2013, the Metropolitan Transportation Commission (MTC) and ABAG adopted the final Plan Bay Area, which includes the region's SCS and the 2040 Regional Transportation Plan.

Plan Bay Area highlights Contra Costa County as an important hub for future job and population growth in the Bay Area. Plan Bay Area identifies Priority Development Areas (PDA). Generally, PDAs are areas of at least 100 acres where there is local commitment to developing housing, amenities, and services to meet the needs of residents in a pedestrian-friendly environment served by transit. There are five PDAs in unincorporated Contra Costa County. Three of these PDAs, Contra Costa Centre, Pittsburg/Bay Point BART, and West Contra Costa Transportation Advisory Committee San Pablo Avenue Corridor, are already planned. Two other potential PDAs, North Richmond and Downtown El Sobrante, are located in the planning area (ABAG 2015). These PDAs concentrate growth in mixed-use, transit-oriented corridors, allowing for reduced emissions, healthier communities, and more land preserved for conservation. This CAP includes policies that support the transit- and pedestrian-oriented developments identified by the region's SCS.

In addition to AB 32 and SB 375, the state has enacted legislation related to transportation and vehicle efficiencies, energy-efficient building and appliances, renewable energy portfolios, renewable energy access, water conservation, and solid waste reduction and recycling.

Scientific & Regulatory Setting

Executive Order (EO) S-3-05

EO S-3-05 establishes the following greenhouse gas emissions reduction targets:

- By 2010, reduce greenhouse gas emissions to 2000 levels.
- By 2020, reduce greenhouse gas emissions to 1990 levels.
- By 2050, reduce greenhouse gas emissions to 80 percent below 1990 levels.

In addition to AB 32 and SB 375, the state has enacted legislation related to transportation and vehicle efficiencies, energy-efficient buildings and appliances, renewable energy portfolios, renewable energy access, water conservation, and solid waste reduction and recycling (**Table 2.3**).

Table 2.3. California Regulatory Framework

Law	Year Passed	Description	Topic
AB 1493	2002	Requires CARB to achieve passenger vehicles and light-duty trucks GHG reductions	Transportation and Vehicle Efficiencies
EO S-1-07	2007	Establishes Low Carbon Fuel Standard	Transportation and Vehicle Efficiencies
SB 375	2008	Requires CARB to set regional GHG reduction targets for passenger vehicles	Transportation and Vehicle Efficiencies
SB 1078	2002	Establishes the California Renewables Portfolio Standard Program	Energy and Renewables
SB 1368	2006	Limits long-term investments in power plants that exceed emissions standards	Energy and Renewables
Title 24 Updates	2010 & 2012	Increases energy and water efficiency in the state building code	Energy and Renewables
SB X-1-2	2011	Codifies CARB's 33% Renewables Portfolio Standard	Energy and Renewables
AB 1881	2006	Mandates landscaping water conservation for new and existing development	Water Conservation
AB 1420	2007	Requires urban water suppliers to implement water demand management measures	Water Conservation
SB X7.7	2009	Sets reduction targets for per capita urban water use	Water Conservation
SB 407	2009	Sets water-efficiency standards during retrofit	Water Conservation
AB 939	1989 & 2011	Creates the Integrated Waste Management Board; requires local jurisdictions to meet waste diversion goals	Waste and Recycling
SB 1016	2008	Changes statutory waste diversion mandates progress measurement from absolute to per capita	Waste and Recycling

Cap-and-Trade

Emissions from oil refineries and power plants are regulated at the regional and state levels. This regulatory environment makes it difficult for the County to control or influence the sector that produces the majority of GHG emissions except through participating in the cap-and-trade programs administered by the state or through conditions and mitigation measures placed in land-use permits. Cap-and-trade is a market-based approach to reducing GHG emissions. In California, the Cap-and-Trade Program sets an enforceable limit, or the cap, on the amount of emissions that can be produced by large industrial emitters. The program then authorizes a number of permits that allow additional emissions that can then be traded, bought, or sold.

Cap-and-trade programs enable industrial emitters to reduce overall emissions and to invest in cleaner fuels and energy efficiency. The AB 32 Scoping Plan update identifies California's Cap-and-Trade Program as a key component in reaching the state's near- and long-term GHG emissions targets. California's Cap-and-Trade Program has been designed by CARB in conjunction with stakeholders through a multiyear process and calls for a statewide limit on the sources that create 85% of California's GHG emissions including electricity generation, large industrial sources, transportation fuels, and residential and commercial use of natural gas. Starting in 2013, the CARB program began regulating utilities and large industrial facilities with a cap 2% below 2012 emissions levels. Starting in 2015, fuel distributors were also brought under the cap. CARB estimates that the Cap-and-Trade Program will generate about \$1 billion in state revenue from the auction of emissions allowances for 2012-13, and possibly up to \$10 billion annually by 2020.

Several pieces of legislation, including AB 1532 and SB 535, seek to allocate cap-and-trade revenue for programs that reduce pollution in disproportionately impacted communities. AB 1532, the California Global Warming Solutions Act of 2006: Greenhouse Gas Reduction Fund, addresses how funds related to market-based compliance mechanisms, such as cap-and-trade, can be used. The bill requires administering agencies to allocate these funds to measures and programs that meet specific criteria, including:

- Areas that are in close proximity to sources that produce toxic air levels, pollution, and other hazards that can lead to negative public health effects.
- Areas that contain or produce materials that pose a significant hazard to human health and safety.
- Areas with a concentration of people that experience low income, high unemployment, low levels of homeownership, high-rent burden, and other socioeconomic challenges.
- The bill also stipulates that the California Environmental Protection Agency must develop a method for the identification of priority communities for investment opportunities based on a variety of geographic, socioeconomic, and environmental factors. SB 535 builds off AB 1532 and requires 25% of the available funds to go to projects that provide benefits to disadvantaged communities, and that 10% of the available funds go to projects located within disadvantaged communities. These funds may be allocated to disadvantaged communities through projects that reduce pollution and develop clean energy. In addition to identifying strategies to reduce local emissions, this CAP includes policies to support local programs that could be funded by potential cap-and-trade revenue.

CEQA Guidelines

SB 97 was adopted in 2007 and directed the Governor's Office of Planning and Research (OPR) to amend the CEQA Guidelines to address GHG emissions. The CEQA Guidelines prepared by OPR were adopted in December 2009 and went into effect March 18, 2010. The updated guidelines include provisions for local governments to use adopted plans for the reduction of GHG emissions to address the cumulative impacts of individual future projects on GHG emissions (see State CEQA Guidelines Section 15183.5(b)(1)). In order to benefit from the streamlining provisions of the updated CEQA Guidelines, a CAP for the reduction of GHG emissions must accomplish the following:

- Quantify GHG emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area.
- Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable.
- Identify and analyze the GHG emissions resulting from specific actions or categories of actions anticipated within the geographic area.
- Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level.
- Establish a mechanism to monitor the plan's progress toward achieving the specified level and to require an amendment if the plan is not achieving specified levels.
- Be adopted in a public process following environmental review.

BAAQMD Guidance

In response to the updated CEQA Guidelines, BAAQMD has adopted thresholds of significance for GHG emissions. These thresholds are used by local governments in the environmental review process for plans and projects and may streamline the environmental review process.

The BAAQMD CEQA Air Quality Guidelines were updated in 2010 to include guidance on assessing GHG and climate change impacts as required under CEQA Section 15183.5(b) and to establish thresholds of significance for impacts related to GHG emissions. These thresholds can be used to determine that a project's impact on GHG emissions is less than significant if it is in compliance with a Qualified GHG Reduction Strategy. Air districts such as BAAQMD do not officially certify Qualified GHG Reduction Strategies, but they play a critical role in providing support to local communities.

This CAP follows both the CEQA Guidelines and the BAAQMD guidelines by incorporating the standard elements of a Qualified GHG Reduction Strategy. **Appendix B** describes in detail how the County's CAP satisfies BAAQMD's requirements for a Qualified GHG Reduction Strategy and will allow the County to determine that a development project has a less than significant impact on GHG emissions if it complies with the CAP.

EXISTING EFFORTS IN CONTRA COSTA COUNTY

In 2005 the County established a Climate Change Working Group to coordinate County efforts to respond to climate change, and to guide practices that result in more sustainable actions. Many County policies and initiatives support this CAP, including:

- The 2007 Municipal Climate Action Plan.
- Energy conservation policies and programs designed to reduce energy demand through a home weatherization programs and green building guidelines.
- Alternative energy policies that will reduce GHG emissions through supporting appropriate renewable energy projects and encouraging energy recovery projects.
- A comprehensive approach to water conservation.
- Transportation policies that support a balanced transportation system including bicycle, pedestrian, transit, and carpooling facilities, transportation and parking demand management, and support for rail and bus transit.
- Waste reduction strategies that reduce landfill disposal by supporting recycling and waste diversion.
- Land use policies that encourage transit-oriented, mixed-use, and infill development, and support local agricultural operations and production.
- Participation in regional energy efficiency efforts, such as the Bay Area Regional Energy Network (BayREN).

A more detailed list of existing County policies and practices that support the reduction of GHG emissions from community-wide sources are identified in **Appendix C**.

Scientific & Regulatory Setting

This page has been intentionally left blank.



INTRODUCTION

The greenhouse gas emissions (GHG) inventory identifies the major sources of GHG emissions from activities occurring within unincorporated Contra Costa County. This chapter presents the results of 2005 inventory, which will serve as a baseline against which future progress can be measured, and a 2013 inventory, which will assist with the assessment of measure interim progress toward future GHG reduction targets. The chapter also presents the results of the forecasts of GHG emissions for the years 2020 and 2035. Specifically, this chapter:

- Presents GHG emissions from community-wide activities in the calendar years of 2005 and 2013.
- Identifies GHG emissions from activities which the County can reasonably influence, and excludes all other sources that are primarily regulated by other agencies (e.g., major industrial facilities).
- Summarizes GHG emissions by sector to compare the relative impact between sectors.
- Provides forecasts of how emissions will grow in the community under various scenarios.
- Provides County decision-makers and the community with adequate baseline and forecast information to inform policy decisions.

INVENTORY BACKGROUND

As recommended by the Governor's Office of Planning and Research, many communities in California use the *US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* (the US Community Protocol) to identify and assess GHG emissions. This protocol provides guidance on how to measure and report community-wide GHG emissions, including identification of relevant sources or activities and methods used to calculate emissions. The Bay Area Air Quality Management District (BAAQMD) has also issued a GHG Plan Level Quantification Guidance document, which provides guidance for Bay Area communities to develop GHG inventories. The 2005 and 2013 inventories are consistent with the recommended practices in these two documents. In accordance with the US

Climate Action Plan

Community Protocol and BAAQMD guidance, these inventories include emissions from the following sources, or sectors:

- **Residential energy:** Electricity and natural gas used in residential buildings.
- **Nonresidential energy:** Electricity and natural gas used in nonresidential buildings, including offices, retail stores, government facilities, institutional facilities, and some industrial buildings.
- **Solid waste:** Emissions from waste produced in the county for the inventory year.
- **Landfills:** Emissions from the decomposition of waste deposited in landfills from prior years.
- **On-road transportation:** On-road vehicle trips, including cars and trucks.
- **Off-road equipment:** Portable equipment and vehicles not used for transportation on roads, including construction and landscaping equipment.
- **Water and wastewater:** Energy used to pump and treat water and wastewater, and emissions from the processing of wastewater.
- **BART:** Energy used by BART trips beginning or ending in the unincorporated area.
- **Agriculture:** Emissions from fertilizer use, farming equipment, and the digestive processes of livestock.

In addition to the above activities and GHG sources, the County identified GHG emissions from the following sources as informational items:

- **Stationary Source GHG Emissions**—Direct process emissions and energy used by industrially classified uses including petroleum refineries, power plants, chemical manufacturing plants, and wastewater treatment plants in the unincorporated county.
- **Energy Use by Major Industrial Facilities**—Electricity and natural gas use by refineries, chemical facilities, and major manufacturing plants in the unincorporated county.

Stationary Sources

Contra Costa County is home to some of the largest GHG-emitting stationary source facilities in the state of California. Stationary sources are nonmoving sources, fixed-site producers of pollution such as power plants, chemical plants, oil refineries, manufacturing facilities, and other industrial facilities. Emissions from stationary source facilities and from the energy required to power those facilities accounted for the majority of all emissions within the unincorporated county.

Acknowledging that local governments have little influence over energy use at or emissions from stationary sources, the state of California has developed a market-based program created through the Assembly Bill (AB) 32 2006 Scoping Plan, often referred to as the “cap-and-trade” program. In order to identify a GHG reduction target attainable through local action, stationary source emissions and emissions from energy used at stationary source facilities were not included in the baseline inventory used in this CAP.



Stationary sources, such as this refinery near Martinez, are some of the biggest GHG emitters in the county.

The stationary source totals identified by BAAQMD for facilities in unincorporated Contra Costa County, as well as the electricity and natural gas used by these facilities, have been excluded from the County's GHG inventory as they are existing sources regulated by BAAQMD and the California Air Resources Board (CARB). For a more detailed discussion of how these sources were analyzed and excluded from the baseline inventory, see **Appendix C**.

DATA COLLECTION METHODS AND ANALYSIS

The GHG emissions inventory starts with collecting activity data for each sector listed above, such as the kilowatt-hours (kWh) of electricity used or therms of natural gas used for the residential, commercial, and industrial energy sectors, the vehicle miles traveled (VMT) for the transportation sector, or million gallons of water used by the community in a single calendar year. These activities are converted into GHG emissions using an emissions factor or coefficient. These emissions factors are supplied by the energy provider or emissions modeling software and indicate the GHGs that are emitted for every kWh produced, mile traveled, or ton of waste disposed.

The inventory measures three primary GHG emissions: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). These GHGs are then converted to carbon dioxide equivalents (CO₂e), enabling the County to consider different GHGs in comparable terms. The conversion is done by comparing the global warming potential (GWP) of each gas relative to CO₂. For example, a single metric ton (MT) of methane traps 28 times as much heat over a 100-year time frame as a ton of CO₂, meaning that the GWP of methane is 28. As a result, a single MT of methane is equal to 28 MTCO₂e. Similarly, nitrous oxide has a GWP of 265, and so a single MT of nitrous oxide is equal to 265 MTCO₂e. The values of GWPs change as a result of improved scientific research and understanding. The GWPs used in this inventory are from the Intergovernmental Panel on Climate Change's Fifth Assessment Report (IPCC).

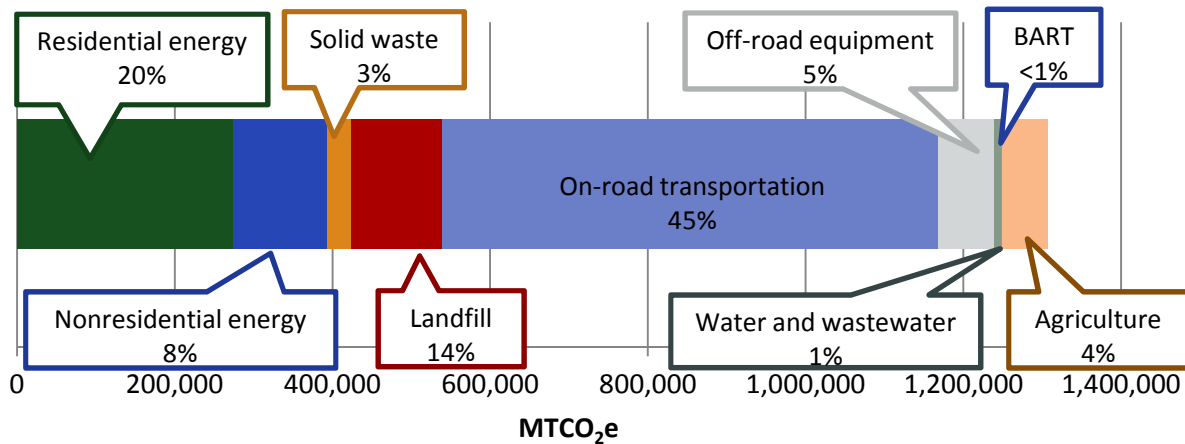
2005 BASELINE INVENTORY RESULTS

This section provides a brief overview of the 2005 baseline GHG emissions for unincorporated Contra Costa County. For a more detailed explanation of how each sector of GHG emissions was calculated, see **Appendix C**. In 2005, activities in the unincorporated county and within the County's jurisdictional land use control generated approximately 1,403,610 metric tons of carbon dioxide equivalents (MTCO₂e).

On-road transportation was the largest source of 2005 GHG emissions in Contra Costa County, contributing approximately 628,200 MTCO₂e, or 45% of emissions. The next-largest source of emissions, residential energy use, contributed approximately 274,960 MTCO₂e, or 20% of emissions. Landfills were the third-largest sector, contributing 193,950 MTCO₂e or 14% of emissions. The nonresidential energy use sector was the fourth-largest emissions source, contributing 118,740 MTCO₂e (8%); off-road emissions were the fifth-largest emissions source (71,880 MTCO₂e, or 5%); agriculture was the sixth-largest emissions source (57,320 MTCO₂e, or 4%). The solid waste, water and wastewater, and BART sectors represented 3%, 1%, and less than 1% of emissions, respectively. **Figure 3.1** shows 2005 emissions by sector, while **Table 3.1** shows 2005 activity data and emissions by sector and subsector.

Climate Action Plan

Figure 3.1. 2005 GHG Emissions by Sector



Source: Michael Baker International 2015

Table 3.1. 2005 Activity Data and GHG Emissions by Sector and Subsector

Sector	Subsector	Activity Data	Unit	MTCO ₂ e	Total MTCO ₂ e	Percent of Total MTCO ₂ e
Residential energy	Residential electricity	488,236,740	kWh	110,120	274,690	20%
	Residential natural gas	30,919,160	Therms	164,570		
Nonresidential energy	Nonresidential electricity	284,558,070	kWh	64,180	118,740	8%
	Nonresidential natural gas	10,251,360	Therms	54,560		
Solid waste	Waste disposed	170,780	Tons disposed	48,450	48,450	3%
Landfill	Waste in place	34,455,010	Tons in place	193,9500	193,950	14%
On-road transportation	On-road transportation	1,291,819,230	Annual VMT	628,200	628,200	45%
Off-road equipment	Lawn and garden equipment	-	None	3,820	71,880	5%
	Construction equipment	-	None	68,060		
Water and wastewater	Indirect water use	26,443,770	kWh	5,960	8,080	1%
	Indirect wastewater use	6,199,120	kWh	1,400		
	Direct wastewater emissions	-	None	720		
BART	BART trips	38,111,050	Passenger miles	2,300	2,300	<1%
Agriculture	Fertilizer application	200,980	Crop acres	3,920	57,320	4%
	Agriculture equipment	-	None	23,960		
	Livestock	16,500	Heads of livestock	29,440		
TOTAL					1,403,610	100%

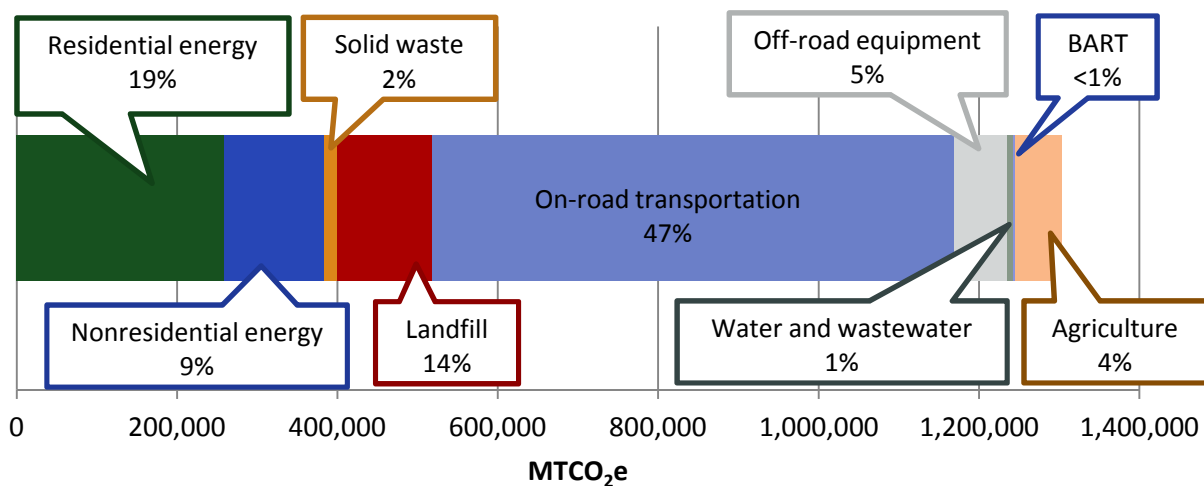
Source: Michael Baker International 2015

2013 INVENTORY UPDATE

The 2013 inventory provides an interim update toward the 2020 GHG reduction target and identifies how sources of emissions have changed since 2005, which can help direct future GHG reduction policies. In 2013, activities in the unincorporated areas of Contra Costa County within the County's jurisdictional control resulted in 1,392,450 MTCO₂e, a 1% decrease from 2005 levels.

The on-road emissions sector was again the largest, contributing 651,130 MTCO₂e, or 47% of the county's emissions. Residential energy was the second-largest source of emissions with approximately 258,420 MTCO₂e or 19% of emissions, followed by landfills with approximately 196,500 MTCO₂e or 14% of emissions. Nonresidential energy was the fourth-largest source of emissions with approximately 125,350 MTCO₂e (9%); off-road equipment contributed approximately 66,230 MTCO₂e (5%) and agriculture contributed approximately 58,200 MTCO₂e (4%). The smallest sources of emissions, solid waste, water and wastewater, and BART, were responsible for 2%, 1%, and less than 1% of emissions, respectively. 2013 emissions by sector are shown in **Figure 3.2**, and activity data and emissions by subsector for 2013 are shown in **Table 3.2**. **Table 3.3** shows the difference in emissions by sector between 2005 and 2013.

Figure 3.2. 2013 GHG Emissions by Sector



Source: Michael Baker International 2015

Climate Action Plan

Table 3.2. 2013 Activity Data and GHG Emissions by Sector and Subsector

Sector	Subsector	Activity Data	Unit	MTCO ₂ e	Total MTCO ₂ e	Percent of Total MTCO ₂ e
Residential energy	Residential electricity	478,219,710	kWh	93,380	258,420	19%
	Residential natural gas	31,007,110	Therms	165,040		
Nonresidential energy	Nonresidential electricity	266,216,660	kWh	51,980	125,350	9%
	Nonresidential natural gas	13,784,410	Therms	73,370		
Solid waste	Waste disposed	92,780	Tons disposed	26,540	26,540	2%
Landfill	Waste in place	41,785,650	Tons in place	196,500	196,500	14%
On-road transportation	On-road transportation	1,349,279,980	Annual VMT	651,130	651,130	47%
Off-road equipment	Lawn and garden equipment	-	None	3,180	66,230	5%
	Construction equipment	-	None	63,050		
Water and wastewater	Indirect water use	28,004,290	kWh	5,470	7,400	1%
	Indirect wastewater use	6,198,590	kWh	1,210		
	Direct wastewater emissions	-	None	720		
BART	BART trips	44,417,320	Passenger miles	2,680	2,680	<1%
Agriculture	Fertilizer application	204,030	Crop acres	4,280	58,200	4%
	Agriculture equipment	-	None	18,910		
	Livestock	19,110	Heads of livestock	35,010		
TOTAL					1,392,450	100%

Source: Michael Baker International 2015

Table 3.3. Comparison of 2005 and 2013 GHG Emissions by Sector

Sector	2005 MTCO ₂ e	2013 MTCO ₂ e	Percent Change, 2005–2013
Residential energy	274,690	258,420	-6%
Nonresidential energy	118,740	125,350	6%
Solid waste	48,450	26,540	-45%
Landfill	193,950	196,500	1%
On-road transportation	628,200	651,130	4%
Off-road equipment	71,880	66,230	-8%
Water and wastewater	8,080	7,400	-8%
BART	2,300	2,680	17%
Agriculture	57,320	58,200	2%
Total	1,403,610	1,392,450	-1%

GHG EMISSIONS FORECAST

A GHG emissions forecast is an estimate of how emissions will change in the future based on anticipated population and jobs growth in the unincorporated areas of Contra Costa County, absent of any actions taken at the federal, state, regional, or local level to reduce emissions. This forecast is often referred to as a business-as-usual forecast. A GHG emissions forecast allows elected officials, County staff, and community members to determine the volume of reductions needed to meet GHG reduction goals.

Consistent with state and regional guidance, as well as widely accepted forecasting methods including the Association of Environmental Professionals white paper on GHG forecasts, the GHG emissions forecast for Contra Costa County assumes that per capita activity data remains constant at 2005 baseline levels. Association of Bay Area Governments (ABAG) demographic growth projections is the primary data source used to forecast GHG emissions. These growth projections are given in **Table 3.4**.

Table 3.4. ABAG Projections for Unincorporated Contra Costa County, 2005–2035

	2005	2013	2020	2035	2005–2035 Change
Population	159,650	162,230	166,100	173,500	6%
Households	57,980	58,550	59,720	61,740	9%
Jobs	41,270	43,210	47,670	50,330	22%
Service Population	200,920	205,440	213,770	223,830	11%

Source: Association of Bay Area Governments 2009, 2013

The anticipated growth scenario identified by ABAG for unincorporated Contra Costa County provides the basis for the County's GHG emissions forecast for the years 2020 and 2035. Emissions in 2020 are forecasted to increase to 1,483,720 MTCO₂e, a 6% increase from 2005 levels. Emissions in 2035 are projected to rise to 1,545,980 MTCO₂e, a 10% increase from 2005 levels. **Table 3.5** shows emissions by sector for the 2005 baseline inventory and the two forecasted years.

Table 3.5. GHG Emissions by Sector, 2005–2035

Sector	2005 MTCO ₂ e	2013 MTCO ₂ e	2020 MTCO ₂ e	2035 MTCO ₂ e	Percent Change, 2005–2035
Residential energy	274,690	258,420	282,930	292,500	6%
Nonresidential energy	118,740	125,350	137,150	144,810	22%
Solid waste	48,450	26,540	51,550	53,970	11%
Landfill	193,950	196,500	204,560	218,560	13%
On-road transportation	628,200	651,130	662,820	687,370	9%
Off-road equipment	71,880	66,230	76,340	79,890	11%
Water and wastewater	8,080	7,400	8,600	9,000	11%
BART	2,300	2,680	2,450	2,560	11%
Agriculture	57,320	58,200	57,320	57,320	0%
TOTAL	1,403,610	1,392,450	1,483,720	1,545,980	10%
Percent Change from 2005	-	-1%	6%	10%	-

Source: Michael Baker International 2015

Emissions associated with energy, water, wastewater, BART, solid waste, and off-road equipment are anticipated to grow linearly with household, employment, and service population growth. Emissions from the landfill subsector were forecasted using the landfill modeling software developed by CARB to estimate net fugitive methane emissions in 2020 and 2035, based on the total amount of waste disposed in the landfills located in the unincorporated county. On-road VMT in the GHG forecast were modeled using the Contra Costa Transportation Authority's Travel Demand Forecasting Model and include regional transportation improvements identified in the Comprehensive Transportation Project List.

EXISTING STATE GHG REDUCTION PROGRAMS

The state of California has been proactive in reducing GHG emissions. Several regulations and efforts at the state level will lessen Contra Costa County's future GHG emissions, including vehicle standards, building standards, and the renewable energy content of electricity. As a result, an initial step in the assessment of GHG reductions in the unincorporated county is to apply the potential effects of these activities on Contra Costa County's forecasted emissions. The state programs analyzed are limited to those programs that have been formally adopted the state legislature and governor and implemented by state agencies, except as noted. These results are detailed in **Table 3.6**. The state programs evaluated in the forecast are briefly discussed below, and explained in more detail in **Appendix C**.

GHG Inventory & Forecast

#3

California's Renewables Portfolio Standard (RPS)

Governor Jerry Brown established a goal to increase the RPS, which is the percentage of electricity delivered in California generated by renewable sources like solar, wind, and geothermal, to 50% by 2030. On September 11, 2015, the California legislature passed Senate Bill 350 to codify the governor's executive order. The forecast in this Plan assumes the RPS goal of 50% by 2030.

AB 1493 Clean Car Standards and the Low Carbon Fuel Standard

California's Clean Car Standards were established by AB 1493 in 2002, requiring new passenger vehicles to reduce tailpipe GHG emissions from 2009 to 2020. These standards are also often referred to as the Pavley standards, after State Senator Fran Pavley, who authored AB 1493 when she was a member of the state assembly. A related program, the Low Carbon Fuel Standard (LCFS), establishes a goal of a 10% reduction in carbon intensity in transportation fuels. Reductions from the Clean Car Standards and the LCFS were calculated using the EMFAC2011 modeling software created by CARB.

Title 24, Energy Efficiency Standards

California's Title 24 (CalGreen) energy standards are updated every few years (the most recent update went into effect on July 1, 2014). These are statewide standards applied at the local level by city and county agencies through project review. The California Energy Commission (CEC) provides information on the energy efficiency of each new set of Title 24 standards relative to the previous standards. The calculation of CalGreen energy reductions assumes that all development occurring after 2005 will comply with the version of the Title 24 standards which apply at the time of construction. It also assumes that all growth in natural gas and electricity sectors is from new construction.

Table 3.6. Expected GHG Reductions from State Policies, 2020 and 2035

State Policy or Program	2020 (MTCO ₂ e)	2035 (MTCO ₂ e)
Renewables Portfolio Standard	-41,620	-78,030
Clean Car Standard and LCFS	-173,480	-236,270
Title 24 Standards	-2,840	-7,970
TOTAL	-217,940	-322,270

Source: Michael Baker International 2015

The regulations implemented by the state will have a profound impact on Contra Costa's GHG emissions. As shown in **Table 3.7**, reductions from state activities are expected to reduce emissions below baseline levels by 2020, and to continue to decrease emissions by 2035 despite population growth.

Climate Action Plan

Table 3.7. GHG Emissions with State Reduction Actions, 2005–2035

Sector	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)	2020 (MTCO ₂ e)	2035 (MTCO ₂ e)	Percent Change, 2005–2035
Residential energy	274,690	258,420	257,310	242,280	-12%
Nonresidential energy	118,740	125,350	119,980	112,170	-6%
Solid waste	48,450	26,540	51,550	53,970	11%
Landfill	193,950	196,500	204,560	218,560	13%
On-road transportation	628,200	651,130	489,340	451,100	-28%
Off-road equipment	71,880	66,230	76,340	79,890	11%
Water and wastewater	8,080	7,400	6,930	5,860	-27%
BART	2,300	2,680	2,450	2,560	11%
Agriculture	57,320	58,200	57,320	57,320	0%
TOTAL	1,403,610	1,392,450	1,265,620	1,223,170	-13%
Percent Change from 2005	-	-1%	-10%	-13%	-

Source: Michael Baker International 2015

GHG REDUCTION TARGETS

The California Environmental Quality Act (CEQA) Guidelines require that a Qualified GHG Reduction Strategy contain a goal for substantive GHG reductions. The CEQA Guidelines do not identify GHG reduction targets or reduction target years; the State's GHG reduction targets and target years are established through executive order and statute and codified in state codes, regulations, and implementation programs. The key targets and target years are noted in Assembly Bill (AB) 32, Executive Order (EO) 1-03-05, and EO B-30-15.

- EO S-03-05, signed by former Governor Schwarzenegger in 2005, establishes a statewide GHG reduction goal of 80% below 1990 levels by 2050.
- The California Global Warming Solutions Act (AB 32) established a statewide GHG reduction goal of returning to 1990 levels by 2020. The AB 32 Scoping Plan provides the State's strategy to achieve the AB 32 reduction goal and documents progress toward the goal through updates. The first Scoping Plan, released in 2008 and approved in 2011, recommends a greenhouse gas emissions target for local government municipal and community-wide emissions of a 15% reduction from current levels by 2020 to parallel the State's target. Best practice for local climate action planning has interpreted "current" year to be a baseline year of 2005, 2006, or 2007, with 2005 being the most commonly used year.
- EO-B-30-15, signed by Governor Brown in 2015, establishes a statewide GHG reduction goal of 40% below 1990 levels by 2030.

This Plan presents a 2020 GHG reduction target consistent with AB 32 and the AB 32 Scoping Plan, which is to reduce community-wide emissions 15% below 2005 levels by 2020. The Plan also provides a set of GHG reduction measures to achieve the 2020 reduction target.

In addition, the CAP forecasts the potential GHG emissions and estimated GHG reductions from proposed measures through 2035. A potential option for the County's 2035 goal is one that reduces emissions to the level specified in EO B-30-15 by 2030 and then continues to reduce on a trajectory that would meet the 2050 target. For 2035, such a goal is equal to 50% below 1990 levels, or approximately 57% below baseline levels. **Table 3.8** and **Figure 3.3** show the difference between the baseline, forecast, and forecast with state reductions relative to the recommended goals, along with the volume of GHG reductions needed from local activities. **Chapter 4** provides a GHG reduction strategy to achieve the goals identified in this chapter.

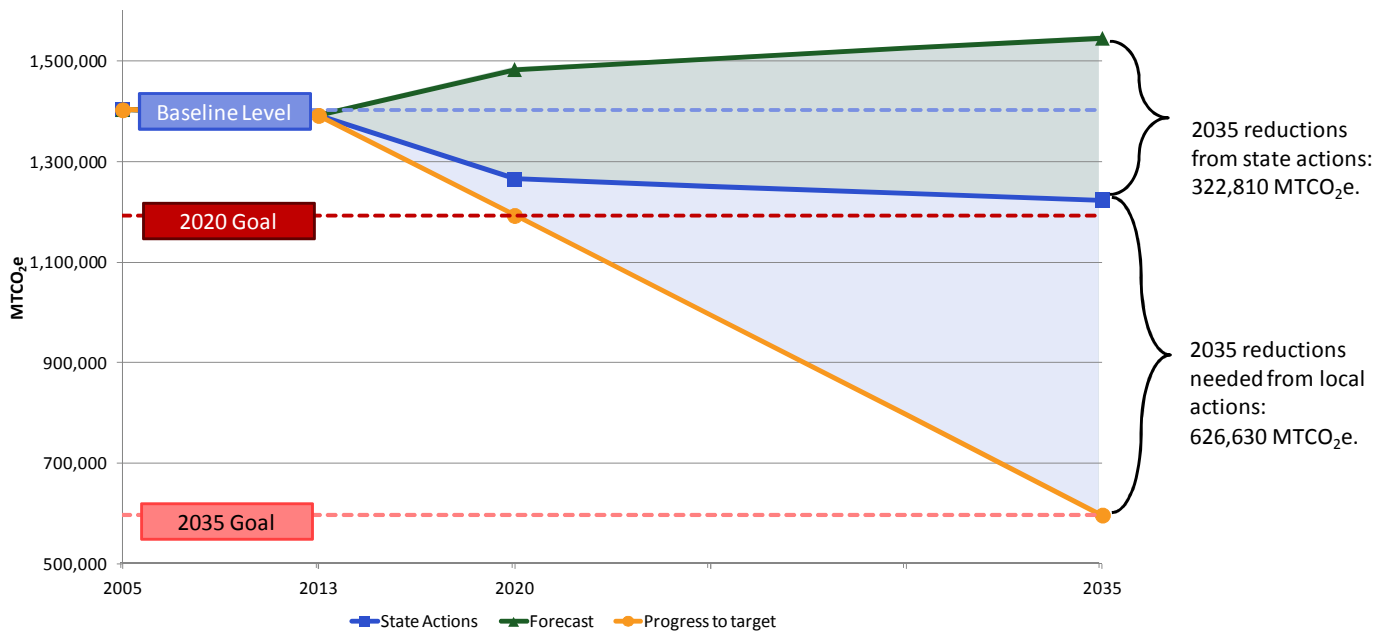
Climate Action Plan

Table 3.8. Baseline GHG Emissions, Forecasts, and Reduction Goals

	2020 MTCO ₂ e	2035 MTCO ₂ e
2005 Baseline Emissions	1,403,610	1,403,610
Forecasted Emissions	1,483,720	1,545,980
Forecasted Emissions Minus Estimated Statewide Reductions	1,265,620	1,223,170
Reduction Target	1,193,070	596,540
Local Reductions Needed	-72,550	-626,630

Source: Michael Baker International 2015

Figure 3.3. Baseline GHG Emissions, Forecasts, and Reduction Goals





This chapter details actions and policies that Contra Costa County can use to achieve necessary greenhouse gas (GHG) reductions. Additionally, this chapter identifies how the suggested reduction measures will also increase public health in Contra Costa County. The reduction measures in this Climate Action Plan (CAP) provide a diverse mix of programs for both new and existing development. The reduction measures also aim to reduce GHG emissions from each sector to avoid reliance on any one strategy or sector to achieve the target.

REDUCTION STRATEGY STRUCTURE

In order to achieve the state-recommended reduction target of 15% below 2005 emissions levels by 2020, Contra Costa County will implement the goals, policies, and actions set forth in this chapter. The County's strategy is structured around the following six topic areas:

1. • Energy Efficiency and Conservation
2. • Renewable Energy
3. • Land Use and Transportation
4. • Solid Waste
5. • Water Conservation
6. • Government Operations

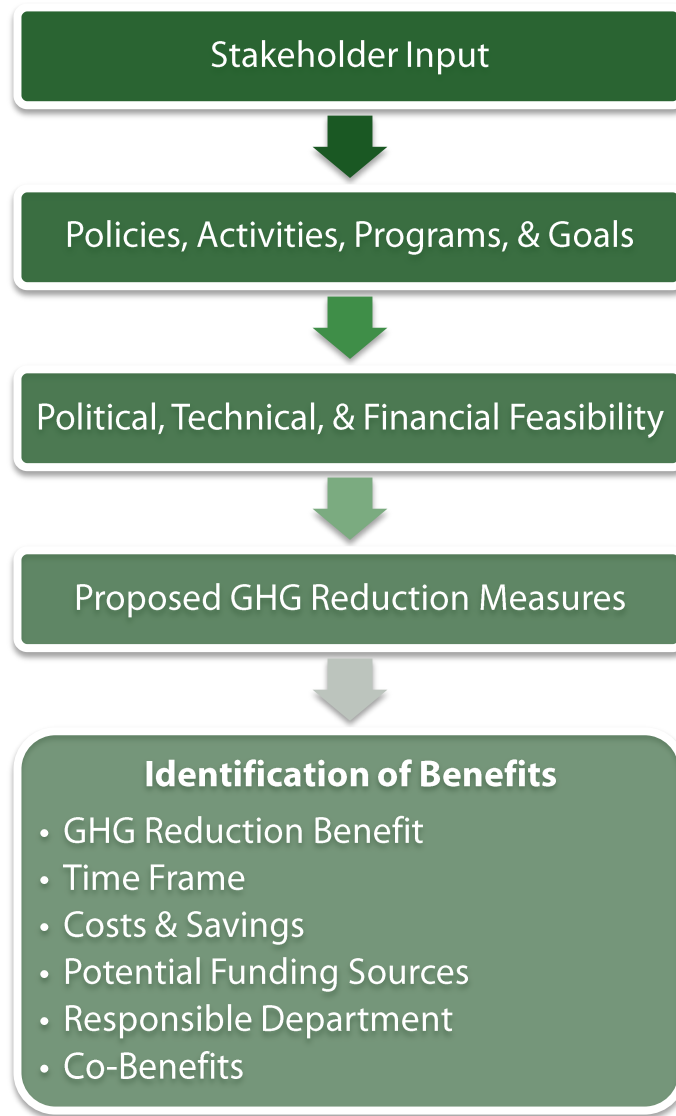
Each topic area has a corresponding goal, reduction measures, and supporting actions necessary for implementation.

GHG Reduction Strategy

GHG REDUCTION MEASURE DEVELOPMENT AND METHODS

The process for developing GHG reduction measures includes a review of existing policies, activities, and programs, identification of topic areas or goals, and preliminary reduction measure language with performance targets and indicators. Preliminary measures are then refined and evaluated for political, technical, and financial feasibility (see **Figure 4.1**). Finally, a path to the successful implementation of each GHG reduction measure is identified by determining the GHG reduction benefit, the time frame for implementation, potential sources of funding, the department responsible for implementation, and the additional benefits, or co-benefits that may occur from the implementation of each measure.

Figure 4.1. GHG Reduction Measure Development Process



GHG Reduction Strategy

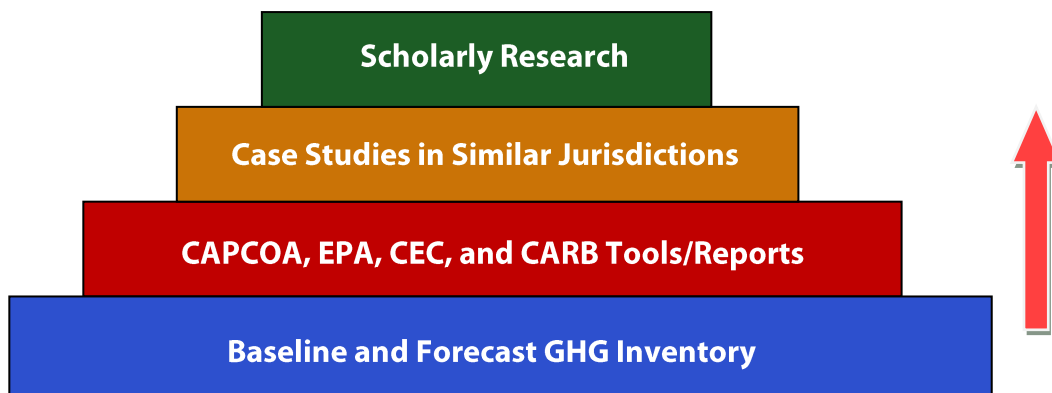
#4

The GHG reduction benefit of each measure is determined by changes in operation, activity, or efficiency. In general, there are three types of reductions in climate action plans: (1) avoided emissions (e.g., walk instead of drive), (2) greater efficiency (e.g., drive an electric vehicle), and (3) sequestration (e.g., increase carbon storage through planting trees). GHG reduction estimates are identified for 2020 and 2035.

The information used to estimate GHG emissions reductions is summarized in **Figure 4.2**. The baseline GHG inventory and forecast serves as the foundation for quantifying the County's GHG reduction measures. Activity data from the inventory (e.g., vehicle miles traveled and kilowatt-hours (kWh) of electricity) is combined with the performance targets and indicators identified in this CAP to calculate the GHG reduction benefit of each measure. This approach ensures that the County's GHG reductions are tied to the baseline and future activities in Contra Costa County.

Whenever possible, emissions reduction estimates are based on tools and reports provided by government agencies such as the US Environmental Protection Agency (EPA), California EPA, California Energy Commission (CEC), California Air Resources Board (CARB), California Air Pollution Control Officers Association (CAPCOA), and local air districts. If accurate reduction estimates are not available through these tools, a case study with comparable characteristics may be used. Finally, for long-range reduction measures that lack on-the-ground testing or analysis, current scholarly and peer-reviewed research is combined with knowledge of existing County practices to create a defensible estimate of future emissions reductions.

Figure 4.2. GHG Quantification Sources and Tools



To demonstrate the types of information and performance indicators that go into quantifying each measure, a detailed example calculation is provided in **Table 4.1**.

GHG Reduction Strategy

Table 4.1. Example Measure Quantification

Example Measure: Implement residential energy efficiency program.			
	Quantification Data	Year: 2020	Data Source
A	Total residential electricity use (kWh)	485,212,670	Example GHG Inventory Forecast
B	Total households	64,190	ABAG
C	Average electricity use per household	7,070	Calculation = A/B
D	Percentage of households participating in program	10%	Measure goal
E	Total households participating in program	6,420	Calculation = B*D
F	Average electricity savings per participant	5%	Case studies from cities A and B
G	Total electricity savings (kWh)	2,270,000	Calculation = C*E*F
H	Metric ton of CO ₂ e per kWh	0.0002	Example County GHG Inventory
I	Emissions reduction (MTCO ₂ e)	300	Calculation = G*H

The method for determining the GHG reduction benefit from each measure is detailed in the GHG Technical **Appendix D**, which summarizes the sources and assumptions used to estimate the GHG reductions from each measure.

EVALUATION CRITERIA

In order to ensure successful implementation and evaluation of the GHG reduction measures included in this CAP, the following criteria have been identified in this CAP or the associated implementation matrix (**Chapter 5**).

GHG Reductions (MTCO₂e) are estimated, as explained above, and reported for 2020 and 2035.

Supportive Measures are measures without identified GHG reductions. Measures that are not quantified because their implementation directly supports other measures are labeled “Supportive of (Measure Title).” Measures that are not quantified because no defensible quantification method exists for unincorporated Contra Costa County are labeled “Supportive of Overall GHG Reductions.” These measures may become quantifiable as research, technology, and methods progress.

GHG Reduction Strategy

#4

Implementation Time Frame is identified for each measure based on community priorities, local goals, and the availability of technological innovations to implement each measure. Time frames will be presented as a range similar to the following:

Time Frame	Year Range
Ongoing	Existing effort that will continue to be implemented
Near-Term	Implemented between 2015 and 2018
Mid-Term	Implemented no later than 2020
Long-Term	Implemented by 2035

Implementing Department/Responsible Agencies will identify the County department that will be responsible for implementing each measure, securing funding resources, reporting on annual progress, and coordinating with the supporting agencies.

Supporting Agencies are the public and private local and regional entities that will be a partner or lead in the implementation of certain actions. Examples of supporting agencies to Contra Costa County include the Bay Area Air Quality Management District (BAAQMD), the Metropolitan Transportation Commission (MTC), the Association of Bay Area Governments (ABAG), the Contra Costa Transportation Authority (CCTA), Contra Costa County Climate Leaders, and other municipal organizations in the county.

Community Co-Benefits will be included to identify the ancillary benefits that each measure may have for the community. Potential co-benefits will be identified if the policy (1) conserves energy, (2) improves air quality, (3) supports local economy, (4) reduces water use, (5) provides educational opportunities, (6) saves money, (7) improves mobility, (8) improves community livability, (9) conserves resources, (10) improves public health, or (11) improves community resiliency to climate change.

Public Health Priority Benefits will be included to demonstrate where the community would experience a positive impact on healthy living. These measures include elements determined by Contra Costa Health Services (CCHS) to provide the highest benefit to human health in the county.

HEALTHY COMMUNITY STRATEGIES

In this CAP, reduction measures and public health measures are closely tied. Many of the GHG reduction measures reduce GHG emissions and have public health co-benefits. Healthy community measures, identified in **Chapter 5**, address the public health impacts of a changing climate, but do not have GHG emissions reductions as the primary goal. Public health measures of this type are commonly referred to as “adaptive measures” because they help the county adapt to a changing climate.

This chapter explains the actions already taken to encourage a more resilient and healthy Contra Costa County and proposes seven additional measures to ensure that climate change-related public health responses are adequately incorporated into future planning efforts.

PUBLIC HEALTH CONSIDERATIONS

While this CAP focuses on reducing GHG emissions, many of the proposed policies have secondary benefits to public health. By including health considerations in the CAP, the County has the ability to target implementation efforts to realize potential health benefits. To paraphrase from Perera and Sanford (2011), the good news is that both health-harming air pollution and climate change are generally caused by the same activities: human beings burning fossil fuels to generate energy and run their vehicles. Similarly, many solutions to reduce GHG emissions involve activities with positive public health outcomes. Working with the Public and Environmental Health Advisory Board (PEHAB), CCHS has led an effort to ensure that the public health impacts of climate change are identified and addressed in this CAP by establishing health indicators against which County actions could be measured and using them to identify priority areas that will have the greatest benefit on public health, and discussing the potential effect of GHG reduction measures on criteria pollutants (**Chapter 2** and **Appendix A**).

PUBLIC HEALTH PRIORITY BENEFITS

Health indicators were developed in consultation with PEHAB and refined to reflect input from community workshops. The indicators were used to evaluate the relative public health benefit of goals and policies that would reduce GHG emissions by determining whether there is a primary link between the action and the health indicator. Because the relative value of a health benefit involves subjective determinations, ratings were not quantified but rather were used to provide structure for assessing the relative merit of the various actions. Based on the evaluation of the potential health benefits of the CAP's reduction measures, CCHS has determined four types of reduction measures that provide the highest benefit to human health. These reduction measures significantly promote the following outcomes: Increased Walking & Biking, Increased Public Transportation, Increased Infill Development, and Health Equity.

Throughout this chapter, public health priority benefits will be indicated alongside GHG reduction measures. This section provides descriptions of each priority benefit. For an expanded discussion of public health and GHG reduction measures, see **Appendices A and D**.

1. Increased Walking and Biking

The CCHS evaluation found walking and biking improvement measures to be associated with multiple health indicators. These improvements enhance physical activity and make it safer, by making walking and biking easier and increasing the number of people doing so. By replacing some vehicle trips, bicycle and pedestrian improvements can increase air quality. While these improvements are sometimes targeted toward recreation, they can also facilitate access to goods and services by making it easier and safer to walk or bike to jobs, schools, healthcare, family, transit stops, or other destinations. Also, since lower-income people may be more dependent on walking (and to a lesser extent, biking) to get around, investments in walking and biking have the potential to contribute to health equity.

2. Increased Public Transportation

CCHS identified a wide range of health indicators associated with transit improvement measures. First, public transit encourages physical activity because transit users usually walk or bike to their stop, an effect which is likely to have a significant impact on human health. On average, transit users spend 19 minutes a day walking to their public transportation stop. Of these users, 29% met the Surgeon General's recommendation of 30 minutes of daily physical activity as a result of walking to public transportation (Besser and Dannenberg 2005). As shown above, increasing physical activity is expected to lead to positive public health outcomes. Public transit can also help create an urban environment where it is possible to live without an automobile, and can significantly improve air quality by shifting trips from cars. By creating a viable alternative to using a car, public transportation can help improve access to jobs, healthcare, and other essential goods and services. Increased access to shopping, jobs, schools, and other key destinations is especially important for Contra Costa households with zero or one vehicles (6% and 29%, respectively). A number of researchers have found that accessible and reliable transportation is essential to finding and keeping jobs, which in turn, facilitates the economic well-being that is essential for good health (Kawabata 2002; Ong and Houston 2002). Similarly, public transportation (not school district buses) currently carries 6% of Contra Costa County students to school (Contra Costa County Safe Routes to School Master Plan 2009).

3. Increased Infill Development

CCHS found infill development measures to be associated with four health indicators. Dense neighborhoods have been consistently found to increase physical activity by bringing people closer to destinations, making it easier to travel by foot or by bike. Higher-density development also improves access to essential destinations, such as grocery store, schools, and jobs, particularly for those without cars (Ewing and Cervero 2010; Walker 2011). Similarly, higher-density neighborhoods improve regional air quality by discouraging car trips. Additionally, by focusing growth in defined centers rather than outward sprawl, infill development can help to preserve open space, which can preserve local character and improve air quality.

While changes to urban form often take decades to solidify, infill development is likely to have significant positive long-term impacts on human health. In a comprehensive analysis of the existing literature, Ewing and Cervero (2010) found that, on average, density yields a 7% increase in walking and a 5% decrease in vehicle miles traveled. This suggests that long-term changes to Contra Costa County's built environment are likely to yield real, if modest, increases in physical activity and decreases in air pollution.

In conjunction with other policies, such as enhanced transit service and bicycle and pedestrian improvements, increasing infill development can also help to alter the long-term patterns of automobile dependence and sprawl that exact high societal health costs such as air pollution, accidents/injuries, diabetes and obesity, cardiovascular disease, urban heat island effects, poor mental health, and exclusion from opportunity (Frumppkin 2001). Encouraging infill development is consistent with the goals and strategy of CCHS's Injury Prevention and Physical Activity Promotion Project, and related measures received moderate to high public support during the open house process (managing parking was a notable exception).

4. Health Equity

Unlike the other priority measure types, which focus on single issues, a wide variety of measures may influence health equity by placing the emphasis on the most vulnerable populations in the county. These may include young children, the elderly and disabled, low-income residents, and minorities. The reduction measures in the CAP that directly contribute to improving health equity do so through targeted job creation, increased access to goods and services, economic incentives for sustainable behavior, and programs that protect vulnerable populations from indoor and outdoor air pollution.

The root causes of most health disparities are the broader, more historic inequalities within society, such as poverty and discrimination. Health disparities are often called health inequities because they result from these broader inequities within society. Poverty and discrimination lead to stress, greater exposure to environmental toxins and poor air quality, and less access to high-quality goods and services including education, health services, transportation, food, and recreation. Health studies have shown that these inequalities and injustices are strongly related to higher rates of injury, illness, and premature death. Therefore, prioritizing measures that counter the effects of these social inequities can help change the underlying conditions that contribute to poor health.

In April 2003, after extensive review and discussion, CCHS adopted a department-wide plan called Reducing Health Disparities: Diversity and Cultural and Linguistic Competence in Contra Costa Health Services. One goal of this plan for reducing health disparities is to engage and partner with other public entities to support healthier environments. In response to this element of the CCHS mission, each GHG reduction measure in the CAP was evaluated for its potential to reduce health inequities. This is especially appropriate since many of the impacts of climate change that are associated with air pollution, such as increased death, disease, and injury from heat waves, floods, storms, and fires, decreased food quality and security, and increased morbidity and mortality—are predicted to disproportionately affect those who are socially and economically disadvantaged. “Reducing health disparities” received extremely high support during the open house process and from PEHAB.

EXISTING LOCAL ACTIONS

EXISTING GHG REDUCTION ACTIONS

Contra Costa County has already taken strides to reduce energy use and promote sustainability in the community. The County's actions, specifically the success of the California Solar Initiative (CSI) and the Bay Area Regional Energy Network (BayREN), have led to measureable reduction in GHG emissions since 2005. These reductions are applied to the overall emissions reduction to avoid double-counting.

EA 1: California Solar Initiative (CSI)

The CSI allows the California Public Utilities Commission (PUC) to provide incentives to install renewable energy technologies on existing homes and businesses in PG&E territory. Participation in the CSI program by Contra Costa County residents has increased the amount of renewable solar power available in the community. By displacing demand for fossil-based power, these installations will lead to reductions through 2035.

MEASURE EA 1

2020 GHG Reduction

1,980 MTCO₂e

2035 GHG Reduction

1,540 MTCO₂e

Co-Benefits

Conserves Energy, Provides
Educational Opportunities, Saves
Money

EA 2: Bay Area Regional Energy Network (BayREN)

BayREN is a collaboration of the nine counties that make up the San Francisco Bay Area. Led by ABAG, BayREN hosts energy saving programs on a regional level, including in Contra Costa County. Since BayREN program implementation began in Contra Costa County in 2013, nearly 30 residences have received incentives to increase home energy efficiency. On average, these projects have saved over 200 therms and 1,500 kWh per home. BayREN will continue to play an important role in encouraging home and business owners in Contra Costa County to implement improvements to decrease energy consumption.

MEASURE EA 2

2020 GHG Reduction

30 MTCO₂e

2035 GHG Reduction

30 MTCO₂e

Co-Benefits

Conserves Energy, Provides
Educational Opportunities, Saves
Money, Adaptive Measure

EXISTING PUBLIC HEALTH ACTIONS

The County has begun to address vulnerable populations in its overall emergency planning efforts, including those related to climate change. Additionally, the County has adopted, or is in the process of completing, several public health and climate change-related strategic plans, including the following:

- Contra Costa County Operational Area Excessive Heat Emergency Plan (2010) amends the County's Emergency Operations Plan to include specific extreme heat event strategies.
- Contra Costa County Hazard Mitigation Plan (2011) addresses climate change as a subset, or secondary impact, for each identified hazard of concern.
- Regional Health Risk Assessment (in progress) will establish a coordinated and synchronized community preparedness planning effort in the region, conduct a regional public health risk assessment, identify the specific health threats and risks that will be addressed by the region, propose strategies and activities designed to reduce and/or mitigate the threats and risks, and develop a regional risk mitigation plan to specifically address the health needs and risks of the community, including vulnerable populations (Cox 2012).

GHG REDUCTION STRATEGIES

GOAL 1: ENERGY EFFICIENCY

Increase energy efficiency in residential and commercial building stock, and reduce community-wide electricity and natural gas use.

Residential and nonresidential buildings in the county depend on electricity and natural gas for lighting, heating, cooling, and running appliances. Energy efficiency is a key component of any strategy that seeks to reduce energy use. According to the 2014 Contra Costa County Housing Element, approximately “60 percent of the housing stock in unincorporated areas is thirty years or older, the age when most homes begin to have major repair or updating needs.” Older homes also tend to be less energy efficient than new homes and provide significant opportunities to reduce energy consumption.

Energy efficiency has the potential to affect public health by reducing the energy cost burden experienced by low-income families and by allowing for a more affordable comfortable indoor climate. With expected increases in severe weather, including increased extreme heat days, the ability for all families to affordably and efficiently maintain a comfortable climate in their homes is critical. Additionally, reductions in electricity and natural gas use have direct impacts on the amount of criteria air pollutants being released into the environment. As demonstrated in **Chapter 2**, reducing the amount of criteria pollutants in a community’s atmosphere can increase public health, especially for vulnerable populations such as the elderly, children, and those with existing respiratory illnesses.

GHG Reduction Strategy

Measure EE 1: Energy-Efficient Retrofits – Residential Buildings

Provide opportunities for residential buildings to become more energy efficient.

Action items:

1. Continue and expand single-family participation in established energy efficiency rebate programs, including BayREN and East Bay Energy Watch.
 - Collaborate with local organizations like Contra Costa County Climate Leaders and PG&E to develop comprehensive and appropriate outreach efforts that effectively reach all segments of the community.
 - Monitor participation in energy efficiency programs.
2. Continue and expand multi-family participation in established energy efficiency rebate programs, including BayREN and East Bay Energy Watch.
3. Increase participation in the existing low-income weatherization program and seek additional program funding.
4. Identify disadvantaged individuals and households for increased participation in energy efficiency programs.
5. Work with PG&E to advertise and promote a residential appliance rebate program with a focus on properties with potential high appliance energy use (e.g., homes with pools would receive a flyer about available pool pump rebates and return on investment information).
6. Participate in one or more Property Assessed Clean Energy (PACE) financing programs.

MEASURE EE 1

2020 GHG Reduction

2,140 MTCO₂e

2035 GHG Reduction

3,160 MTCO₂e

Responsible Department(s)

Conservation & Development

Co-Benefits

Conserves Energy, Provides Educational Opportunities, Saves Money, Improves Public Health, Adaptive Measure

Public Health Priority Benefits

Health Equity

MEASURE EE 1 COMMUNITY BENEFITS

In addition to helping Contra Costa homeowners save money on their utility bills, increasing a home's efficiency can have health benefits for residents. Simple actions, such as adding insulation, sealing leaky ducts, or adding energy-efficient heating, ventilation, and air-condition systems, can improve indoor air quality and manage the home's temperature. While a home that more efficiently warms up in cold winter weather and cools down in summer heat adds comfort for all residents, it can be essential for people with health conditions or those who are more vulnerable to extreme temperatures. Seniors, children, and people with respiratory illnesses can avoid illness and injury by living in a home that is safe, healthy, and comfortable.

Measure EE 2: Energy-Efficient Retrofits – Nonresidential Buildings

Provide opportunities for nonresidential buildings to become more energy efficient.

Action Items:

1. Continue expanding nonresidential participation in energy efficiency rebate and financing programs, including East Bay Energy Watch, BayREN, low-interest California Energy Commission (CEC) loans, and PG&E on-bill financing opportunities. Create a prioritized list of energy-intense facilities to target for additional education and/or financial support for energy efficiency improvements, while complying with existing privacy regulations.
2. Provide focused outreach to local businesses describing PACE program opportunities, constraints, and benefits.
3. Develop outreach materials that explain the opportunities for financing energy efficiency retrofits such as a PACE program, low-interest energy efficiency loans through the CEC, integration of energy efficiency retrofit projects into capital lease structures, and mortgage refinancing.
4. Identify staffing and a revenue stream to develop a shared landlord-tenant program to support the financing of energy efficiency retrofits to renter-occupied buildings.
5. Inform nonresidential building owners about the savings potentials from retrocommissioning, retrofits, and deep retrofits.
6. Inform the business community about the monetary benefits associated with energy-efficient appliances.
7. Collaborate with local organizations like 4CL and PG&E to develop and implement the outreach approaches outlined in this measure.

MEASURE EE 2

2020 GHG Reduction

4,630 MTCO₂e

2035 GHG Reduction

9,310 MTCO₂e

Responsible Department(s)

Conservation & Development

Co-Benefits

Conserves Energy, Supports Local Economy, Provides Educational Opportunities, Saves Money, Improves Public Health

Public Health Priority Benefits

None

GHG Reduction Strategy

Measure EE 3: Energy Conservation Awareness

Provide education and outreach highlighting the benefits of energy conservation.

Action Items:

1. Engage with PG&E to provide multilingual and culturally relevant educational material to residents and businesses to increase the community's awareness and utilization of real-time energy consumption data available through the SmartMeter program.
2. Work with the Bay Area Green Business Program to highlight examples of energy-efficient local businesses.

MEASURE EE 3

2020 GHG Reduction

430 MTCO₂e

2035 GHG Reduction

810 MTCO₂e

Responsible Department(s)

Conservation & Development, Health Services

Co-Benefits

Conserves Energy, Supports Local Economy, Provides Educational Opportunities, Saves Money

Public Health Priority Benefits

Potential Health Equity

MEASURE EE 3 COMMUNITY BENEFITS

The Contra Costa Green Business Program has certified over 580 green businesses in Contra Costa since it started in 1998, and 335 are still recognized and operating. Businesses and organizations certified include auto body and repair shops, business and home maintenance services, landscapers, printers, grocery and hardware stores, public offices and facilities, and solar panel installers. Certified green businesses adopt the principles of sustainability and make an effort to eliminate or reduce the use of hazardous materials, waste generated, and air and wastewater discharges, and to use energy and water as efficiently as possible. These waste reduction and energy conservation measures have also resulted in a conservative estimate of 25 million pounds of carbon dioxide emissions reductions since the program started.

GHG Reduction Strategy

#4

Measure EE 4: Urban Forestry and Paving and Roofing Materials

Reduce urban heat islands through vegetation management and cool surfaces.

Action Items:

1. Encourage multi-family residential and nonresidential development to increase use of higher-albedo materials for surfaces including roofs, parking areas, driveways, roads, and sidewalks.
2. Encourage developments with parking lot areas to shade these areas with vegetation or solar panels when appropriate.
3. Continue to promote the use of low-impact development (LID) strategies and reduction in impervious surface area of new development.
4. Encourage increased use of cool roof materials on new and existing buildings to reduce the urban heat island effect and corresponding cooling energy consumption.
5. Support various programs to plant and maintain trees in urban and rural areas.

MEASURE EE 4

2020 GHG Reduction

20 MTCO₂e

2035 GHG Reduction

40 MTCO₂e

Responsible Department(s)

Conservation & Development, Public Works

Co-Benefits

Conserves Energy, Improves Air Quality, Saves Money, Improves Community Livability, Improves Public Health, Adaptive Measure

Public Health Priority Benefits

Increased Walking & Biking, Potential Health Equity

GHG Reduction Strategy

Measure EE 5: Energy Efficiency Capacity Building

Increase Contra Costa County's capacity for energy efficiency through financing opportunities and workforce training.

Action Items:

1. Monitor grants from cap-and-trade revenue and other funding sources, and inform applicable County agencies.
2. Create a framework for revenues from cap-and-trade offsets or allocations to fund energy efficiency and resource conservation programs, such as those proposed in this CAP, to be used locally, particularly within recognized impacted communities or areas.
3. Work with the Contra Costa Community College District and the Contra Costa Workforce Development Board to encourage and develop workforce training programs for green jobs, including energy efficiency audits, energy retrofits, and renewable energy installation.

MEASURE EE 5

2020 GHG Reduction

Supportive of Overall GHG Reductions

2035 GHG Reduction

Supportive of Overall GHG Reductions

Responsible Department(s)

Conservation and Development,
Health Services, Public Works;
additional departments, depending on
grant resource.

Co-Benefits

Conserves Energy, Supports Local
Economy, Provides Educational
Opportunities, Saves Money, Improves
Public Health

Public Health Priority Benefits

Health Equity

Measure EE 6: Energy-Efficient New Buildings

Support the statewide transition to net zero energy construction for new residential buildings by 2020 and new nonresidential buildings by 2030.

Action Items:

1. Identify and remove barriers to zero net energy construction in the County's regulatory framework.
2. Work with developers, property owners, and financial donors to construct and publicize example zero net energy homes prior to the adoption of zero net energy building codes by the California Energy Commission.
3. Provide information about zero net energy buildings at public events, on the County website, and in the development review process, including publicizing information about the cost effectiveness of zero net energy buildings. Include information about zero net energy buildings in other energy efficiency education efforts.
4. Explore making new and significantly retrofitted County buildings zero net energy.

MEASURE EE 6

2020 GHG Reduction

290 MTCO₂e

2035 GHG Reduction

680 MTCO₂e

Responsible Department(s)

Conservation & Development, Public Works

Co-Benefits

Conserves Energy, Provides Educational Opportunities, Saves Money, Conserves Resources

Public Health Priority Benefits

None

GHG Reduction Strategy

GOAL 2: RENEWABLE ENERGY

Increase the production of renewable energy from small-scale and commercial-scale renewable energy installations.

The County provides a diverse mix of opportunities for renewable energy resource installations. This goal seeks to shift a portion of energy production and consumption away from electricity and natural gas to renewable energy sources. Both natural gas and electricity can be offset with renewable sources of energy that are profitable, yield cost savings to users, and spur local energy independence. Through this goal, the county will reduce GHG emissions from traditional electricity production and natural gas by promoting the production of local, on-site renewable energy for both residential and nonresidential uses. Renewable energy sources such as wind and solar do not emit criteria air pollutants and therefore have the positive health impact of reducing the amount of criteria air pollutants released into the local environment. Programs that incentivize renewable energy installation on low-income residences can help households save money. Job training programs can also increase the community's economic health and providing viable employment for Contra Costa residents.

Measure RE 1: Alternative Energy Installations

Promote installation of alternative energy facilities on homes and businesses.

Action Items:

1. Amend the County Zoning Code to designate areas and development standards that are appropriate for and supportive of small- and medium-sized alternative energy and energy storage installations not covered by AB 2188.
2. Train planning staff to provide guidance and information on the streamlined process and available incentives.
3. Create development standards allowing for the ministerial approval of rooftop energy systems on commercial buildings, with a focus on warehouses and other structures with large surface area roofs.
4. Encourage participation in PG&E's green tariff program.

MEASURE RE 1

2020 GHG Reduction

8,820 MTCO₂e

2035 GHG Reduction

14,840 MTCO₂e

Responsible Department(s)

Conservation & Development

Co-Benefits

Supports Local Economy, Provides Educational Opportunities, Conserves Resources, Adaptive Measure

Public Health Priority Benefits

None

Measure RE 2: Alternative Energy Facilities

Promote installation of alternative energy facilities on public land.

Action Items:

1. Continue to install alternative energy facilities (e.g., photovoltaic panels and electric vehicle charging stations) on public buildings and lands in the unincorporated county
2. Continue to participate in the Regional Renewable Energy Procurement Project or similar bulk purchasing programs to purchase solar photovoltaic systems for on-site generation at public facilities.
3. Work with East Bay Municipal Utility District and other wastewater processors to install cogeneration infrastructure on wastewater treatment facilities.

MEASURE RE 2

2020 GHG Reduction

270 MTCO₂e

2035 GHG Reduction

630 MTCO₂e

Responsible Department(s)

Conservation & Development, Public Works

Co-Benefits

Supports Local Economy, Provides Educational Opportunities, Conserves Resources

Public Health Priority Benefits

None

GHG Reduction Strategy

Measure RE 3: Alternative Energy Financing

Lower barriers to entry for the installation of alternative energy systems.

Action Items:

1. Improve participation in existing and planned financing mechanisms for renewable energy and energy storage systems, such as PACE and BayREN.
2. Connect low-income homeowners with renewable energy rebate and financing programs.
3. Work with local governments in Contra Costa County and neighboring areas to participate in a regional solar photovoltaic energy systems bulk-buying program.
4. Connect business owners with available finance and rebate programs.
5. Work with PG&E to identify areas where grid capacity may be insufficient to accommodate an increase in renewable energy capacity, and encourage PG&E to upgrade such areas to reduce barriers.
6. Continue exploring options for implementing Community Choice Aggregation within the unincorporated area of the county.

MEASURE RE 3

2020 GHG Reduction

Supportive of Overall GHG Reductions

2035 GHG Reduction

Supportive of Overall GHG Reductions

Responsible Department(s)

Conservation & Development

Co-Benefits

Conserves Energy, Supports Local Economy, Provides Educational Opportunities, Saves Money

Public Health Priority Benefits

Health Equity

GOAL 3: LAND USE AND TRANSPORTATION

Reduce transportation emissions.

The intent of this goal is to reduce transportation emissions, primarily through improvements in vehicle efficiency, reduction in single-occupant vehicle use, and support of mixed-use communities (where appropriate) throughout the unincorporated county and in identified “priority development areas.” This goal promotes the location of homes in close proximity to schools, employment centers, transit centers, and shops, while protecting the unique characteristics of the county’s neighborhoods and rural areas. Policies and actions for mobility and connectivity in new development build on these strategies, developed to respect the specific challenges and opportunities of the county’s unincorporated communities.



This low-income senior housing project in Crockett is an example of infill development. Residents are within walking distance of the city's senior center.

In addition to lowering criteria air pollutants associated with automobiles, this goal facilitates active transportation and reduced vehicle dependence, both of which have documented public health benefits. By strategically locating people closer to services and revising development standards to create pedestrian-oriented streetscapes, this goal also helps improve community health by encouraging walking and bicycling.

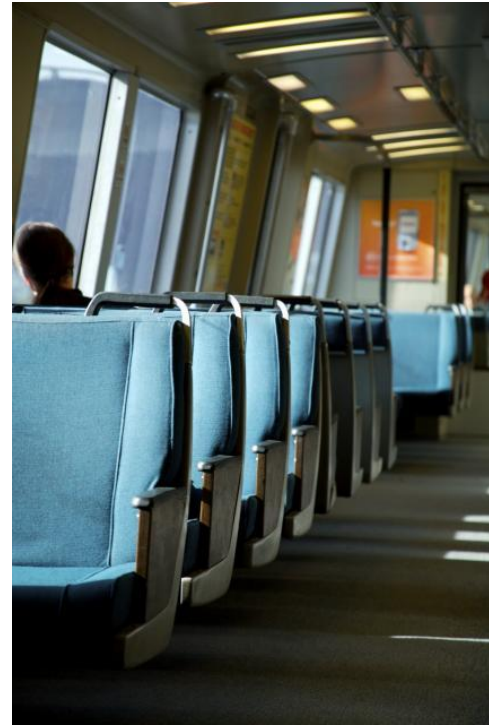
Physical activity has been shown to have powerful influence on a variety of health outcomes including lower mortality, lower risk of cardiovascular diseases, lower risk of diabetes, lower risk of some cancers, improved mental health, and healthier bones, muscles and joints. A recent study (Maizlish et al. 2011) estimated the potential cost savings from the health benefits of dramatically increasing Bay Area physical activity at \$34 billion annually. Improving walking and biking safety can also have a significant effect on injury rates. As of 2007, traffic accidents (involving cars, bikes, and people) were the leading cause of injury deaths in Contra Costa County (CCHS 2010). Investments in bike and pedestrian safety can dramatically reduce these rates.

In baseline year 2005, on-road and off-road vehicles emitted 628,200 MTCO₂e. While policies that seek to reduce vehicle miles traveled are necessary and useful, the quickest way to reduce transportation emissions is by operating cleaner, more efficient vehicles and equipment. This goal seeks to reduce emissions associated from on-road and off-road vehicles by encouraging the use of less carbon-intensive fuel sources such as electricity.

As mentioned in **Chapter 2**, climate change is expected to have a direct impact on public health through increases of urban ozone levels. Decreasing emissions typically associated with carbon-intensive vehicles and equipment would reduce the amount of criteria air pollutants that exacerbate ozone-related public health issues.

GHG Reduction Strategy

In conjunction with other policies, such as infill development and bicycle and pedestrian improvements, improving transit service can also help to alter the long-term patterns of automobile dependence and sprawl that exact high societal health costs such as air pollution, accidents/injuries, diabetes and obesity, cardiovascular disease, urban heat island effects, poor mental health, and exclusion from opportunity. Improving public transit is consistent with the goals and strategy of CCHS's Injury Prevention and Physical Activity Promotion Project and related measures received extremely high public support during the open house process (Frumppkin 2001).



Public transportation, including BART and local buses, provides access to goods and services for residents without vehicles

Measure LUT 1: Mobility and Land Uses

Maintain and expand access to goods, services, and other destinations through increased transportation alternatives (mobility improvements) and improved proximity (land use improvements).

Action Items:

1. Collaborate with local transportation, land use agencies, nonprofits, and other stakeholders to expand bicycle and pedestrian facilities and existing public transportation (BART, Amtrak, AC Transit, County Connection, and Tri Delta Transit).
2. Assist with Safe Routes to School program implementation.
3. Work with the Contra Costa Transportation Authority, local school districts, and advocacy organizations such as the East Bay Bicycle Coalition to encourage bicycle safety classes in all schools.
4. Update County road standards, as opportunities arise, to accommodate all modes of transportation in local street designs (i.e., complete streets). Implement standards as part of routine maintenance and striping.
5. Through periodic updates to the Contra Costa Transportation Authority's Countywide Bicycle and Pedestrian Plan, identify opportunities to improve access to community-wide bicycle and pedestrian networks by closing gaps in the network, removing barriers, and providing additional bike- and pedestrian-oriented infrastructure.
6. Cooperate with the Contra Costa Transportation Authority and adjoining jurisdictions in updating and implementing the Countywide Bicycle and Pedestrian Plan and local plans.
7. Revise the County CEQA guidelines to reflect implementation of Senate Bill 743.
8. Establish a 2020 mode share goal for bicycling by a Board of Supervisors resolution, identify specific actions to reach the goal, integrate the goal into future General Plan updates, and appeal to other agencies to adopt the same goal.
9. Identify funding sources to support increased walking and bicycling activity.

MEASURE LUT 1

2020 GHG Reduction

910 MTCO₂e

2035 GHG Reduction

2,680 MTCO₂e

Responsible Department(s)

Conservation & Development, Health Services, Public Works

Co-Benefits

Improves Air Quality, Improves Mobility, Improves Community Livability, Improves Public Health

Public Health Priority Benefits

Increased Walking & Biking, Increased Public Transportation, Health Equity

GHG Reduction Strategy

Measure LUT 2: Alternative-Fuel Infrastructure

Expand the use of alternative fuels in vehicle travel.

Action Items:

1. As opportunities arise, include alternative-fuel use goals in franchise agreements for waste hauling and contracts with other vehicle fleets.
2. Support development of alternative-fuel vehicle infrastructure such as biofuel and electric vehicle (EV) charging stations and designated parking spots with chargers, including amending parking design and layout section (82-16-404) of the County Zoning Code to locate alternative fuel vehicle infrastructure in areas of high visibility and easy access.
3. Pursue grant funding opportunities to install public EV chargers or other alternative fuel charging stations.

MEASURE LUT 2

2020 GHG Reduction

7,630 MTCO₂e

2035 GHG Reduction

11,670 MTCO₂e

Responsible Department(s)

Conservation & Development, Public Works; additional departments depending on grant resources

Co-Benefits

Improves Air Quality, Conserves Resources, Improves Public Health

Public Health Priority Benefits

Health Equity

Measure LUT 3: Off-Road Vehicles and Equipment

Reduce emissions from off-road vehicles and equipment.

Action Items:

1. Work with BAAQMD to incentivize the use of battery-powered lawn and garden equipment.
2. Provide support for BAAQMD's voluntary exchange program for residential lawn mowers.
3. Work with BAAQMD to increase the use of alternatively fueled equipment in agricultural operations through education, incentives, or revisions to existing regulations.
4. Consider an amendment to the County Building Code that would prohibit unnecessary idling of off-road and heavy equipment.

MEASURE LUT 3

2020 GHG Reduction

10 MTCO₂e

2035 GHG Reduction

10 MTCO₂e

Responsible Department(s)

Agriculture, Conservation & Development

Co-Benefits

Improves Air Quality, Conserves Resources, Improves Public Health

Public Health Priority Benefits

Health Equity

MEASURE LUT 3 COMMUNITY BENEFITS

Gas-powered lawn and garden equipment isn't just loud; it pollutes the air and creates greenhouse gas carbon dioxide. The workers using it are also at increased risk because they are so close to the source. In 2015, Contra Costa Health Services teamed up with BAAQMD to implement a pilot grant program for school districts and local jurisdictions to exchange old gas-powered lawn and garden equipment for new battery-powered equipment. Not only does the battery-powered equipment pollute less, but it is quieter, produces less vibration, and weighs less than gas-powered, backpack-style equipment. Since it is quieter, school districts are also able to use it during school hours. If this pilot is successful, funding could be sought to expand it to commercial landscaping businesses.

GHG Reduction Strategy

Measure LUT 4: Vehicle Miles Traveled Reduction

Reduce vehicle miles traveled.

Action Items:

1. Collaborate with BART and other transit providers to increase ridership in the county.
2. Partner with waste haulers and other fleets with regular routes to reduce the frequency of routes where possible.
3. Support and increase the use of carpooling services such as rideshare or casual carpool.
4. Continue to promote voluntary trip reduction programs such as school buses, Rideshare, Spare-the-Air Days, Bike to Work Day, employer shuttles, and alternative work schedules.
5. Work to increase densities within half a mile of BART and Amtrak stations, and within a quarter of a mile of stops for express bus routes.
6. Prioritize alternative mode access to BART and other transit stations.
7. Continue to explore funding transit with development applications and other alternative transportation finance methods.
8. Continue the County's policy of encouraging the establishment of Priority Economic Development Areas in residential communities.

MEASURE LUT 4

2020 GHG Reduction

4,080 MTCO₂e

2035 GHG Reduction

9,020 MTCO₂e

Responsible Department(s)

Conservation & Development

Co-Benefits

Improves Air Quality, Provides Educational Opportunities, Improves Mobility, Improves Community Livability, Improves Public Health

Public Health Priority Benefits

Increased Walking & Biking, Increased Public Transportation, Increased Infill Development, Health Equity

Measure LUT 5: Agricultural Land Uses

Provide opportunities to grow, sell, and purchase local food.

Action Items:

1. Continue to support local farmers markets, local community gardens, school gardens, and other urban agricultural practices, including in areas with poor food access.
2. Amend the Zoning Code to allow urban agriculture in appropriate areas.
3. Amend the General Plan to add a policy that encourages community gardens in new residential developments as appropriate.
4. Encourage partnerships between local food growers and local food retailers.
5. Encourage partnerships between local food growers and local institutions such as schools, hospitals, colleges, and correctional facilities.
6. Continue to discourage schools being sited in agricultural areas.
7. Encourage retention of agricultural land to maintain the County's agricultural base and enable long-term carbon sequestration.

MEASURE LUT 5

2020 GHG Reduction

Supportive of Overall GHG Reductions

2035 GHG Reduction

Supportive of Overall GHG Reductions

Responsible Department(s)

Agriculture, Conservation & Development, County Administrator's Office

Co-Benefits

Supports Local Economy, Provides Educational Opportunities, Improves Community Livability, Improves Public Health

Public Health Priority Benefits

Infill Development Potential, Health Equity

GHG Reduction Strategy

GOAL 4: SOLID WASTE

Reduce waste disposal.

Both the consumption and the disposal of resources require energy and emit GHGs. Most waste is sent to the landfill, decomposes, and emits methane gas over time. By providing additional opportunities to recycle and compost, the amount of waste disposed can be reduced, thereby reducing GHG emissions associated with waste disposal. Additionally, the impact of collecting and transporting waste from homes and businesses by waste fleet vehicles can be reduced through increased diversion and cleaner vehicle fleets. A reduction in emissions from refuse trucks and landfills in Contra Costa County may lead to a decrease in criteria air pollutants, thus increasing public health.

Reduction Measure W 1: Waste Reduction and Recycling

Develop a waste reduction strategy to increase recycling and reuse of materials.

Action Items:

1. Achieve a local 75% waste diversion rate, in support of the 2020 state target diversion rate of 75%, as identified in AB 341.
 - Establish new and enhanced programs to collect organic material from businesses and residents in order to recover their material, energy, and nutrient values.
2. Increase public outreach to promote participation in existing waste diversion and prevention programs.
 - Continue promoting and supporting proper backyard composting, grass-cycling, and low-maintenance gardening programs, and greater participation in other recycling and composting programs. Consider outreach campaigns targeted to low-income or non-English-speaking residents.
 - Continue participating in the Bay Area Regional Outreach Campaign by serving on the steering committee and contributing funding.
 - Continue to offer and promote the Environmental Action Program for Schools as a way to achieve waste prevention reduction and recycling in K–12 schools.
3. Work with private owners and operators of solid waste transfer stations and landfills, as well as with publicly owned wastewater treatment plants, to establish anaerobic digesters to treat and recover energy from food waste and other organic waste.
4. Update the County's Source Reduction and Recycling Element, Household Hazardous Waste Element, and other relevant components of the Countywide Integrated Waste Management Plan to include an updated list of measures, actions, and programs supportive of this CAP.
5. Identify best practices and reduce the amount of wastewater treatment sludge (biosolids) that is disposed of in landfills.

MEASURE W 1

2020 GHG Reduction

25,780 MTCO₂e

2035 GHG Reduction

37,780 MTCO₂e

Responsible Department(s)

Conservation & Development

Co-Benefits

Improves Air Quality, Provides Educational Opportunities, Conserves Resources

Public Health Priority Benefits

Health Equity

Measure W 2: Landfill Management

Reduce fugitive methane emissions and other greenhouse gas emissions from solid waste landfills.

Action Items:

1. Annually verify compliance with the California Air Resource Board's landfill methane control measures.
2. Request that landfill operators consider implementing additional reduction actions, including but not limited to:
 - Reducing landfilled materials with high methane-generation potential.
 - Reducing idling time for diesel equipment.
 - Encouraging adequate maintenance of rolling stock.
 - Establishing standards beyond those required by regulation for landfill gas collection system leak detection and prevention.
 - Excluding the use of green waste as a material for alternative daily cover (ADC), consistent with AB 1594.
3. Amend the General Plan and Zoning Code to allow renewable energy generation, such as solar and wind, on closed landfill areas. Market renewable energy on closed landfill areas to potential stakeholders (energy providers and landfill owners).

MEASURE W 2

2020 GHG Reduction

29,500 MTCO₂e

2035 GHG Reduction

41,650 MTCO₂e

Responsible Department(s)

Conservation & Development, Health Services

Co-Benefits

Improves Air Quality, Provides Educational Opportunities, Conserves Resources, Improves Public Health

Public Health Priority Benefits

Health Equity

GOAL 5: WATER CONSERVATION

Conserve Water

Water consumption requires energy to pump, treat, distribute, collect, and discharge water as it is used by the community, which results in GHG emissions. GHG emissions also occur as a direct process from wastewater treatment. Despite a fragmentation of water service providers throughout the unincorporated county, conservation and more efficient use of water are both important strategies to reducing GHG emissions from water use. Water reductions also prepare the County to adapt to the reduced water availability that may occur due to a changing climate.

This goal identifies opportunities to reduce energy-intensive water consumption from both new construction projects and existing development. Through the implementation of water efficiency measures and increased use of recycled water, the need to procure additional water sources in the future will be reduced. Climate change impacts, such as extreme drought conditions, are expected to impact low-income communities first. Conservation of water resources helps ensure sustained access for all members of the community.

Measure WE 1: Water Conservation

Reduce water demand.

1. Continue to reduce potable water use by at least 20% by 2020 through conservation efforts in new and existing development.
2. Continue to enforce water conservation requirements in new developments per the State Model Water Efficient Landscape Ordinance.

MEASURE WE 1

2020 GHG Reduction

1,210 MTCO₂e

2035 GHG Reduction

940 MTCO₂e

Responsible Department(s)

Conservation & Development

Co-Benefits

Conserves Energy, Reduces Water Use,
Provides Educational Opportunities,
Saves Money, Conserves Resources

Public Health Priority Benefits

None

GHG Reduction Strategy

#4

Measure WE 2: Alternative Water Supplies

Provide alternative water resources for irrigation in residential and nonresidential areas.

1. Promote rainwater collection for irrigation purposes.
2. Update the Dual Water Systems Ordinance to allow the use of recycled water for irrigation in residential and nonresidential areas.

MEASURE WE 2

2020 GHG Reduction

Supportive of Measure WE 1

2035 GHG Reduction

Supportive of Measure WE 1

Responsible Department(s)

Conservation & Development

Co-Benefits

Conserves Energy, Reduces Water Use,
Saves Money, Conserves Resources

Public Health Priority Benefits

None

GOAL 6: GOVERNMENT OPERATIONS

Conserve Resources

The 2007 Municipal Climate Action Plan illustrates the County's leadership in GHG reductions. The 2007 Municipal Climate Action Plan offered a suite of municipal strategies including existing measures, planned measures, and potential measures. Potential measures are similar to the types of measures in this CAP. The development of this CAP provides an opportunity for the County to add to its "potential measures" list. The Government Operations measures in this CAP should be seen as supportive of and in addition to the 2007 Municipal Climate Action Plan.

Measure GO 1: Government Operations – Public Lighting

Save energy used for public lighting.

Action Items:

1. Complete LED upgrade of traffic signals, street lighting, and other public lighting located in the unincorporated areas of the county.

MEASURE GO 1

2020 GHG Reduction

580

2035 GHG Reduction

450

Responsible Department(s)

Public Works

Co-Benefits

Conserves Energy, Saves Money

MEASURE GO 1 COMMUNITY BENEFITS

Streetlights: In 2015, Contra Costa County embarked on an endeavor to replace high-pressure sodium vapor streetlights with light-emitting diode (LED) lights. By the end of 2015, over 4,000 lights will have been replaced and resident feedback so far has been very positive. Light replacements have been done by PG&E under a PUC-approved program for PG&E-owned lights, and under an agreement with the County for a turnkey project for County-owned lights. (Work has been done in conjunction with PG&E's replacement of lights in the county's cities.) Once all replacements have been made throughout the unincorporated areas of the county, a total of 7,210 lights will have been replaced with LEDs. In addition to using 50-75% less energy, LEDs provide a more natural-looking and evenly distributed light, resulting in greater visibility for pedestrians and drivers. As an additional benefit, LED technology keeps most of its light output up to four times longer; the new lights are not expected to burn out for up to 20 years, keeping maintenance costs reduced. Using less energy per light reduces GHG emissions and helps the County reach its long-term energy goals.

County Facilities: The County has been introducing LED lighting to various County facilities, including office space and public access areas and building exteriors. Earlier this year, the County completed a project at the Contra Costa Regional Medical Center to convert more than 1,300 lights to LED. The project was funded 85% with rebate incentives, resulting in a reduced cost to the County to complete the project. This project will save the County in lighting and maintenance costs, and project excellent lighting to both staff and the public.

GHG Reduction Strategy

#4

Measure GO 2: Government Operations – Energy Efficiency

Promote energy-saving tools and practices.

Action Items:

1. Continue to conduct audits of existing and recently acquired facilities, prioritize improvements, and upgrade facilities to save energy.
2. Increase solar electricity use for County and agency operations.
3. Develop policies related to powering off lights and appliances after hours and after dark.
4. Site facilities that have more than 50 personnel in close proximity to infrastructure and services that support alternative commute modes.

MEASURE GO 2

2020 GHG Reduction

Supportive of Overall GHG Reductions

2035 GHG Reduction

Supportive of Overall GHG Reductions

Responsible Department(s)

County Administrator's Office, Public Works

Co-Benefits

Conserves Energy, Saves Money,
Improves Mobility

Public Health Priority Areas

Increased Walking & Biking, Increased
Public Transportation, Health Equity

MEASURE GO 2 COMMUNITY BENEFITS

The County is currently wrapping up six new solar sites at various County facilities as part of the Regional Renewable Energy Procurement (RREP) Project. This multi-agency project brought together 19 agencies to procure solar bids on projects throughout the various jurisdictions. This partnership produced excellent bids and the County purchased the solar equipment being installed. The systems will provide energy to various departments as well as carport shade structures to large portions of the areas where they have been installed. In addition, during the construction of the solar infrastructure, the County provided conduits to install EVSEs (electric vehicle supply equipment). The County is currently in the process of starting installation of EVSEs at several County sites.

GHG Reduction Strategy

Measure GO 3: Government Operations – Water Conservation

Conserve water.

Action Items:

1. Continue to install water-efficient landscaping on County properties.
2. Where possible, remove turf from County-owned facilities.

MEASURE GO 3

2020 GHG Reduction

Supportive of Overall GHG Reductions

2035 GHG Reduction

Supportive of Overall GHG Reductions

Responsible Department(s)

Public Works

Co-Benefits

Reduces Water Use, Provides Educational Opportunities, Saves Money

MEASURE GO 3 COMMUNITY BENEFITS

The County has embarked on an effort to reduce water use at its facilities and public landscape areas. In July 2015, the County completed a turf replacement project at the Pittsburg Health Center, converting a large portion of turf to drought-tolerant landscaping, including native plant materials. It is estimated that that County will save approximately 1 million gallons of water a year by this conversion, saving money in water costs and maintenance while also saving a valuable resource. This model is also being explored for use in other areas of the county.

In addition, the Public Works Department completed a Storm Water Treatment Demonstration Project in the County's Administration Building parking lot. Two treatment basins have been completed to treat stormwater runoff in the parking lot, thus reducing pollution and toxins. This project will provide an opportunity to research these kinds of facilities.

Measure GO 4: Government Operations – Waste Reduction

Reduce waste.

Action Items:

1. Develop a recycling and composting program for County facilities.
2. Educate and train staff to recycle and compost appropriately.
3. Develop interim waste diversion/reduction goals.
4. Achieve zero-waste operations by 2035.

MEASURE GO 4

2020 GHG Reduction

Supportive of Overall GHG Reductions

2035 GHG Reduction

Supportive of Overall GHG Reductions

Responsible Department(s)

Public Works

Co-Benefits

Provides Educational Opportunities, Conserves Resources,

Measure GO 5: Government Operations – CAP Implementation Support

Establish budgeting and administration practices to support the Climate Action Plan.

Action Items:

1. Ensure that the Environmental Purchasing Policy includes:
 - Green office supplies: Purchase energy-efficient appliances and recycled/recyclable and compostable supplies.
 - Green fleet and equipment: Evaluate progress of hybrid and compressed natural gas (CNG) fleet measures in the 2007 Municipal Climate Action Plan. Create purchase orders for replacing less efficient vehicles with fuel-efficient vehicles (e.g., hybrids, electric vehicles, and biofuel vehicles) and old office machines with energy-efficient machines.
2. Reduce County fleet use of traditional fuels 25% by the year 2020.
3. Evaluate progress of Measure 13 from the 2007 Municipal Climate Action Plan (30% of employees telecommuting two days a week). If the target has not been achieved, establish policies to further support telecommuting and flexible work hours for employees. If the target has been achieved, consider increasing the target to 40% employee participation.
4. Develop a process for sharing information on government operations' energy and water use and efficiency and conservation measures with the public as an educational tool.
5. Advocate for regional, state, and federal activities that support GHG emissions in the county, including but not limited to the following:
 - Work with BAAQMD to support reductions in process emissions from industrial entities.
 - Where appropriate, adopt language in the County's state and federal legislative platforms that directs support and lobbying for local GHG reductions.
 - Advocate for additional transit funding sources concurrently with the development of priority development areas.

MEASURE GO 5

2020 GHG Reduction

Supportive of Overall GHG Reductions

2035 GHG Reduction

Supportive of Overall GHG Reductions

Responsible Department(s)

County Administrator's Office, Public Works

Co-Benefits

Conserves Energy, Reduces Water Use, Provides Educational Opportunities, Improves Mobility, Improves Air Quality

Public Health Priority Areas:

Increased Walking & Biking, Increased Public Transportation, Health Equity

MEASURE GO 5 COMMUNITY BENEFITS

The County Fleet operations have implemented green fleet standards for some time, but the Public Works Department has recently been adding to these efforts. The County fleet consists of many fuel-efficient vehicles including hybrids, CNG, and electric vehicles. The County has recently purchased additional electric vehicles for use by various departments, identified EVSE locations, and embarked on installation of some of those sites. The County's Fleet Services Division has completed a poll of various department staff to help identify interest in electric vehicles and perceived impediments to their use.

GHG Reduction Strategy

GHG REDUCTION SUMMARY

This CAP identifies a clear path to allow the County to reach the community-wide GHG reduction target of 15% below baseline levels by 2020 to ensure the County can utilize the CAP as a Qualified GHG Reduction Strategy for use in environmental review of projects for new development.

The reduction measures included in this CAP are a diverse mix of regulatory and incentive-based programs for both new and existing development. The reduction measures also aim to reduce GHG emissions from each source to avoid reliance on any one strategy or sector to achieve the target. In total, existing actions, state programs, and GHG reduction measures in this CAP will reduce GHG emissions in the unincorporated areas of Contra Costa County by 86,300 MTCO₂e in 2020 (see **Table 4.2**).

Table 4.2. GHG Reduction Summary by Topic (MTCO₂e)

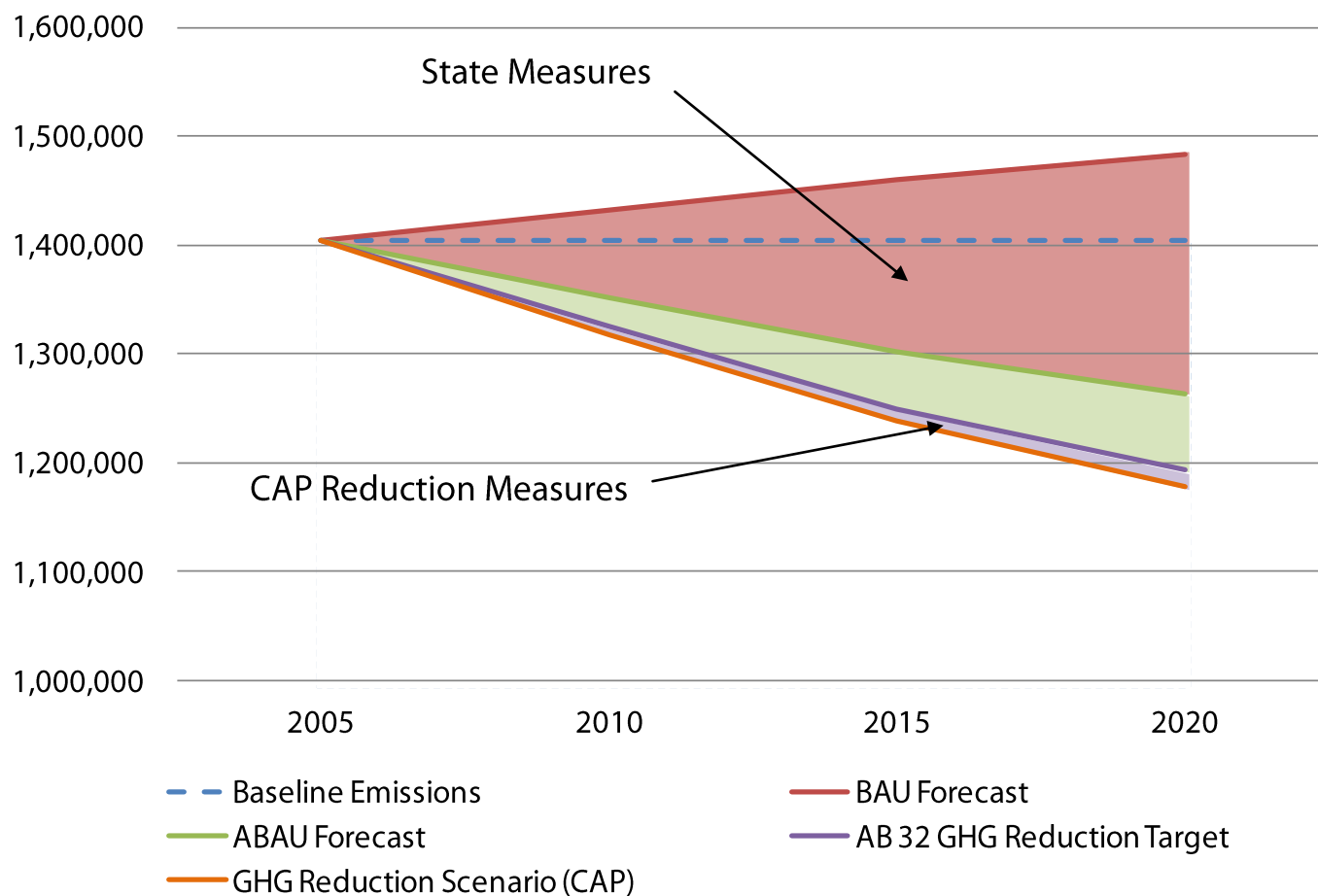
Topic	2020	2035
Energy Efficiency	7,510	14,000
Renewable Energy	9,090	15,470
Land Use and Transportation	12,630	23,380
Solid Waste	55,280	79,430
Water	1,210	940
Government Operations	580	450
Total	86,300	133,670

Complete implementation of this CAP will allow the County to achieve a 16% reduction of GHG emissions below 2005 levels by 2020 and will set the County on a trajectory to achieve the state GHG reduction target set by Executive Order S-3-05 of reducing GHG emissions 80% below 1990 levels by 2050. **Figure 4.3** illustrates the County's anticipated progress toward achieving the GHG reduction target of 15% below baseline through the implementation of this CAP.

GHG Reduction Strategy

#4

Figure 4.3. GHG Reduction Summary (MTCO₂e)



GHG Reduction Strategy

This page has been intentionally left blank.



This chapter outlines a path for the County to implement the Climate Action Plan (CAP) and reduce greenhouse gas (GHG) emissions at least 15% below 2005 baseline levels by 2020. Additionally, this chapter outlines the ways in which the County can incorporate the public health priority areas identified in Chapter 4 into implementation efforts. This ensures that public health benefits are considered during CAP implementation.

IMPLEMENTATION POLICIES

CAP implementation will require County leadership to execute these measures and report on the progress of their implementation. This CAP identifies the responsible department for each measure and offers time frames and cost estimates for implementing each strategy. To assist with implementation, a development checklist that verifies a project's consistency with the CAP is included in **Appendix E**. Lastly, successful implementation requires regular reporting. Staff will monitor the CAP's implementation progress on an annual basis and report to the Board of Supervisors on the progress made each year. The following policies are presented to ensure the County is successful in implementing the CAP.

GREENHOUSE GAS REDUCTION STRATEGIES

Implementation Measure 1: Monitoring

Annually monitor and report the County's progress toward achieving the greenhouse gas (GHG) reduction target.

Action Items:

Implementation Action 1.1. Facilitate implementation of measures and actions related to municipal operations.

Implementation Action 1.2. Prepare an annual implementation progress report for review and consideration by the Board of Supervisors with direction to:

Implementation

- Modify or strengthen actions if expected results aren't being achieved.
- Initiate CAP revisions, as necessary, to respond to significant changes to the regulatory framework (at the regional, state, or national level) or other unforeseen events that render the CAP ineffective or obsolete.

Implementation Action 1.3. Utilize the implementation matrix and reduction measure workbook to assist with annual reports.

Implementation Action 1.4. Identify key staff, such as members of the Climate Action Plan Interdepartmental Working Group, responsible for annual reporting and monitoring.

Implementation Measure 2: Update Greenhouse Gas Inventory and Climate Action Plan

Update the baseline GHG inventory and CAP at a minimum every five years.

Action Items:

Implementation Action 2.1. Inventory 2018 GHG emissions no later than 2020.

Implementation Action 2.2. Update the CAP no later than 2020 to incorporate new technology, programs, and policies to reduce GHG emissions.

Implementation Action 2.3. Consider updating and amending the CAP should the County find that specific reduction measures are not meeting intended GHG reductions.

Implementation Measure 3: Collaborative Partnerships

Continue to develop partnerships that support implementation of the CAP.

Action Items:

Implementation Action 3.1. Continue formal memberships and participation in local and regional organizations that provide tools and support for energy efficiency, energy conservation, GHG emissions reductions, adaptation, education, and implementation of this CAP.

Implementation Measure 4: Funding Sources

Secure necessary funding to implement the Climate Action Plan.

Action Items:

Implementation Action 4.1. Participate in cap-and-trade implementation to ensure that funds are returned to areas where GHG emissions are generated and used to fund projects and programs that benefit the communities impacted by emissions.

Implementation Action 4.2. Identify funding sources for reduction measures as part of annual reporting.

Implementation Action 4.3. As identified in Reduction Measure GO 5, ensure implementation through the inclusion of emissions reduction and adaptation measures in department budgets, the capital improvement program, and other plans as appropriate.

Implementation Action 4.4. Pursue local, regional, state, and federal grants as appropriate to support CAP implementation.

HEALTHY COMMUNITY STRATEGIES

To ensure climate change-related public health responses are adequately incorporated into future planning efforts, the following measures have been provided to guide County staff involvement in coordinating, preparing for, and educating the public on the potential impacts that climate change may have on community health.

Healthy Community Measure 1: Cap-and-Trade Funding

Promote health equity by applying Greenhouse Gas Reduction Fund (GGRF) grants and other sources of funding to vulnerable communities.

Action Items:

Healthy Community Action 1.1. Identify areas with a disproportionate health burden and, when appropriate, prioritize projects that would be eligible for and benefit from cap-and-trade and other grant funding.

Healthy Community Measure 2: Regional Coordination

Participate in regional efforts to analyze and prepare for the impacts of climate change in the Bay Area.

Action Items:

Healthy Community Action 2.1. Continue participation in regional adaptation and resiliency task forces such as those of the San Francisco Bay Area Conservation and Development Commission and the Bay Area Regional Collaborative (formerly Joint Policy Committee).

Healthy Community Action 2.2. Continue participation in regional meetings focusing on adaptation and resilience, and ensure that relevant information is conveyed to the Board of Supervisors and appropriate staff.

Healthy Community Measure 3: Preparedness

Ensure that Contra Costa County is prepared for potential environmental risks and hazards related to climate change, with a special emphasis on vulnerable populations.

Action Items:

Healthy Community Action 3.1. Explore preparing a climate adaptation plan or similar analysis to assess potential climate change impacts and identify responses.

Healthy Community Action 3.2. Update the 2016 County Local Multi-Hazard Mitigation Plan and other applicable documents such as long-range capital improvement plans to include climate change issues and best practices during required revisions/updates and as funding allows.

Healthy Community Action 3.3. Monitor climate change science and policy to inform implementation of the CAP.

Healthy Community Measure 4: Adaptation Integration

Consider potential climate change impacts in local planning documents and processes.

Action Items:

Healthy Community Action 4.1. During the development review process, consider possible impacts of climate change on the project or plan area.

Healthy Community Action 4.2. Consider integrating climate change adaptation into future updates of the Zoning Code, General Plan, and other related documents.

Healthy Community Measure 5: Public Health

Update or expand County planning tools to support implementation of measures that address public health issues.

Action Items:

Healthy Community Action 5.1. Expand vulnerability assessments of the public health infrastructure, facilities, and services to evaluate needs given anticipated changes to the climate.

Healthy Community Action 5.2. Continue Contra Costa Health Services efforts to create a geographic database identifying areas that are vulnerable to health impacts associated with climate change, with emphasis on health equity.

Healthy Community Measure 6: Community Engagement

Engage the community in preparing for climate change through distribution of information and promotion of Climate Action Plan measures.

Action Items:

Healthy Community Action 6.1. Explore utilizing the County's website and local media channel to:

- Provide information on climate change and promote GHG reduction and energy efficiency programs.
- Allow the public to follow implementation of the CAP.
- Provide media communication that is linguistically and culturally appropriate to vulnerable populations.

Healthy Community Action 6.2. Promote sustainability education in schools through green competitions that encourage recycling, walking, and biking.

Healthy Community Action 6.3. Target outreach to areas projected to be most impacted by climate change.

Healthy Community Action 6.4. Expand partnerships with community-based organizations to implement GHG reduction and climate change adaptation programs.

Healthy Community Measure 7: Health Equity

Ensure that actions to address climate change are equitably applied throughout the county and take special care to protect vulnerable populations.

Action Items:

Healthy Community Action 7.1. Incorporate the needs of vulnerable populations in the design and implementation of projects and programs addressing climate change. Vulnerable populations include the following:

- Low-income households
- Seniors
- People with disabilities
- Linguistically, culturally, or historically disadvantaged groups
- Communities exposed to unsafe conditions as exhibited by high crime, accident, and hospitalization rates
- Residents with limited access to vehicles
- Communities exposed to climate change impacts as identified in a vulnerability assessment

Healthy Community Action 7.2. Work to minimize possible negative health impacts from implementation of the CAP. For examples, bicycle and pedestrian safety must be optimized when designing and installing bicycle and pedestrian improvements, and indoor air-quality impacts should be minimized when locating housing near comparatively high vehicle emissions (e.g., transportation corridors and facilities).

Healthy Community Action 7.3. Employ culturally appropriate, multilingual training and communication tools to support participation by low-income and historically disadvantaged communities.

Healthy Community Action 7.4. As healthy community strategies are implemented, consider prioritizing projects and programs that conserve and/or construct green spaces.

Healthy Community Action 7.5. Work to minimize potential neighborhood destabilization and displacement resulting from infill development.

Implementation

IMPLEMENTATION MATRIX

This matrix contains the information regarding GHG reduction, performance target, implementation time frame, and the responsible and supporting agencies for the year 2020. This matrix allows County staff to effectively integrate these actions into budgets, other programs, and projects. The County will use the implementation matrix to track, monitor, and update the CAP. As the County reports on progress in implementing the CAP, staff will evaluate the effectiveness of each measure to ensure that the anticipated GHG reductions are occurring. In the event that GHG reductions do not occur as expected, the County will be able to modify and add policies to the CAP.

Policy Language		2020 GHG Reductions (MTCO ₂ e)	2020 Performance Targets		Implementation Time Frame	Responsible Agencies
EE 1	Provide opportunities for residential buildings to become more energy efficient.	2,140	3,000	Single-family homes receiving basic retrofits	Mid-Term (by 2020)	Conservation & Development
			210	Single-family homes receiving advanced retrofits		
			700	Multi-family homes receiving retrofits		
			150	Single-family homes receiving pool pump upgrades		
			2,010	Homes receiving appliance upgrades		
EE 2	Provide opportunities for nonresidential buildings to become more energy efficient.	4,630	240	Businesses receiving retrocommissioning	Mid-Term (by 2020)	Conservation & Development
			120	Businesses receiving standard retrofits		
			30	Businesses receiving deep retrofits		

Implementation

#5

Policy Language		2020 GHG Reductions (MTCO ₂ e)	2020 Performance Targets		Implementation Time Frame	Responsible Agencies
			300	Businesses receiving appliance upgrades		
EE 3	Provide education and outreach highlighting the benefits of energy conservation.	430	2,900	Participating homes	Near-Term (by 2018)	Conservation & Development, Health Services
			60	Participating businesses		
EE 4	Reduce urban heat islands through vegetation management and cool surfaces.	20	1,790	Existing homes completing cool roof retrofits	Near-Term (by 2018)	Conservation & Development, Public Works
			9	Existing businesses completing cool roof retrofits		
			500	New shade trees		
EE 5	Increase Contra Costa County's capacity for energy efficiency through financing opportunities and workforce training.	Supportive of Overall GHG Reductions	Supportive	n/a	Mid-Term (by 2020)	Conservation & Development, Health Services, Public Works; additional departments, depending on grant resources

Implementation

Policy Language		2020 GHG Reductions (MTCO ₂ e)	2020 Performance Targets		Implementation Time Frame	Responsible Agencies
EE 6	Support the statewide transition to net zero energy construction for new residential buildings by 2020 and new nonresidential buildings by 2030.	290	30	New ZNE homes	Mid-Term (by 2020)	Conservation & Development, Public Works
			3	New ZNE businesses		
			12	Retrofitted ZNE homes		
			1	Retrofitted ZNE businesses		
RE 1	Promote installation of alternative energy facilities on homes and businesses.	8,820	50	New homes with solar arrays	Mid-Term (by 2020)	Conservation & Development
			2,500	Existing homes with solar arrays		
			10	New businesses with solar arrays		
			60	Existing businesses with solar arrays		
			3,740	kW supplied by PG&E Green Tariff program		
RE 2	Promote installation of alternative energy facilities on public land.	270	1	MW of solar installed at public facilities in the unincorporated area	Near-Term (by 2018)	Conservation & Development, Public Works
RE 3	Lower barriers to entry for the installation of alternative energy systems.	Supportive of Overall GHG Reductions	Supportive	n/a	Mid-Term (by 2020)	Conservation & Development

Implementation

#5

Policy Language		2020 GHG Reductions (MTCO ₂ e)	2020 Performance Targets		Implementation Time Frame	Responsible Agencies
LUT 1	Maintain and expand access to goods, services, and other destinations through increased transportation alternatives (mobility improvements) and improved proximity (land use improvements).	910	33,630	Average countywide bike trips per weekday	Mid-Term (by 2020)	Conservation & Development, Health Services, Public Works
LUT 2	Expand the use of alternative fuels in vehicle travel.	7,630	4,700	Annual VMT per public charging station	Mid-Term (by 2020)	Conservation & Development, Public Works; additional departments, depending on grant resources
			14,220	VMT per EV		
			4,830	Electricity use per EV		
			1,790	Households with an EV		
LUT 3	Reduce emissions from off-road vehicles and equipment.	10	50	Lawnmowers traded in	Near-Term (by 2018)	Agriculture, Conservation & Development
LUT 4	Reduce vehicle miles traveled.	4,080	54,400	BART extension trips taken by unincorporated County residents	Long-Term (by 2035)	Conservation & Development
			32,740,820	New bus ridership miles taken by unincorporated county residents		
			1,202,980	New BART ridership miles taken by unincorporated county residents		
			1,170,070	Estimated decrease in VMT from HOV lanes		

Implementation

Policy Language		2020 GHG Reductions (MTCO ₂ e)	2020 Performance Targets		Implementation Time Frame	Responsible Agencies
LUT 5	Provide opportunities to grow, sell, and purchase local food.	Supportive of Overall GHG Reductions	Supportive	n/a	Mid-Term (by 2020)	Agriculture, Conservation & Development, County Administrator's Office
W 1	Develop a waste reduction strategy to increase recycling and reuse of materials.	25,780	90,850	Tons of waste reduced	Mid-Term (by 2020)	Conservation & Development
W 2	Reduce fugitive methane emissions and other greenhouse gas emissions from solid waste landfills.	29,500	29,500	Increase in captured landfilled gas (MTCO ₂ e)	Mid-Term (by 2020)	Conservation & Development, Health Services
WE 1	Reduce water demand.	1,210	20%	Reduction from 2013 water use	Mid-Term (by 2020)	Conservation & Development
WE 2	Provide alternative water resources for irrigation in residential and nonresidential areas.	Supportive of Measure WE 1	Supportive	n/a	Mid-Term (by 2020)	Conservation & Development
GO 1	Save energy used for public lighting.	580	7,210	Number of lightbulbs replaced with LED bulbs	Near-Term (by 2018)	Public Works
GO 2	Promote energy-saving tools and practices.	Supportive of Overall GHG Reductions	Supportive	n/a	Mid-Term (by 2020)	County Administrator's Office, Public Works
GO 3	Conserve water.	Supportive of Overall GHG Reductions	Supportive	n/a	Near-Term (by 2018)	Public Works

Implementation

#5

Policy Language		2020 GHG Reductions (MTCO ₂ e)	2020 Performance Targets		Implementation Time Frame	Responsible Agencies
GO 4	Reduce waste.	Supportive of Overall GHG Reductions	Supportive	n/a	Long-Term (by 2035)	Public Works
GO 5	Establish budgeting and administration practices to support the Climate Action Plan.	Supportive of Overall GHG Reductions	Supportive	n/a	Mid-Term (by 2020)	County Administrator's Office, Public Works

Glossary



Adjusted Business-as-Usual: A projection that includes expected reductions from state regulations and programs in the greenhouse gas emissions forecast.

Air Basin: A land area with generally similar meteorological and geographic conditions throughout. To the extent possible, air basin boundaries are defined by the California Air Resources Board along political boundary lines and include both the source and receptor areas. California is currently divided into 15 air basins. Contra Costa County is in the San Francisco Bay Area Air Basin.

Air Pollutants: Amounts of foreign and/or natural substances occurring in the atmosphere that may result in adverse effects to humans, animals, vegetation, and/or materials.

Alternative Energy: See “Renewable Energy.”

Assembly Bill (AB) 32, California Global Warming Solutions Act of 2006: Establishes a comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of greenhouse gases for the state of California. AB 32 designates the California Air Resources Board as the responsible agency for monitoring and reducing statewide greenhouse gas emissions to reduce emissions to 1990 levels by 2020. AB 32 requires the California Air Resources Board to develop a Scoping Plan that describes the approach California will take to reduce greenhouse gases (GHG) to achieve the goal of reducing emissions to 1990 levels by 2020. The Scoping Plan was first considered by the California Air Resources Board in 2008 and must be updated every five years. The California Air Resources Board approved the First Update to the Climate Change Scoping Plan on May 22, 2014.

Association of Bay Area Governments (ABAG): The regional planning agency for the nine counties and 101 incorporated cities in the San Francisco Bay Area.

Build-out: Development of land to its full potential or theoretical capacity as permitted under current or proposed planning or zoning designations.

Glossary

Business-as-Usual (BAU): A business-as-usual projection forecasts greenhouse gas emissions without regulatory or technical intervention to reduce greenhouse gas emissions.

California Air Resources Board: A division of the California Environmental Protection Agency charged with protecting public health, welfare, and ecological resources through the reduction of air pollutants.

California Environmental Quality Act (CEQA): A state law requiring state and local agencies to regulate activities with consideration for environmental protection. If a proposed activity has the potential for a significant adverse environmental impact, an environmental impact report (EIR) must be prepared and certified as to its adequacy before action can be taken on the proposed project. General plans require the preparation of a program EIR.

California Green Building Standards Code (CALGreen): The 2013 California Green Building Standards Code, commonly referred to as the CALGreen code, is a statewide mandatory construction code that was developed and adopted by the California Building Standards Commission and the Department of Housing and Community Development. The CALGreen standards require new residential and commercial buildings to comply with mandatory measures under the topics of planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental quality. CALGreen also provides voluntary tiers and measures that local governments may adopt that encourage or require additional measures in the five green building topics.

California Solar Initiative: Allows the California Public Utilities Commission to provide incentives to install solar technology on existing residential, commercial, nonprofit, and governmental buildings if they are customers of the state's investor-owned utilities.

Cap and Trade: Refers to a market based regulation that is designed to reduce greenhouse gases (GHGs) from multiple sources. Cap-and-trade sets a firm limit or cap on GHGs and minimize the compliance costs of achieving AB 32 goals.

Carbon Dioxide (CO₂): A colorless, odorless gas that occurs naturally in the earth's atmosphere. Significant quantities are also emitted into the air by fossil fuel combustion.

Carbon Dioxide Equivalent (CO₂e): A metric measure used to compare the emissions from various greenhouse gases based on their global warming potential (GWP). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP.

Carbon Sequestration: The process through which agricultural and forestry practices remove carbon dioxide (CO₂) from the atmosphere. The term "carbon sinks" is also used to describe agricultural and forestry lands that absorb CO₂.

Car Sharing: A type of car rental where people rent cars for short periods of time, often by the hour.

Glossary

Clean Air Act: Requires the US Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards for six common air pollutants, known as "criteria pollutants," that are found all over the United States: particle pollution (particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. The EPA regulates the pollutants by developing human health-based and/or environmentally based criteria (science-based guidelines) for setting permissible levels.

Clean Car Fuel Standards (AB 1493, Pavley): Signed into law in 2002 and commonly referred to as Pavley standards. Requires carmakers to reduce greenhouse gas emissions from new passenger cars and light trucks beginning in 2011. The California Air Resources Board anticipates that the Pavley standards will reduce greenhouse gas emissions from new California passenger vehicles by about 22% in 2012 and about 30% in 2016, all while improving fuel efficiency and reducing motorists' costs.

Climate Action Plan: Strategic plans that establish policies and programs for reducing (or mitigating) a community's greenhouse gas emissions and adapting to the impacts of climate change.

Climate Change (also referred to as global climate change): The term "climate change" is sometimes used to refer to all forms of climatic inconsistency, but because the earth's climate is never static, the term is more properly used to imply a significant change from one climatic condition to another. In some cases, climate change has been used synonymously with the term "global warming"; scientists, however, tend to use the term in the wider sense to also include natural changes in climate.

Climate Change Adaptation: The adjustment in natural or human systems to respond to actual or expected climate changes to minimize harm or take advantage of beneficial opportunities.

Climate Change Mitigation: A technical or behavioral intervention to reduce the sources of greenhouse gas emissions in order to reduce the potential effects of climate change.

Climate Zone: The California Energy Commission (CEC) has classified the distinct climates throughout California by climate zone to recognize the variability in energy use based on local weather patterns. The CEC uses these climate zones to determine energy budgets for new and renovated buildings and prescriptive packages for each climate zone to ensure that it meets the state's Title 24 energy efficiency standards.

Co-Benefits: An additional benefit occurring from the implementation of a greenhouse gas reduction measure that is not directly related to reducing greenhouse gas emissions.

Community Choice Aggregation (CCA): CCA allows communities or groups of communities to procure electricity for customers within their boundaries, often with the intention of providing a higher percentage of power from renewable sources. This provides an option for customers to purchase energy from the CCA rather than their existing utility. The existing utility is still responsible and able to charge for utility services, including delivering energy, maintaining the grid, and billing customers.

Glossary

Complete Streets: Complete streets policies ensure that transportation planners and engineers consistently design and operate the entire roadway with all potential users in mind. This includes private vehicles, bicyclists, public transportation vehicles and riders, and pedestrians of all ages and abilities. In 2007, the state of California adopted AB 1358, which directs the legislative body of a city or county, upon revision of the circulation element of its general plan, to identify how the jurisdiction will provide for the routine accommodation of all users.

Compressed Natural Gas (CNG): A fossil fuel substitute for gasoline, diesel, or propane that can be used in passenger and heavy-duty vehicles.

Conservation: Planned management of a natural resource to prevent exploitation, destruction, or neglect.

Construction and Demolition Waste (C&D): C&D materials consist of the waste generated during the construction, demolition, or renovation of buildings, roads, and other construction projects. C&D materials may include heavy, bulky materials such as concrete, glass, wood, and metal, among other materials.

Criteria Air Pollutant: The Clean Air Act requires the Environmental Protection Agency to set National Ambient Air Quality Standards for six common air pollutants, commonly referred to as “criteria air pollutants”. The criteria air pollutants are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. **Disadvantaged Communities:** For the purposes of cap and trade funding, “disadvantaged communities” refers to communities disproportionately burdened by and vulnerable to multiple sources of pollution. Disadvantaged communities in California are specifically targeted for investment of proceeds from the State’s cap-and-trade program. These investments are aimed at improving public health, quality of life and economic opportunity in California’s most burdened communities at the same time they’re reducing pollution that causes climate change.

Distributed Energy Resources (DER): Small, modular, energy generation and storage technologies that provide electric capacity or energy located where it’s needed. DERs typically produce fewer than 10 megawatts of power and include wind turbines, photovoltaic, fuel cells, micro turbines, reciprocating engines, combustion turbines, cogeneration, and energy storage systems. DER systems may be either connected to the local electric power grid or isolated from the grid in stand-alone applications.

Emissions Standard: The maximum amount of pollutant legally permitted to be discharged from a single source, either mobile or stationary.

Energy Conservation: Reducing energy waste, such as turning off lights, heating, and motors when not needed.

Energy Efficiency: Doing the same or more work with less energy, such as replacing incandescent lightbulbs with compact fluorescent light bulbs or buying an Energy Star appliance to use less energy for the same or greater output.

Energy Efficiency and Conservation Block Grant (EECBG): The EECBG program was funded through the American Recovery and Reinvestment Act and is managed by the US Department of Energy to assist cities, counties, states, and territories to develop, promote, and implement energy efficiency and conservation programs and projects.

Glossary

Energy Efficiency Standards (Title 24, Part 6): Title 24 standards were first adopted in 1978 and established minimum energy efficiency standards for residential and nonresidential buildings. These standards are updated continually by providing more stringent energy budgets for new buildings in an effort to reduce California's energy consumption.

Environment: In the California Environmental Quality Act, "the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, mineral, flora, fauna, noise, and objects of historic or aesthetic significance."

Environmental Impact Report (EIR): A report required by the California Environmental Quality Act that assesses all the environmental characteristics of an area and determines what effects or impacts will result if the area is altered or disturbed by a proposed action or project. See California Environmental Quality Act.

Environmentally Preferable Purchasing (EPP): California law requires state government to practice environmentally preferable purchasing, which is the procurement of goods and services that have a reduced impact on human health and the environment as compared to other goods and services serving the same purpose.

Feasible: Capable of being accomplished in a successful manner within a reasonable time taking into account economic, environmental, social, and technological factors.

Feed-In Tariff: A market mechanism designed to encourage the installation of renewable energy by setting a fixed rate for excess energy generated through local renewable energy systems and fed back into the grid for distribution and other uses.

Fossil Fuel Facilities: Include, but are not limited to, oil and gas wells, separators, and petroleum refineries.

Global Warming Potential (GWP): An index used to translate the level of emissions of various gases into a common measure in order to compare the relative potency of different gases without directly calculating the changes in atmospheric concentrations. Greenhouse gases are expressed in terms of carbon dioxide equivalent. GWPs are expressed in terms relative to carbon dioxide, which has a GWP of 1.

Green Building: Sustainable or "green" building is a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community. See the California Green Building Standards Code for green building regulations in California.

Greenhouse Gas/Gases (GHGs): Gases which cause heat to be trapped in the atmosphere, warming the earth. GHGs are necessary to keep the earth warm, but increasing concentrations of these gases are implicated in global climate change. Greenhouse gases include all of the following: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The majority of greenhouse gases come from natural sources, although human activity is also a major contributor.

Greenhouse Gas Inventory: A greenhouse gas (GHG) inventory provides estimates of the amount of GHGs emitted to and removed from the atmosphere by human activities. A city or county that conducts an inventory looks at both

Glossary

community emissions sources and emissions from government operations. A base year is chosen and used to gather all data from that year. Inventories include data collection from such things as vehicle miles traveled, energy usage from electricity and gas, and waste. Inventories include estimates for carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulfur hexafluoride (SF₆), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Green Tariff: A program provided by PG&E that allows customers to pay a monthly premium to receive 50% to 100% renewable energy.

Green Waste: Refers to lawn, garden, or park plant trimmings and materials and can be used in home composters or picked up curbside by municipal waste haulers.

Greywater: Wastewater collected from showers, bathtubs, bathroom sinks, and clothes washing machines that is reused on site for irrigation purposes.

Indicator: Types of data or information that can be used to determine the progress or success of each reduction measure.

Infill Development: Refers to development occurring in unused and underutilized lands within existing development patterns, typically but not exclusively in urban areas.

Investor Owned Utility: Refers to private electricity and natural gas providers. The California Public Utilities Commission has broad constitutional and statutory powers to regulate investor owned utilities. **LEED:** Leadership in Energy and Environmental Design, a standard established by the US Green Building Council.

Life-Cycle Costing (LCC): The process of evaluating the total overall costs and benefits of buildings or equipment over time, including initial costs of design and construction; operating costs; long-term costs of maintenance, repair, and replacement; and other environmental or social costs over its full life, rather than simply based on purchase cost alone.

Light-Emitting Diode (LED): A lower-energy consuming and longer-lasting alternative to incandescent and compact fluorescent lightbulbs.

Low Carbon Fuel Standard (S-1-07): An executive order from former Governor Schwarzenegger, the Low Carbon Fuel Standard established the goal of reducing the carbon intensity of transportation fuels in California by 10% by 2020.

Low Impact Development (LID): An innovative stormwater management approach with a basic principle to design the built environment to remain a functioning part of an ecosystem rather than exist apart from it. LID's goal is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source.

Metropolitan Planning Organization (MPO): A federally funded transportation planning organization comprising representatives from local government agencies and transportation authorities. See Association of Bay Area Governments for more information on the local MPO.

Glossary

Mixed Use: Properties on which various uses such as office, commercial, institutional, and residential are combined in a single building or on a single site in an integrated development project with significant functional interrelationships and a coherent physical design. A single site may include contiguous properties.

National Ambient Air Quality Standards: The prescribed level of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified geographical area.

Native Species: A species within its natural range or natural zone of dispersal, i.e., within the range it would or could occupy without direct or indirect introduction and/or care by humans.

Neighborhood Electric Vehicle (NEV): Small, battery-powered, low-speed electric vehicles. NEVs are typically limited to streets with a posted speed limit of 25 mph or less. NEVs are classified by the California Air Resources Board as zero-emissions vehicles, as they do not produce any tailpipe emissions.

Nonattainment: The condition of not achieving a desired or required level of performance. Frequently used in reference to air quality.

Nonrenewable Energy: Energy from sources that use a nonrenewable natural resource such as uranium or fossil fuels such as coal, oil, or natural gas.

Operations and Maintenance: Refers to the activities related to the routine, preventive, predictive, scheduled, and unscheduled actions aimed at preventing equipment failure or decline with the goal of increasing efficiency, reliability, and safety.

Ordinance: A law or regulation set forth and adopted by a governmental authority, usually a city or county.

Ozone: Produced when gases or vapors created by cars, solvents, factories, and pesticides mix and react in the presence of sunlight. This results in certain health effects such as breathing difficulties, lung damage, coughing, and chest pains.

Particulate Matter (PM₁₀) and Fine Particulate Matter (PM_{2.5}): Fine mineral, metal, smoke, soot, and dust particles suspended in the air. In addition to reducing visibility, particulate matter can lodge in the lungs and cause serious, long-term respiratory illness and other health problems. The smaller the size of the particle, the deeper it can penetrate into the lungs and the more difficult it is to expel.

Preservation: To keep safe from injury, harm, or destruction.

Property Assessed Clean Energy (PACE): Refers to a financing method of providing loans to property owners to finance permanent energy efficiency improvements on real property. A property owner who obtains a PACE loan repays the loan by entering into an agreement that allows an assessment to be levied on the property. These assessments are known as voluntary contractual assessments.

Glossary

Recycled Water: Wastewater from tubs, toilets, and sinks inside homes and offices that is cleaned through a treatment process, producing nonpotable water that is safe for landscapes, raw vegetable crops, and agricultural crops.

Reduction Measure: A goal, strategy, program, or set of actions that target and reduce a specific source of greenhouse gas emissions.

Regional Transportation Plan (RTP): A long-term blueprint of the region's transportation systems. The RTP is a federally mandated comprehensive long-range regional planning document that identifies the region's transportation needs, sets forth an action plan of projects, determines actions and programs to address the needs and issues, and documents the financial resources needed to implement the RTP.

Renewable Energy: Energy from sources that regenerate and are less damaging to the environment, such as solar, wind, biomass, and small-scale hydroelectric power.

Renewables Portfolio Standard: A regulation requiring utility companies in California to increase the production of renewable energy from solar, wind, or biomass, or geothermal sources.

Safe Routes to School (SR2S or SRTS): A national movement aimed at providing safe environments to encourage walking and bicycling surrounding local schools through engineering, enforcement, education, encouragement, and evaluation. Safe Routes to School programs are typically funded through federal, state, and local grants. SR2S is the California program; SRTS is the national program.

Safeguarding California Plan: Summarizes the best-known science on climate change impacts to California and provides recommendations on how to manage the risks. This plan is an update to the 2009 California Climate Adaptation Strategy.

Senate Bill (SB) X7-7: Passed in 2009, SB X7-7 requires the state to achieve a 20% reduction in per capita water use by 2020. This law also requires local water providers to set an interim 2015 and a final 2020 community-wide target and demonstrate that projected water use is in compliance with that target; otherwise funding will be affected.

Senate Bill (SB) 97: Requires lead agencies to analyze greenhouse gas emissions and climate change impacts under the California Environmental Quality Act.

Senate Bill (SB) 375: Directs the metropolitan planning organizations in California to create a Sustainable Communities Strategy (SCS) as part of the Regional Transportation Plan. The SCS will demonstrate how the region will achieve the 2020 and 2035 greenhouse gas reduction targets for the region set by the California Air Resources Board.

Senate Bill (SB) 407: Adopted in 2010, SB 407 requires inefficient indoor plumbing fixtures be replaced with more efficient models by 2014. Starting in 2017 for single-family property sales and 2019 for multi-family sales, the seller must disclose inefficient indoor plumbing fixtures at the time of sale.

Glossary

Senate Bill (SB) 610 (Chaptered at Water Code 10910): Requires proposed projects subject to the California Environmental Quality Act to include a water supply assessment that proves adequate water exists for the project.

Senate Bill (SB) 1016: Adopted in 2008, SB 1016 establishes per capita waste disposal rate requirements and goals for local agencies in California. The requirements are expressed in a pounds-per-person-per-day measurement.

Smart Grid: The smart grid delivers electricity from suppliers to consumers using two-way digital communications. The smart grid is envisioned to overlay the ordinary electrical grid with an information and net metering system, which includes smart meters. Smart meters will allow consumers to become more aware of their energy use and in the future will allow smart grid-enabled appliances to be preprogrammed to operate at a time when electricity costs are lowest.

Stationary Sources: Nonmoving sources, fixed-site producers of pollution such as power plants, chemical plants, oil refineries, manufacturing facilities, and other industrial facilities.

Sustainability: Community use of natural resources in a way that does not jeopardize the ability of future generations to live and prosper.

Sustainable Communities Strategy (SCS): The land use element of each metropolitan planning organization's Regional Transportation Plan as required by Senate Bill 375. The SCS will demonstrate how the region will achieve the 2020 and 2035 vehicle miles traveled and greenhouse gas reduction targets for the region set by the California Air Resources Board.

Sustainable Development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Transit-Oriented Development (TOD): A mixed-use residential or commercial area designed to maximize access to transit options.

Transportation Demand Management (TDM) Plan: A voluntary or mandatory program developed by local agencies, large employers, or high-traffic commercial services to limit the amount of congestion and pollution related to transportation demand. TDM plans may include incentives, regulations, and education about transportation alternatives.

Urban Heat Island: The term "heat island" describes built-up areas that are hotter than nearby rural areas. On a hot, sunny summer day, roof and pavement surface temperatures can be 50–90°F (27–50°C) hotter than the air, while shaded or moist surfaces remain close to air temperatures. These surface urban heat islands, particularly during the summer, have multiple impacts and contribute to atmospheric urban heat islands. Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.

Glossary

Vehicle Miles Traveled (VMT): A key measure of overall street and highway use. Reducing VMT is often a major objective in efforts to reduce vehicular congestion and achieve regional air quality goals.

Volatile Organic Compounds (VOC): A variety of chemicals with both short- and long-term adverse health effects. VOCs are emitted as gases from a wide array of products such as paints, lacquers, cleaning supplies, markers, and office equipment and furnishings.

Vulnerable Populations: There are three primary segments of vulnerable populations: those at risk to adverse climate change impacts due to exposure, sensitivity, or adaptive capacity.

Exposure: Physical conditions may put particular populations at risk to the impacts of climate change. For instance, populations living in low-lying or coastal areas may be more exposed to flooding events and sea level rise, while those who work outside may suffer from health-related issues due to increased temperatures and decreased air quality.

Sensitivity: Certain populations, including young children and those over the age of 65, are physiologically more sensitive to extreme temperatures and increased instances of air pollution.

Adaptive Capacity: The adaptive capacity of lower-income and institutionalized populations can be limited due to lower access to the resources necessary to prepare for or react to the long-term impacts of climate change and the increased frequency of disasters.

Water Conservation: Reducing water use, such as by turning off taps, shortening shower times, and reducing outdoor irrigation demand.

Water-Efficient Landscape: Native or low-water-using landscapes. Water-efficient landscapes are required by law in all cities and counties in California to conserve water.

Water Use Efficiency: Replacing older technologies and practices in order to accomplish the same results with less water, for example, by replacing toilets with new high efficiency models and by installing “smart controllers” in irrigated areas.

Zero-Emissions Vehicle (ZEV): A vehicle that does not emit any tailpipe emissions from the on-board source of power. Both electric and hydrogen fuel cell vehicles are classified as ZEVs.

Zero Net Energy (ZNE): A ZNE building has a ZNE consumption, meaning that the energy the building uses each year is equal to the amount of renewable energy that the building generates. In 2007, the California Public Utilities Commission adopted the goals that all new residential construction in California will be zero net energy by 2020, and all new commercial construction in California will be zero net energy by 2030.

Works Cited



- ABAG (Association of Bay Area Governments). 2015. *Priority Development Area Showcase*. <http://gis.abag.ca.gov/website/PDAShowcase/#>
- American Public Health Association. 2011. *Climate Change: Mastering the Public Health Role*. http://www.apha-environment.org/pdf/APHA_ClimateChg_guidebook.pdf.
- BAAQMD (Bay Area Air Quality Management District). 2010a. California Environmental Quality Act Air Quality Guidelines. San Francisco: BAAQMD.
- . 2010b. *The Bay Area 2010 Clean Air Plan*. <http://www.baaqmd.gov/Divisions/Planning-and-Research/Plans/Clean-Air-Plans.aspx>.
- . 2010c. Source Inventory of Bay Area Greenhouse Gas Emissions. <http://gismap.ccmmap.us/imf/imf.jsp?site=ccmap>.
- Besser, Lilah and Andrew Dannenberg. 2005. "Walking to Public Transit: Steps to Help Meet Physical Activity Recommendations." *American Journal of Preventative Medicine*. 29(4): 273-280.
- Butrick, Elizabeth. 1999. "Factors in Nonattendance in Extended Evening Clinics in Contra Costa County." Unpublished internal CCHS paper.
- California Climate Action Team. 2009. Biennial Report. <http://www.energy.ca.gov/2009publications/CAT-1000-2009-003/CAT-1000-2009-003-D.pdf>.
- California Natural Resources Agency. 2009. California Climate Adaptation Strategy. Sacramento.
- Cal-Adapt. 2015. <http://www.cal-adapt.org>.

Works Cited

- CalRecycle. 2011. Disposal Reporting System. <http://www.calrecycle.ca.gov/LGCentral/Reports/DRS/>.
- CARB (California Air Resources Board). 2009. California's 1990–2004 Greenhouse Gas Emissions Inventory and 1990 Emissions Level Technical Support Document. http://www.arb.ca.gov/cc/inventory/doc/methods_v1/ghg_inventory_technical_support_document.pdf.
- . 2010a. Assembly Bill 32: Global Warming Solutions Act. <http://www.arb.ca.gov/cc/ab32/ab32.htm>.
- . 2010b. Clean Car Standards—Pavley, Assembly Bill 1493. <http://www.arb.ca.gov/cc/ccms/ccms.htm>.
- . 2010c. Pavley I and Low Carbon Fuel Standard Postprocessor Version 1.0. <http://www.arb.ca.gov/cc/sb375/tools/postprocessor.htm>.
- . 2010d. ARB Landfill Emissions Tool. <http://www.arb.ca.gov/cc/protocols/localgov.htm>.
- . 2010e. Local Government Operations Protocol Version 1.1. http://www.arb.ca.gov/cc/protocols/localgov/pubs/lgo_protocol_v1_1_2010-05-03.pdf.
- CCHS (Contra Costa Health Services). 2008. *Health Disparities in Contra Costa*. http://cchealth.org/groups/rhdi/pdf/health_disparities_in_cc.pdf
- . 2010. Fatal and Non-Fatal Unintentional Injury. http://cchealth.org/health-data/hospital-council/2010/pdf/40_fatal_and_nonfatal_injury.pdf.
- . 2015. Interview with CCHS Staff.
- CDPH (California Department of Public Health). 2012. Climate Action for Health: Integrating Public Health into Climate Action Planning.
- CEC (California Energy Commission). 2006a. *Our Changing Climate: Assessing the Risks to California*. Web document. Sacramento: California Energy Commission.
- . 2006b. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. Contra Costa County. 2005. Contra Costa County General Plan 2005-2020. <http://www.co.contra-costa.ca.us/depart/cd/current/advance/GeneralPlan/CCCGeneralPlan.pdf>.
- . 2011a. "Water Use and Energy Intensity Data." Memo to County staff.
- . 2011b. *Urban Water Management Plan*. <https://www.ccwater.com/files/UWMP.pdf>.
- . 2014. Housing Element of the General Plan. <http://www.co.contra-costa.ca.us/DocumentCenter/View/30916ContraCostaWaterDistrict>.

Works Cited

- Cox, Kim. 2012. Contra Costa Health Services Emergency Services Manager. Interpersonal communication, October 8, 2012.
- Cravens, Marisa, Miriam Chion, Michael Reilly, Gukkuab Adams, Sailaja Kurella, Lauren Baranco, and Sarah Truehaft. 2009. "Development without Displacement, Development with Diversity." <http://www.bayareavision.org/initiatives/dwd-final.pdf>
- DOF (California Department of Finance), Demographic Research Unit. 2010. *E-5 Population and Housing Estimates for Cities, Counties and the State, 2001–2010, with 2000 Benchmark*. <http://www.dof.ca.gov/research/demographic/reports/view.php#objCollapsiblePanelEstimatesAnchor>.
- Downs, A. 2004. "Remedies that increase residential densities" in Downs (ed.), *Still stuck in traffic: Coping with peak-hour traffic congestion*. Washington, D.C.: Brookings Institution Press.
- East Bay Municipal Utility District. 2011. *Urban Water Management Plan, 2010*. <http://www.ebmud.com/our-water/water-supply/long-term-planning/urban-water-management-plan>.
- EPA (US Environmental Protection Agency). 2010. Sources of Pollutants in the Ambient Air - Stationary Sources. <http://www.epa.gov/apti/course422/ap3b.html>.
- . 2012. What Are the Six Common Air Pollutants?. <http://www.epa.gov/air/urbanair>.
- Ewing, Reid and Cervero, Robert. 2010. "Travel and the Built Environment: A Meta-Analysis." *Journal of the American Planning Association* 6(3): 265-294.
- Fehr & Peers. 2012. Contra Costa County Baseline and Future Year VMT Estimates Inventory.
- Frumppkin, Howard. 2001. "Urban Sprawl and Public Health." *Public Health Reports* p. 117.
- Garzón, Catalina. 2011. "At a Crossroads in Our Region's Health: Freight Transport and the Future of Community Health in the San Francisco Bay Area." Oakland, Calif.: Pacific Institute. http://pacinst.org/reports/crossroads_for_health/report_without_maps.pdf.
- HUD (US Department of Housing and Urban Development). 2015. *Income Limits*. <http://www.huduser.gov/portal/datasets/il.html>
- IPCC (Intergovernmental Panel on Climate Change). 1997. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html>.
- . 2013. Climate Change 2013: The Physical Science Basis. IPCC Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

Works Cited

- Joseph, John. 2011. Pacific Gas and Electric Company. E-mail correspondence. Oct 2011.
- Kawabata, M. 2002. "Job accessibility by travel mode in U.S. metropolitan areas." *Papers and Proceedings of the Geographic Information Systems Association* (11): 115-120.
- Maizlish, Neil, James Woodcock, Sean Co, Bart Ostro, Amir Fanai, and David Fairley. 2011. *Health Co-Benefits in Transportation-Related Reductions in Greenhouse Gas Emissions in the Bay Area: Technical Report*. Richmond, CA: Center for Chronic Disease Prevention and Health Promotion, California Department of Public Health. http://www.cdph.ca.gov/programs/CCDPHP/Documents/ITHIM_Technical_Report11-21-11.pdf
- Mahmud, Abdullah, Mary Tyree, Dan Cayan, Nehzat Motallebi, and Michael Kleeman. 2008. "Statistical Downscaling of Climate Change Impacts on Ozone Concentrations in California." *Journal of Geophysical Research* (113): D21103.
- Margolis, H., A. Gershunov, T. Kim, and R. Trent. 2008. "2006 California Heat Wave High Death Toll: Insights Gained from Coroner's Reports and Meteorological Characteristics of Event." *Epidemiology* 19(6): 363-364. http://journals.lww.com/epidem/Fulltext/2008/11001/2006_California_Heat_Wave_High_Death_Toll_.1000.aspx
- Meyer, Edward P. 2005. Contra Costa County 2005 Crop Report. <http://www.co.contra-costa.ca.us/index.aspx?NID=2207>.
- Moreland, Kimberley. 2002. "Access to Healthy Foods Limited in Poor Neighborhoods." *American Journal of Preventative Health* 92(11):1761-7.
- Ong, P. and D. Houston. 2002. "Transit, employment, and women on welfare." *Urban Geography* (23): 344-364.
- Perera, Elizabeth and Todd Sanford. 2011. *Rising Temperatures, Worsening Ozone Pollution*. Union for Concerned Scientists. <http://access2healthinfo.wordpress.com/2011/06/06/climate-change-ozone-pollution-threaten-public-health-report-says/>
- Schweitzer, Lisa and Zhou, Jiangping. 2010. "Neighborhood Air Quality, Respiratory Health, and Vulnerable Populations in Compact and Sprawled Regions." *Journal of the American Planning Association* 76(3): 363-371.
- Walker, Jarrett. 2011. *Human Transit*. Island Press, Washington.

Appendix A: Health Co-Benefit Evaluation

A



INTRODUCTION

In the coming years, scientists predict dramatic changes to take place in the world's climate, changes that are likely to have significant consequences for the health and economy of Contra Costa County (see Chapter 2 of the Climate Action Plan for more details). Specifically, these changes are predicted to cause increases in droughts, heat waves, sea level rise, degraded air quality, infectious disease and allergies, and extreme weather events.¹ The County prepared its Climate Action Plan (CAP) to reduce the emissions of greenhouse gases (GHG) from the unincorporated areas of Contra Costa County to help slow, and eventually reduce, these impacts.

While successful implementation of the CAP will allow Contra Costa County to do its part to help reduce climate change on a global scale, it will not directly or immediately impact local weather or conditions. However, implementing the individual GHG reduction actions contained in the CAP does have the potential to directly and immediately improve the health of Contra Costa County residents by making changes to the built environment and to the social, economic, and ecological conditions that affect health.² These potentially better health outcomes are referred to in this analysis as health co-benefits.

What is a health “co-benefit”?

Strategies to prevent further climate changes that also have a beneficial effect on human health and quality of life.

—California Department of
Public Health

1 CDPH (California Department of Public Health). 2012. Climate Action for Health: Integrating Public Health into Climate Action Planning.

2 “The built environment includes all of the physical parts of where we live and work (e.g., homes, buildings, streets, open spaces, and infrastructure).”—Centers for Disease Control and Prevention <http://www.cdc.gov/nceh/publications/factsheets/impactofthebuiltenvironmentonhealth.pdf>

Health Co-Benefit Evaluation

Contra Costa Health Services (CCHS) undertook this analysis to identify these health co-benefits in order to give policy-makers and the general public a richer understanding of the proposed GHG reduction actions beyond their potential to reduce GHG emissions, and to identify which actions should be prioritized for implementation based on their potential to improve public health.

Additionally, this analysis is intended to support health equity in Contra Costa County. While CCHS works to improve the health of all county residents, not all groups of people experience similar health outcomes. Indeed, significant differences (or “health inequities”) in illness, injury, life expectancy, and cause of death exist among different groups of people. Often these inequities occur by race/ethnicity, income, gender, sexual orientation, or neighborhood—mirroring and exacerbating already existing societal inequalities.³ CCHS has an important role in reducing health inequities, and has adopted a mission to eliminate health inequities by caring for and improving the health of all who live in Contra Costa County.⁴ Toward this end, this evaluation specifically considered the impact of implementing the GHG reduction actions on reducing health inequities. This is especially appropriate since many of the impacts of climate change—such as increased death, disease and injury from heat waves, floods, storms, and fires; decreased food quality and security; and increased morbidity and mortality—associated with air pollution are predicted to disproportionately affect those who are socially and economically disadvantaged.⁵

METHODS

Overall Approach

This analysis was designed to qualitatively identify the health co-benefits that could result from the GHG reduction actions contained in the CAP. No attempt was made to quantify the amount of health benefits that might result from the implementation of these GHG reduction actions, in either sickness avoided, lives saved, or dollars saved. While other studies have attempted to conduct this type of quantification^{6,7} it was both outside the scope of this analysis to do so, and considered to be potentially misleading given the limited research linking GHG reduction actions to

³ Wilkinson R., Marmot, M. (Eds.) 2003. *Social Determinants of Health: The Solid Facts*, 2nd Edition. Copenhagen: World Health Organization.

⁴ Contra Costa Health Services. 2005. *Reducing Health Disparities Initiative Progress Report and Plan for 2005 and 2006*.

http://cchealth.org/groups/rhdi/pdf/rhdi_report_2005_09.pdf

⁵ California Office of Environmental Health Hazard Assessment. 2010. *Indicators of Climate Change in California: Environmental Justice Impacts*.

⁶ Maizlish, Neil, James Woodcock, Sean Co, Bart Ostro, Amir Fanai, and David Fairley. 2011. *Health Co-Benefits in Transportation-Related Reductions in Greenhouse Gas Emissions in the Bay Area: Technical Report*. Richmond, CA: Center for Chronic Disease Prevention and Health Promotion, California Department of Public Health. http://www.cdph.ca.gov/programs/CCDPPH/Documents/ITHIM_Technical_Report11-21-11.pdf

⁷ ICF International. 2012. *Evaluation of the Air Quality Co-Benefits of Local Greenhouse Gas Reduction Measures: A Case Study of San Francisco*. San Francisco, Calif.: Prepared for US Environmental Protection Agency Region 9.

Health Co-Benefit Evaluation

quantifiable health outcomes. There is, however, precedent to conduct a qualitative assessment of the health co-benefits of a CAP.⁸

Additionally, the actual health benefits that will result from the implementation of any of the GHG reduction actions in this CAP will depend on many factors including the extent of action implementation, the geographic area or population targeted by the action, the timing of action implementation, and the duration of action implementation. Despite these qualifications, this analysis has attempted to prioritize the actions based on their potential to provide health benefits as explained below.

Health Indicators

The first step in this analysis was to select the health indicators by which each GHG reduction action would be evaluated. Health indicators are defined as changes in the natural environment, built environment, or social and economic conditions that are linked with positive health benefits. Based on a review of the literature and consultation with staff of the Public Health Division of CCHS, the public in the community open houses, and the County's Public and Environmental Health Advisory Board, nine health indicators were selected to be used in the evaluation. These indicators were chosen because of their potentially significant link to health benefits, and because they may potentially be affected by the GHG reduction strategies proposed in this document.

Because there is little chance that this plan will affect other aspects of human health that are high priorities for CCHS—such as smoking prevention, immunization, or violence reduction—many potential health indicators were not included in this analysis.

The nine health indicators selected for this evaluation are defined below. The link between each health indicator and the health benefits it provides is documented in the next section.

1. **Healthy Food:** Does the action increase the availability of affordable, healthy food to Contra Costa neighborhoods—particularly in areas currently without adequate access?
2. **Physical Activity, Walkability, and Bikeability:** Does the action make it more likely, easier, or safer to walk/bicycle for exercise or transportation?
3. **Outdoor Air Quality:** Does the action directly or indirectly reduce regional air pollution?
4. **Indoor Air Quality:** Does the action improve indoor air quality?
5. **Improved Access:** Does the action make it easier to reach jobs, services, and other necessities—either by making travel easier, or by placing housing and destinations closer together?
6. **Green Space:** Does the action encourage the planting of vegetation, or create or preserve open space or parks?
7. **Job Creation:** Does the action directly increase opportunities for new job creation for Contra Costa residents?

⁸ City of Eugene. 2010. *A Community Climate and Energy Action Plan for Eugene*. <http://www.eugene-or.gov/DocumentCenter/Home/View/565>

Health Co-Benefit Evaluation

8. Climate Risk Reduction (Adaptation): Does the action help deal with the impacts of climate change such as extreme heat, drought, sea level rise, degraded air quality, flooding, increases in infectious disease and allergies, and extreme weather events?
9. Health Equity: Does the action directly contribute to reducing health inequities by race, income, age, neighborhood or other factors?

LITERATURE REVIEW: LINKING HEALTH INDICATORS AND HEALTH BENEFITS

Healthy Food

Definition—Greenhouse gas reduction actions that increase the availability of affordable, healthy food to Contra Costa neighborhoods—particularly in areas currently without adequate access.

The Link to Health Benefits

Healthy food has long been understood to be essential for human health, and has been linked to diabetes, cardiovascular disease, cancer, and obesity prevention.⁹ To an extent, eating a nutritious diet is a personal choice. However, many communities lack access to nutritious food altogether—making healthy eating impossible. A growing body of research has documented these so-called “food deserts” and noted their disproportionate occurrence in low-income neighborhoods and communities of color.^{10,11,12,13} There is a strong base of evidence for a correlation between unhealthy food environments and unhealthy diets.¹⁴ However, the evidence causally linking food deserts to diet, and in turn to health outcomes, is considerably less robust. Few studies have yet attempted to draw these links.¹⁵ While the evidence base is sparse and evolving, it is nonetheless highly plausible that the availability of healthy food does, to some degree, shape health outcomes through diet. It is therefore prudent to seek GHG reduction actions that promote healthy food availability.

⁹ Ploeg, Michele, Vince Breneman, Tracey Farrigan, Karen Hamrick, David Hopkins, Phillip Kaufman, Biing-Hwan Lin, Mark Nord, Travis A. Smith, Ryan Williams, Kelly Kinnison, Carol Olander, Anita Singh, and Elizabeth Tuckermanty. 2009. *Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences*. Washington, DC: US Department of Agriculture. <http://www.ers.usda.gov/Publications/AP/AP036/AP036.pdf>.

¹⁰ Ibid. 18-20.

¹¹ Beaulac, Julie Kristjansson and Steven Cummins. 2009. “A Systematic Review of Food Deserts, 1966- 2007.” *Preventing Chronic Disease: Public Health Research, Practice and Policy* 6(3): 1-10.

¹² Larson, Nicole, Mary Story and Melissa Nelson. 2009. “Neighborhood Environments Disparities in Access to Healthy Foods in the U.S.” *American Journal of Preventative Medicine* 36(1): 74-81.

¹³ Nayga, Rodolpho and Zy Weinberg. 1999. “Supermarket Access in the Inner Cities.” *Journal of Retailing and Consumer Services* 6(3):141-145.

¹⁴ Ploeg, et al. 2009.

¹⁵ Ploeg, et al. 2009.

Health Co-Benefit Evaluation

A

Physical Activity, Walkability, and Bikeability

Definition—Greenhouse gas reduction actions that increase physical activity, including both intentional exercise and walking and biking for transportation.

The Link to Health Benefits

There is a large body of evidence linking physical activity to health. In 1996, the Surgeon General considered hundreds of studies evaluating the links between physical activity and health outcomes.¹⁶ While most studies considered were cross-sectional, the report nonetheless found sufficient evidence to conclude that there is a clear causal pathway between physical activity and a variety of outcomes, including:

- Lower mortality, longer life spans.
- Reduced risk of premature death from cardiovascular diseases.
- Reduced risk of developing non-insulin-dependent diabetes.
- Reduced risk of high blood pressure or hypertension.
- Reduced risks of developing colon and breast cancers.
- Slowed development of osteoarthritis and osteoporosis.
- Reduced fall-related injuries.
- Help maintaining a healthy weight.
- Increased bone, muscle, and joint health.
- Reduced depression and anxiety and better physiological well-being.

These findings are reinforced by Warburton, Nicol, and Bredin's more recent (2006) review of the literature. The authors found "irrefutable evidence" that physical activity is effective in reducing all-cause mortality and in the primary and secondary prevention of many of the diseases identified by the Surgeon General's study.¹⁷

Based on an analysis of 40 population-based studies, Williams¹⁸ cautions that the effects of moderate amounts of physical activity on coronary heart disease and cardiovascular diseases are likely overstated in many studies, since

¹⁶ US Department of Health and Human Services. 1996. Physical activity and health: a report of the Surgeon General. Atlanta, Georgia: US Department of Health and Human Services, Public Health Service, CDC, National Center for Chronic Disease Prevention and Health Promotion.

¹⁷ Warburton, Darren, Crystal Nicol and Shannon Bredin. 2006. "Health Benefits of Physical Activity: The Evidence." *Canadian Medical Journal*. 174(6):801-809.

¹⁸ Williams, Paul. 2001. "Physical Fitness and Activity as Separate Heart Disease Risk Factors: A Meta-Analysis." *Med Sci Sports Exerc*. 33(5): 754-61.

Health Co-Benefit Evaluation

many researchers conflate physical activity with physical fitness.¹⁹ While it is important to note this qualification, the overwhelming bulk of evidence nonetheless supports a strong link between physical activity and health.

More recently, other authors have specifically examined the health co-benefits of climate change mitigation strategies designed to increase biking and walking. In synthesis of systematic reviews of the medical literature, Woodcock et al. found that moderate levels of physical activity reduced rates of cardiovascular disease, colon and breast cancers, diabetes, dementia, lung cancer and respiratory diseases.²⁰ Building on Woodcock's analysis, Maizlich estimated the potential health benefits of GHG reduction strategies in the Bay Area, suggesting that bringing walking and biking rates from 2% to 15% would yield approximately 2,000 fewer deaths and 22,000 years of life gained annually.²¹

Outdoor Air Quality

Definition—Greenhouse gas reduction actions that reduce the amount of air pollutants, other than greenhouse gases, being emitted, either directly or indirectly.

The Link to Health Benefits

Carbon dioxide, the main greenhouse gas, is formed during the combustion of fossil fuels such as gasoline, diesel fuel and natural gas in cars, trucks, construction equipment, power plants and other sources. Also formed during the combustion of these fuels are byproducts such as volatile organic compounds, nitrous oxides, sulfur oxides, particulate matter, and carbon monoxide. They are considered air pollutants because they have all been found to have acute and/or long-term health impacts. The burning of fossil fuels also creates toxic air contaminants—pollutants that may cause serious effects, such as cancer, with long-term low levels of exposure. Also, when landfills generate methane (a potent greenhouse gas) from the decomposition of garbage, other volatile hydrocarbons that are toxic are also generated.

There is a large body of evidence linking air pollutants to health impacts.²² Both federal and state laws have set ambient air quality standards for many air pollutants at levels intended to adequately protect the health of the public, including infants and children, with an adequate margin of safety.²³ These standards have been set for ozone, two forms of particulate matter (PM₁₀ and PM_{2.5}), carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, sulfates,

¹⁹ Physical activity shows a linear relationship, while physical fitness exhibits a non-linear response in which increases at lower levels of fitness show greater responses than those at higher levels of fitness.

²⁰ Woodcock, James, Phil Edwards, Cathryn Tonne, Ben Armstrong, Olu Ashiru, David Banister, Sean Beevers, Zaid Chalabi, Zohir Chowdhury, Aaron Cohen, Oscar H Franco, Andy Haines, Robin Hickman, Graeme Lindsay, Ishaan Mittal, Dinesh Mohan, Geetam Tiwari, Alistair Woodward and Ian Roberts. 2009. "Public Health Benefits of Strategies to Reduce Greenhouse-Gas Emissions: Urban Land Transport." *The Lancet* 374(9705): 1930-1943.

²¹ Maizlich, 2011.

²² California Air Resources Board. 2012. *Health Effects of Air Pollution*. <http://www.arb.ca.gov/research/health/health.htm>.

²³ Ibid.

Health Co-Benefit Evaluation

A

hydrogen sulfide, vinyl chloride, and visibility-reducing particles. The major pollutants of concern associated with the burning of fossil fuels are ozone, particulate matter, nitrogen dioxide, and sulfur dioxide. Ozone itself isn't generated by the combustion of fossil fuels, but the volatile organic hydrocarbons and nitrous oxides generated from the combustion process, known as precursors, react in the air with sunlight to form ozone. Some of the major health impacts of these pollutants are^{24, 25}:

- Particulate matter—Increased respiratory disease, lung damage, cancer, premature death
- Ozone—breathing difficulties, lung tissue damage
- Nitrogen dioxide—lung irritation and damage
- Sulfur dioxide—increased lung disease, breathing problems for asthmatics

The Bay Area is currently out of attainment with the state and federal ozone and particulate matter health-based standards.²⁶ Ambient air quality-monitoring stations in Concord and Bethel Island have some of the highest values for ozone in the Bay Area, and these stations violated health-based standards for both ozone and particulate matter in 2011.²⁷

Since Contra Costa County is home to five major fossil fuel-based power plants and a number of other smaller power plants,²⁸ any reduction in electrical use can potentially reduce levels of ozone precursors and particulate in the county, and can potentially help bring the Bay Area closer to attainment with these health-based standards. The complexities of the power production grid make it extremely difficult to determine from which energy source air pollution reductions will occur due to local energy conservation actions.²⁹ However, local reductions in pollution emissions from cars, industries, and landfills resulting from implementation of the CAP will directly contribute to improving local air quality.

The major toxic air contaminants created by the burning of fossil fuels in cars, trucks power plants, and industrial facilities are diesel particulate matter; 1,3 butadiene; benzene; formaldehyde; and acrolein. Health risks posed by these compounds include cancer risks; chronic, non-cancer risks, such as diseases of the lungs, liver, and kidneys; and acute risks, such as eye and respiratory irritations. The Office of Environmental Health Hazard Assessment has

²⁴ California Air Resources Board. 2012. *ARB Fact Sheet, Air Pollution and Health*. <http://www.arb.ca.gov/research/health/fs/fs1/fs1.htm>.

²⁵ California Air Resources Board. 2012. *ARB Fact Sheet: Air Pollution Sources, Effects and Control*. <http://www.arb.ca.gov/research/health/fs/fs2/fs2.htm>.

²⁶ Bay Area Air Quality Management District. 2012. *Air Quality Standards and Attainment Status*. http://192.69.142.5/pln/air_quality/ambient_air_quality.htm.

²⁷ Bay Area Air Quality Management District. 2011. *Bay Area Air Pollution Summary*. http://www.baaqmd.gov/~media/Files/Communications%20and%20Outreach/Annual%20Bay%20Area%20Air%20Quality%20Summaries/pollsum11_rev2.ashx.

²⁸ California Energy Commission. 2012. *Annual Energy Generation by County*. http://energyalmanac.ca.gov/electricity/web_qfer/Annual_Generation-County.php.

²⁹ I. Rhyne, California Energy Commission., telephone interview, September 2012.

Health Co-Benefit Evaluation

conducted complete reviews of the toxic properties of these compounds.³⁰ The Bay Area Air Quality Management District has developed an emissions model for these contaminants, ozone and particulates to determine the cancer and non-cancer risk to communities in the Bay Area. Typically, these risks are highest in close proximity to major sources such as highways and ports, and in the eastern portions of the County for ozone. The Bay Area Air Quality Management District has established seven high priority areas in the Bay Area based on risk and demographic factors. Three of these areas, portions of Richmond, Antioch/Pittsburg/Bay Point and Concord, are in Contra Costa County. Therefore, any emissions reduction of these pollutants resulting from implementation of the CAP will help lessen the toxic burden from these contaminants, including in these already overburdened areas of the county.³¹

Indoor Air Quality

Definition—Greenhouse gas reduction actions that improve indoor air quality.

The Link to Health Benefits

Some of the air pollutants that are created when fossil fuels are burned can affect indoor air quality, particularly nitrogen dioxide and particulate matter.³² Of particular concern is a subset of particulate that is formed from the combustion of diesel fuel in trucks, buses, ships, trains, construction equipment, and generators called diesel particulate matter (DPM).

Many studies have documented the health impacts of DPM.³³ The California Air Resources Board (CARB) declared diesel particulate matter a toxic air contaminant in 1998 based on these health risks.³⁴ Exposure to diesel exhaust can have immediate health effects. CARB estimates that about 70% of the cancer risk to the average Californian from breathing toxic air pollutants is from diesel particulate matter. Exposure to diesel exhaust can irritate the eyes, nose, throat and lungs, and it can cause coughs, headaches, light-headedness, and nausea. In studies with human volunteers, diesel exhaust particles made people with allergies more susceptible to the materials to which they are allergic, such as dust and pollen. Exposure to diesel exhaust also causes inflammation in the lungs, which may

³⁰ California Office of Environmental Health Hazard Assessment. *Toxics Air Contaminants Reports*. 2012. http://www.oehha.ca.gov/air/toxic_contaminants/tactable.html.

³¹ Bay Area Air Quality Management District. 2014. *Improving Air Quality & Health in Bay Area Communities. Community Air Risk Evaluation Program Retrospective & Path Forward (2004-2013)*.

³² Suh, Helen, Petros Koutrakis and Stephanie Ebelt. 2004. *Detailed characterization of indoor and personal particulate matter concentration*. Boston, MA: Final report contract no. 00-302 prepared for the California Air Resources Board.

³³ California Air Resources Board. 2012. *Diesel and Health Research*. <http://www.arb.ca.gov/research/diesel/diesel-health.htm>.

³⁴ California Air Resources Board. 2012. *Rulemaking Identification of Particulate Emissions from Diesel-Fueled Engines as a Toxic Air Contaminant*. <http://www.arb.ca.gov/regact/diesltac/diesltac.htm>.

Health Co-Benefit Evaluation

A

aggravate chronic respiratory symptoms and increase the frequency or intensity of asthma attacks. Other research has suggested that diesel exhaust may even cause asthma.³⁵

Diesel engines are a major source of fine-particle pollution. The elderly and people with emphysema, asthma, and chronic heart and lung disease are especially sensitive to fine-particle pollution. Numerous studies have linked elevated particle levels in the air to increased hospital admissions, emergency room visits, asthma attacks, and premature deaths among those suffering from respiratory problems. Because children's lungs and respiratory systems are still developing, they are also more susceptible than healthy adults to fine particles. Exposure to fine particles is associated with increased frequency of childhood illnesses and can also reduce lung function in children.³⁶

Because of the physical properties of DPM, the exposure risks significantly diminish a short distance from the source. Many studies have documented greater health impacts to people living near sources of air pollution, such as DPM.^{37,38} For this reason, CARB has issued guidelines for how close sensitive receptors such as homes, schools, and hospitals should be located to sources of pollution.³⁹ GHG reduction actions in the CAP that either reduce the emissions of DPM and nitrogen dioxide or mitigate the impacts of these pollutants on indoor environments will lessen the health impacts of these pollutants.

Improved Access

Definition—Greenhouse gas reduction actions that make it easier to reach jobs, services, and other necessities. This includes actions which make traveling a given distance easier, as well as those that reduce the distance between destinations (i.e., infill development). While access to jobs and services is important to all people, this criteria is particularly important for people with disabilities, elderly people, those with few resources or no cars, and others for whom travel may be difficult or prohibitively expensive.

The Link to Health Benefits

Access contributes to health by allowing people to reach the basic necessities of a healthy life, such as healthcare, food, economic opportunity, and social/familial interaction. Few if any studies attempt to link access overall to health outcomes. Rather, researchers in a variety of fields have assessed the health effects of access to specific categories of services. These are briefly elaborated below.

³⁵ Pandya, Robert, Gina Solomon, Amy Kinner and John Balmes. 2002. "Diesel Exhaust and Asthma: Hypotheses and Molecular Mechanisms of Action". *Environmental Health Perspectives* 110 (Sup 1):103 -111.

³⁶ California Office of Environmental Health Hazard Assessment and the American Lung Association. Undated. Health Effects of Diesel Exhaust Factsheet.

³⁷ Health and Clean Air. Spring-Summer. 2004. Health and Clean Air Newsletter. <http://www.healthandcleanair.org/newsletters/issue6.pdf>

³⁸ Kim, Janice, Svetlana Smorodinsky, Michael Lipsett, Brett Singer, Alfred Hodgson and Bart Ostro. 2004. "Traffic-related Air Pollution near Busy Roads, the East Bay Children's Respiratory Health Study". *American Journal of Respiratory and Critical Care Medicine* (170): 520-526.

³⁹ California Air Resources Board. 2005. Air Quality and Land Use Handbook: A Community Health Perspective. <http://www.arb.ca.gov/ch/handbook.pdf>

Health Co-Benefit Evaluation

While there is an intuitive link between geographic access to healthcare and health outcomes—patients cannot be treated if they cannot reach healthcare providers—there is sparse literature documenting this link. The few reviews published have largely reported on the state of the practice and have not offered conclusions about the relationship between access to healthcare and health outcomes.^{40,41,42,43}

However, a number of individual studies do suggest that lack of access can significantly contribute to poor healthcare and health. Baker, for instance, found that long transportation times were associated with increased reliance on the emergency room⁴⁴, while Meden found them to change cancer treatment choices.⁴⁵ In this county, patients in evening clinics reported that 24% of their missed appointments were due to transportation difficulties.⁴⁶ These difficulties are often exacerbated for those without cars; Rask found low-income patients who depend on transit or their feet to be less likely to receive consistent, timely care.⁴⁷

As discussed in the healthy food section above, many neighborhoods—especially low-income neighborhoods and communities of color—are not adequately served by affordable, healthy food retailers. This situation is often exacerbated by poor transportation access. As the Centers for Disease Control and Prevention notes, “A poor transportation system cuts off access to many food outlets—especially for those who do not own a car or have no access to reliable and affordable public transportation.”⁴⁸ This statement is echoed by several reviews of the food access literature, which conclude that healthy food access is mediated by transportation availability and affordability.^{49,50}

⁴⁰ McLafferty, Sara. 2003. “GIS and Health Care”. *Annual Review of Public Health* (24):25-42.

⁴¹ Higgs, Gary. 2004. “A Literature Review of the Use of GIS-Based Measures of Access to Health Care Services.” *Health Services and Outcome Research Methodology* (5): 125-145.

⁴² Graves, Barbara. 2008. “Integrative Literature Review: A Review of Literature Related to Geographical Information Systems, Healthcare Access, and Health Outcomes.” *Perspectives in Health Information Management* 5(11).

⁴³ Nykiforuk Candace and Laura Flaman. 2011. “Geographic Information Systems (GIS) for Health Promotion and Public Health: A Review.” *Health Promotion Practice* 12(1):63–73

⁴⁴ Baker, David, Carl Stevens and Robert Brook. 1996. “Determinants of Emergency Department Use: Are Race and Ethnicity Important?” *Annals of Emergency Medicine* 28(6):667-682.

⁴⁵ Meden, Terry. Celeste St John-Larkin, Deborah Hermes and Stephen Sommershield. 2002. “Relationship between Travel Distance and Utilization of Breast Cancer Treatment in Rural Northern Michigan.” *Journal of the American Medical Association* 287(1):111.

⁴⁶ Butrick, Elizabeth. 1999. “Factors in Nonattendance in Extended Evening Clinics in Contra Costa County,” Unpublished paper for Contra Costa Health Services. This study examined the reasons patients missed appointments at CCHS’s Extended Evening Clinics located in Richmond, Martinez, and Pittsburg.

⁴⁷ Rask, Kimberly, Mark Williams, Ruth Parker, and Sally McNagny. 1994. “Obstacles Predicting Lack of a Regular Provider and Delays in Seeking Care for Patients at an Urban Public Hospital.” *Journal of the American Medical Association* 1(24):1931-3.

⁴⁸ Centers for Disease Control and Prevention. 2010. Transportation and Food Access. <http://www.cdc.gov/healthyplaces/healthtopics/healthyfood/transportation.htm>

⁴⁹ Beaulac, Julie Kristjansson and Steven Cummins. 2009. “A Systematic Review of Food Deserts, 1966- 2007.” *Preventing Chronic Disease: Public Health Research, Practice and Policy* 6(3): 1-10.

⁵⁰ Nayga, Rodolpho and Zy Weinberg. 1999. “Supermarket Access in the Inner Cities.” *Journal of Retailing and Consumer Services* 6(3):141-145.

Health Co-Benefit Evaluation

A

Access is also a primary factor in determining economic opportunity, which in turn is linked to health outcomes. There is a large body of planning literature on the so-called spatial mismatch hypothesis, which suggests that proximity to jobs is a strong predictor of employment, earnings, and job security.^{51,52,53,54} More recently, scholars have proposed a “modal mismatch” faced by carless workers and dispersed employment opportunity, finding strong evidence that low access to automobiles shapes economic outcomes.⁵⁵ These socioeconomic outcomes have, in turn, a strong and well-documented link to health.^{56,57,58}

Green Space

Definition—Greenhouse gas reduction actions that encourage the planting of trees or vegetation, or create or preserve open space or parks.

The Link to Health Benefits

A number of studies have drawn links between green space and health outcomes. In general, researchers have identified statistically significant associations between green spaces and health, although the exact causal pathways remain somewhat murky. That said, the links between green space and physical activity, and to corresponding improvements in health, are relatively clear and well established.⁵⁹ Green space is also thought to increase perceptions of safety, attractiveness, and calm,⁶⁰ and most studies do find positive, self-reported mental health benefits such as increased relaxation, attention, energy, and feelings of well-being.⁶¹ There is less evidence for physiological effects such as reduced blood pressure or lower cortisol levels, although research is, as yet, underdeveloped.⁶² Green spaces may also improve health outcomes by mitigating the harmful effects of noise, heat,

⁵¹ Holzer, Harry J. 1991. “The Spatial Mismatch Hypothesis: What Has the Evidence Shown?” *Urban Studies* 28 (1): 105-22.

⁵² Ihlanfeldt, Keith and David Sjoquist. 1998. The Spatial Mismatch Hypothesis: A Review of Recent Studies and their Implications for Welfare Reform. *Housing Policy Debate* 9 (4): 849-92.

⁵³ Kain, John. 1992. The Spatial Mismatch Hypothesis: Three Decades Later. *Housing Policy Debate* 3 (2): 371-460.

⁵⁴ Preston, Valerie, and Sara McLafferty. 1999. Spatial Mismatch Research in the 1990s: Progress and Potential. *Papers in Regional Science* 28:387-402.

⁵⁵ Blumenberg, Evelyln and Manville, Michael. 2004. “Beyond the Spatial Mismatch: Welfare Recipients and Transportation Policy.” *Journal of Planning Literature* 19(2): 182-205.

⁵⁶ Marmot Michael, Manolis Kogevinas and Mary Ann Elston. 1987. “Social/economic Status and Disease.” *Annual Review of Public Health* 8:111–135.

⁵⁷ Feinstein JS. 1993. The relationship between socioeconomic status and health: a review of the literature. *Milbank Q.* 71:279–322.

⁵⁸ Yen IH, Syme SL. 1999. The social environment and health: a discussion of the epidemiologic literature. *Annu Rev Public Health* 20:287–308.

⁵⁹ Lee, Andrew and Maheswaren, Ravi. 2011. “The Health Benefits of Urban Green Spaces: A Review of the Evidence.” *Journal of Public Health* 22(2):212-222. <http://jpubhealth.oxfordjournals.org/content/33/2/212.full>.

⁶⁰ Ibid.

⁶¹ Bowler, et al. 2010. “A Systemic Review of Evidence for the Added Benefits to Health of Exposure to Natural Environments.” *BMC Public Health* 10: 456. <http://www.biomedcentral.com/1471-2458/10/456>

⁶² Ibid.

Health Co-Benefit Evaluation

and air and water pollution.⁶³ In particular, research suggests that green space can help cool urban heat islands, a role that will increase in importance as the climate continues to change.^{64,65,66}

Job Creation

Definition—Greenhouse gas reduction actions that directly increase opportunities for new job creation for Contra Costa residents.

The Link to Health Benefits

Because they are essential to economic security in this country, jobs are an essential precondition of good health. A wide range of research has established the links between employment and health. Overall, researchers have consistently found a strong relationship between socioeconomic status and health.^{67,68,69} More specifically, increases in income are associated with better health outcomes, particularly near the bottom of the income scale.⁷⁰ Furthermore, a recent meta-analysis found that income inequality negatively impacted both self-rated health and overall mortality risk, implying that it might be particularly important to create jobs for low-income individuals and communities.⁷¹ Research also suggests that job insecurity is associated with increased risk of poor health, and that unemployment is associated with decreased mental health.^{72,73}

Climate Risk Reduction (Adaptation)

Definition—Greenhouse gas reduction actions that help communities deal with the impacts of climate change such as extreme heat, drought, sea level rise, degraded air quality, flooding, and increases in infectious disease and allergies.

⁶³ http://www.hiaconnect.edu.au/files/Guide_to_HIA_of_Greenspace.pdf

⁶⁴ Department of Transport Local Government and Regions. 2002. Green spaces, better places: final report of the Urban Green Spaces Taskforce: Department of Transport Local Government and Regions.

⁶⁵ Countryside and Community Research Unit University of Gloucester. 2003. Community forestry delivering sustainable regeneration project evaluation. Edinburgh: Forestry Commission.

⁶⁶ Environmental Protection Agency. 2008. Reducing Urban Heat Islands: Compendium of Strategies: Trees and Vegetation. <http://www.epa.gov/hiri/resources/compendium.htm>

⁶⁷ Marmot MG, Kogevinas M, Elston MA. 1987. Social/economic status and disease. *Annual Review of Public Health* 8:111–135.

⁶⁸ Feinstein JS. 1993. The relationship between socioeconomic status and health: a review of the literature. *Milbank Q.* 71:279–322.

⁶⁹ Yen IH, Syme SL. 1999. The social environment and health: a discussion of the epidemiologic literature. *Annual Rev Public Health* 20:287–308.

⁷⁰ Bhatia, Rajiv and Katz, Mitchell. 2001. "Estimation of Health Benefits from a Local Living Wage Ordinance." *American Journal of Public Health* 91(9): 13987-1402.

⁷¹ Kondo, N., Sembajee G., Kawachi, I., van Dam R.M., Subramanian, S.V. and Yamagata, Z. 2009. "Income Inequality, Mortality, and Self Rated Health: A Meta-Analysis of Multilevel Studies." *BMJ* Nov 10;339:b4471.

⁷² László, Kristina, Pihart, Hynek, Kopp, Mária, Bobak, Martin, Pajak, Andrezej, Malyutina, Sofia, Gyöngyvér Salavecz, and Michael Marmot. 2010. "Job insecurity and health: a study of 16 European countries." *Social Science Medicine* 70: 867–874.

⁷³ McKee-Ryan, Frances; Song, Zhaoli; Wanberg, Connie R.; Kinicki, Angelo J. 2005. "Psychological and Physical Well-Being During Unemployment: A Meta-Analytic Study." *Journal of Applied Psychology* 90(1), 53-76.

The Link to Health Benefits

As detailed in Chapters 2 and 4 of the CAP, the changing climate is projected to have wide-ranging negative impacts that will affect public health. These include negative impacts on air quality; increases in extreme heat, average temperature, and severe weather events such as flooding and wildfires; and risks to food security from drought, and changing patterns and yields of crops.⁷⁴ Therefore, any action could potentially help reduce the health risks from climate change by addressing any one of these impacts.

Actions that directly reduce outdoor air pollution are those that reduce the use of cars, trucks, or other sources that burn fossil fuels, or reduce the emissions of air pollutants from sources at the same time as reducing their GHG emissions through control technologies or efficiency, such as at landfills or industrial sources. Indirect reductions occur when the implementation of an action reduces the need to generate electricity through conservation or energy efficiency actions, or creates alternative sources of energy that do not burn fossil fuels. Increased levels of air pollution are predicted because of hotter temperatures driving up ozone levels and additional pollution generated by the increased need for electricity to cool homes during extreme heat events.⁷⁵ The links to health benefits from reducing air pollution are detailed in the Outdoor Air Quality section above.

Increasing energy conservation through better insulation and weatherization practices can have the added benefit of keeping homes and commercial buildings without air conditioners cooler during extreme heat events and make it more cost-effective to cool building with air conditioners. A broad spectrum of health impacts have been associated with exposure to heat, ranging from mild heat cramps to severe, life-threatening heat stroke. Children and the elderly, socially isolated populations, outdoor workers, the poor, the chronically ill, and the medically underserved are more vulnerable to the effects of heat than the general population.⁷⁶ Heat waves are expected to occur more frequently and grow longer and more intense, posing particular risk to the most vulnerable.⁷⁷ One study of the 2003 heat wave in France that killed thousands of people found that an inefficient amount of building insulation was one factor associated with death.⁷⁸

Reducing the risk from extreme heat has been identified as an important steps to counter the heat island effect.^{79,80} On a hot, sunny summer day, roof and pavement surface temperatures can be 50–90°F (27–50°C) hotter than the air,

⁷⁴ California Department of Public Health. 2012. Climate Action for Health: Integrating Public Health into Climate Action Planning.

⁷⁵ California Climate Change Center. 2006. Public Health-related Impacts of Climate Change in California. CEC-500-2005-197-SF

⁷⁶ California Department of Public Health. 2007. Public Health Impacts of Climate Change in California: Community Vulnerability Assessments and Adaptation Strategies. Report No. 1: Heat-Related Illness and Mortality. [Http://www.ehib.org/paper.jsp?paper_key=Climate_change_2008](http://www.ehib.org/paper.jsp?paper_key=Climate_change_2008)

⁷⁷ California Climate Change Center. 2012. Our Changing Climate 2012 Vulnerability & Adaptation to the Increasing Risks from Climate Change in California - Brochure. Publication # CEC-500-2012-007.

⁷⁸ Vandentorren S, Bretin P, Zeghnoun A, Mandereau-Bruno L, Croisier A, Cochet C, Ribéron J, Siberan I, Declercq B, Ledrans M. 2003. "Heat wave in France: risk factors for death of elderly people living at home." *Eur J Public Health*. 16(6):583-91. Epub 2006 Oct 6.

⁷⁹ California Department of Public Health. 2007. Public Health Impacts of Climate Change in California: Community Vulnerability Assessments and Adaptation Strategies. Report No. 1: Heat-Related Illness and Mortality. [Http://www.ehib.org/paper.jsp?paper_key=Climate_change_2008](http://www.ehib.org/paper.jsp?paper_key=Climate_change_2008)

⁸⁰ EPA. Heat Island Effect web site. <http://www.epa.gov/heatisld/mitigation/index.htm>

Health Co-Benefit Evaluation

while shaded or moist surfaces—often in more rural surroundings—remain close to air temperatures.⁸¹ These surface urban heat islands, particularly during the summer, have multiple impacts and contribute to atmospheric urban heat islands. Air temperatures in cities, particularly after sunset, can be as much as 22°F (12°C) warmer than the air in neighboring, less developed regions.⁸²

Increasing water conservation or improving access to locally grown food reduces the risk from drought. Climate change is projected to reduce freshwater supplies. As surface water supplies are reduced, groundwater pumping is expected to increase, resulting in potentially lower water tables and adverse impacts on water quality. Drought conditions may lead to increased concentrations of contaminants in drinking water supplies.⁸³ In addition, drought could lead to hunger and malnutrition caused by disruption in food and water supply, increased cost and conflict over food and water, food and water-borne disease, and the emergence of new contagious and vector-borne disease.⁸⁴ The state's climate change adaptation strategy for addressing projected impacts on water supply calls for aggressive conservation and efficiency strategies.⁸⁵

Health Equity

Definition—Greenhouse gas reduction actions that directly reduce health inequities by race, income, gender, disability, age, neighborhood, or other factors.

The Link to Health Benefits

The vision for Healthy People 2020, the official document that defines the nation's goals for health,⁸⁶ is a society in which **all** (emphasis added) people live long, healthy lives. Two of the four main goals of Healthy People 2020 are:

- Achieving health equity, eliminating disparities, and improving the health of all groups.
- Creating social and physical environments that promote good health for all.

Therefore, implementing actions that will help reduce health inequities will move the county closer to meeting these national health goals. Unequal access to healthy food, jobs, services, and opportunities for physical activity, and unequal exposure to indoor and outdoor air pollution all contribute to health inequity.⁸⁷

⁸¹ Berdahl P. and S. Bretz. 1997. Preliminary survey of the solar reflectance of cool roofing materials. *Energy and Buildings* 25:149-158.

⁸² Akbari, H. 2005. Energy Saving Potentials and Air Quality Benefits of Urban Heat Island Mitigation (PDF) (19 pp, 251K). Lawrence Berkeley National Laboratory.

⁸³ California Office of Environmental Health Hazard Assessment. 2010. Indicators of climate change in California: Environmental Justice Impacts. <http://www.oehha.ca.gov/multimedia/epic/epic123110.html>

⁸⁴ California Department of Public Health. 2012. Climate Action for Health: Integrating Public Health into Climate Action Planning.

⁸⁵ California Department of Water Resources. 2008. Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water. <http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf>

⁸⁶ Federal Interagency Working Group. Undated. *Healthy People 2020 Framework*. <http://www.healthypeople.gov/2020/Consortium/HP2020Framework.pdf>

Health Co-Benefit Evaluation

A

Contra Costa County suffers from serious health inequity. The Public Health Division of Contra Costa Health Services publishes a periodic report detailing health outcomes in the county.⁸⁸ According to this report, 29% of the poorest adults self-reported their health as fair or poor, while only 8% of those in the highest category reported their health as fair or poor. Life expectancy in the wealthiest census tracts in the county was 81.4 years, while in the poorest census tracts it was 74.9 years. Only 5.3% of adults with at least a master's degree or professional degree self-reported poor or fair health while 22.6% of adults with a high school diploma or less self-reported poor or fair health. For the best-educated census tracts the life expectancy is 84 years, while those census tracts with the lowest levels of education have a life expectancy of 74.6 years. Health expectancy also differs by race in the county. Life expectancy for Asian/Pacific Islanders is 86 years, while for Hispanics it is 85.7 years; for whites it is 84 years, and for African Americans it is 73.1 years.

In addition, health outcomes varied by race. African Americans have significantly higher rates than the county as a whole for risk of death from heart disease, cancer, diabetes, stroke, and homicide, unintentional injury, fetal and infant death, childhood asthma hospitalization, being overweight and obese, assault hospitalization, low birth weight, teen births and AIDS. Hispanics have significantly higher rates than the county as a whole for risk of teen birth. People living in certain cities also have higher risks than the county as a whole for certain health outcomes. As an example, San Pablo residents have a higher risk than the county as a whole for death from heart disease, cancer, stroke, and homicide, overweight and obese fifth-graders, and teen births. In addition, Contra Costa County as a whole has a worse rate of homicide, cases of all types of cancer, and childhood asthma hospitalizations than the California average.

EVALUATION OF GREENHOUSE GAS REDUCTION MEASURES

The second step in the process was to evaluate each proposed GHG reduction measure in the CAP to determine if they were likely to affect each health indicator. This evaluation was made through a review of the literature, and in consultation with staff of the Public Health Division of Contra Costa Health Services and the County's Public and Environmental Health Advisory Board.

The following criteria for evaluating each GHG reduction measure were developed:

- 1) The measures themselves were individually evaluated, not the sub-actions or goals.
- 2) There had to be a primary link between the measure and the health indicator for there to be considered a positive effect.

⁸⁷ Bay Area Regional Health Inequities Initiative. 2008. Health Inequities in the Bay Area. http://www.barhii.org/press/download/barhii_report08.pdf.

⁸⁸ Community Health Indicators for Contra Costa County. 2010. Community Health Assessment, Planning and Evaluation (CHAPE) Unit of Contra Costa Health Services' Public Health Division. http://cchealth.org/health-data/hospital-council/2010/pdf/2010_community_health_indicators_report_complete.pdf

Health Co-Benefit Evaluation

- 3) The number of health indicators positively affected by each measure was not totaled because this would give the false impression that a measure affecting multiple health indicators necessarily provided more health benefits than a measure which affected fewer health indicators.
- 4) For a measure to positively affect the equity health indicator, the implementation of the measure as described had to have an explicit benefit to a vulnerable or disproportionately impacted population.
- 5) For a measure to have a positive effect on any health indicator, the health benefit derived from the implementation of the measure had to occur within Contra Costa County. Outdoor air quality was considered an exception because the complexities of the power production grid make it extremely difficult to determine from which energy source air pollution reductions will occur due to local energy conservation actions.⁸⁹

GHG reduction measures that met the above criteria for a given health indicator were considered to have a positive effect on that indicator. GHG reduction measures could have an effect on more than one health indicator. If a measure could potentially affect a health indicator, but did not explicitly do so as written, it was marked as P (for potential). Measures that could have potential negative impacts on health were marked as PN for that category. Notes were provided as to how measures could be modified so that potential positive effects could be changed to positive effects and potential negative impacts could be addressed.

RESULTS

This section summarizes the results of the evaluation of the 93 greenhouse gas reduction measures contained in the CAP. All of the measures had a positive effect on the health indicators to a varying degree. **Table A.1** summarizes the measures that affected each health indicator. These effects are described below.

⁸⁹ I. Rhyne, California Energy Commission, telephone interview, September 2012.

Health Co-Benefit Evaluation

A

Table A.1. Summary of Measures by Health Criteria

Health Indicator	Healthy Food	Physical Activity, Walkability, Bikeability	Outdoor Air Quality	Indoor Air Quality	Improved Access	Green Space	Job Creation	Climate Risk Adaptation	Health Equity
Reduction Measures	LUT 5.1	EE 4.1	ALL	EE 1.1	LUT 1.1	EE 4.1	EE 5.3	EE 1.1	EE 1.3
	LUT 5.2	EE 4.5		EE 1.2	LUT 1.4	EE 4.5		EE 1.2	EE 1.4
	LUT 5.3	LUT 1.1		EE 1.3	LUT 1.5	LUT 5.1		EE 1.3	EE 5.2
	LUT 5.4	LUT 1.2		EE 1.4	LUT 1.6	LUT 5.2		EE 1.4	RE 3.2
	LUT 5.5	LUT 1.3		EE 1.6	LUT 1.8	LUT 5.3		EE 1.6	LUT 1.2
	LUT 5.6	LUT 1.4		EE 2.1	LUT 4.1	LUT 5.4		EE 2.1	LUT 1.7
		LUT 1.5		EE 2.2	LUT 4.5	LUT 5.5		EE 2.2	LUT 2.1
		LUT 1.6		EE 2.3		LUT 5.6		EE 2.3	LUT 3.1
		LUT 1.7		EE 2.4				EE 2.4	LUT 3.3
		LUT 1.8		EE 2.5				EE 2.5	LUT 4.2
		LUT 4.1		EE 2.6				EE 2.6	W 1.5
		LUT 4.4		EE 2.7				EE 2.7	W 2.1
		LUT 4.5		EE 3.1				EE 3.1	W 2.2
		LUT 4.6		EE 3.2				EE 3.2	GO 5.5
		GO 2.4		EE 5.3				EE 4.1	
				RE 3.1				EE 4.2	
				RE 3.2				EE 4.3	
				LUT 2.1				EE 4.4	
				LUT 3.1				EE 4.5	
				LUT 3.2				EE 5.3	
				LUT 3.3				RE 3.1	
				LUT 3.4				RE 3.2	
				LUT 4.2				LUT 5.1	
				LUT 4.4				LUT 5.2	
				W 1.5				LUT 5.3	
				W 2.2				LUT 5.4	
				GO 2.1				LUT 5.5	
								WE 1.1	
								WE 1.2	
								WE 2.1	
								WE 2.2	
								GO 2.1	
								GO 3.1	
								GO 3.2	

Health Co-Benefit Evaluation

Measures that Increased the Availability of Healthy Food—Only six measures explicitly increased the availability of healthy food. These measures call on the county to support farmers markets, community and school gardens, and other agricultural practices; create partnerships and discourage schools from being sited in agricultural areas.

Measures that Promote Physical Activity, Walkability and Bikeability—Fifteen of the measures promoted physical activity, walkability, and bikeability. Some measures did so directly, by providing safer and more convenient sidewalks, streets, and paths on which to walk and bike. Some measures recommend improving transit service which can also increase physical activity because transit users must walk or bike to transit stops, and because good transit can make it possible to live without a car. Other measures increased physical activity in less intuitive, but no less powerful ways. Some measures, for instance, recommended increasing density near public transportation which can increase physical activity by allowing more people to live within walking distance of transit stops.

Eight measures that promoted physical activity, walkability, and bikeability also had the potential to have a negative health impact. By increasing the number of walkers and bikers these actions also increased the risk of accidents, especially between bikers and walkers, and cars. This potential negative impact could be mitigated by ensuring that proper actions are taken to improve bike and pedestrian safety.

Measures that Improved Outdoor Air Quality—All of the proposed measures reduced outdoor air pollution, either directly or indirectly. Measures that directly reduce outdoor air pollution are those that reduce the use of cars, trucks or other sources that burn fossil fuels, or reduce the emission of air pollutants from sources at the same time as reducing their GHG emissions through control technologies or efficiency, such as at landfills or industrial sources. Indirect reductions occur when the implementation of a measure reduces the need to generate electricity through conservation or energy efficiency actions, or creates alternative sources of energy that do not burn fossil fuels. Since much of the electricity used in Contra Costa County is currently generated by the burning of fossil fuels, increasing energy conservation, increasing efficiency, or creating alternative sources of electricity will result in the reduction of the pollution associated with the burning of fossil fuels.

Two measures had the potential to increase outdoor air quality risks by possibly creating new sources of outdoor air pollution within the county. Two other measures had the potential to increase outdoor and indoor air quality health risks by encouraging housing and work production in areas potentially located too close to sources of air pollution. These risks could be minimized by limiting development close to sources of air pollution, and/or through appropriate mitigation measures (see Priority Measures 3 for more details).

Measures that Improved Indoor Air Quality—Twenty seven of the measures improved indoor air quality. Seventeen of these measures would help improve energy efficiency in buildings which can also help prevent the intrusion of particulate matter. Ten of the measures reduced sources of particulate matter near residential areas, which will help reduce indoor levels of these pollutants.

Two measures had the potential to increase indoor air quality health risks by encouraging housing and commercial production in areas potentially located too close to sources of air pollution.

Health Co-Benefit Evaluation

A

Measures that Improved Access to Jobs, Services, and Other Necessities—Seven measures improved access to jobs, services, and other necessities. There are two types of measures that increase access to jobs and services. The first type includes actions that increase mobility. In other words, these measures make it easier for Contra Costa residents to travel to their destinations. Some of the measures proposed in the CAP, particularly those in the Land Use and Transportation section, help to increase mobility—for instance, by providing more transit options and establishing walking and biking connections, or enabling “virtual mobility” through telecommuting.

Other recommended measures increase access by reducing the distance to destinations. Jobs, housing, healthcare, or other services are far easier to reach when they are clustered near housing. This clustering is particularly important for people without cars, who must depend on transit, bicycles, carpools, or their own feet to reach destinations. A number of the actions included in this plan help to achieve this result by increasing densities and infill development, ensuring that housing and services are co-located.⁹⁰

Measures that Increased Green Space—Eight measures increased green space. One measure recommended creating greener urban spaces, sidewalks, and streets by increasing shading vegetation. Several measures promoted community gardens and other agricultural spaces. A third measure promoted infill development which can preserve green spaces by diverting development that would otherwise be built on “greenfield” lots. Four other measures had the potential to increase green space, primarily by ensuring that development plans specifically address the development of green space.

Measures that Promoted Job Creation—One energy-efficiency measure in the CAP had a job creation element in it. This measure calls for programs to train local residents in energy-efficiency retrofits, weatherization, and green building careers. Three other measures had the potential to promote job creation if they were modified to include job training and development programs.

Measures that Addressed Climate Risk Reduction—Thirty four measures addressed climate risk reduction. As detailed in Chapter 2 of the CAP, the changing climate is projected to have wide-ranging negative public health impacts. These include negative impacts on air quality; increases in extreme heat, average temperature, severe weather events such as flooding and wildfires; and risks to food security from drought, and changing patterns and yields of crops. Therefore, a measure could help reduce the health risks of climate change by addressing any one of these impacts.

All of the proposed measures reduced outdoor air pollution, either directly or indirectly, as discussed in the Outdoor Air Quality section above. This will be most beneficial for reducing the predicted increases in ozone pollution caused by hotter weather. (See Chapter 2 of the CAP for more details.) Seventeen measures included elements to reduce building energy use through better insulation and weatherization practices. This can help keep homes and commercial buildings without air conditioners cooler during extreme heat events, and lower the cost of cooling for those buildings with air conditioners. Two measures encouraged the shading of buildings and pavement with vegetation, and two measures encouraged the increased use of cool roofs and cool pavement materials in order to

⁹⁰ Shoup, Donald. 2011. The High Cost of Free Parking. Chicago, IL: American Planning Association.

Health Co-Benefit Evaluation

reduce the urban heat island effect. All of these measures will help keep internal building temperatures lower during extreme heat events. Eleven measures encouraged water conservation or urban agriculture, which will help reduce the impacts of drought.

Measures that Improved Health Equity— Fourteen of the measures improved health equity. Five of these measures specifically benefited low-income populations, and eight targeted air quality improvements for low-income, minority populations,

Twenty five measures had the potential to improve health equity if they were modified appropriately, primarily by targeting the benefit of the action more specifically to a vulnerable population or area. These modifications included such factors as targeting training programs specifically in low-income areas, targeting built environment improvements for vulnerable populations, emphasizing increased bus ridership, and incorporating crime prevention actions and targeting outreach in culturally appropriate ways in multiple languages. Two measures were also identified as having the potential to increase health inequity by increasing air pollution in already impacted predominately low-income, minority communities.

PRIORITY MEASURES AND RECOMMENDATIONS

Based on the above evaluation of the potential health benefits of the CAP's GHG reduction measures, CCHS has concluded that four types of measures provided the highest benefit to human health. These were measures that significantly promoted the following outcomes:

- Increased Walking and Biking
- Increased Public Transportation
- Increased Infill Development
- Health Equity

In prioritizing these types of measures, CCHS considered several factors:

Health Indicators: In the evaluation above, did measures show the potential to positively affect a number of health indicators?

Significant Impact: Where the evaluation found the measures had potential positive effects, were these effects likely to have a significant impact on human health?

Structural Change: Will the effects of the measures be wide-scale and long-lasting, and will they help to change the underlying conditions that contribute to poor health?

Public Health Mission Consistency: Do the measures match CCHS's policies, mission, and mandate?

Community Input: Were the measures supported by Contra Costa residents during community workshops and by the Public and Environmental Health Advisory Board?

Health Co-Benefit Evaluation

A

This section outlines why these outcomes are priorities. It also lists the individual measures which promoted each outcome. It is the intention of this document to help guide Contra Costa County in the adoption and implementation of its CAP. Toward this end, this section also makes recommendations about how these measures can best support health and safety. **Table A.2** identifies priority measures for each of the priority outcomes.

Table A.2. Measures to Achieve Priority Outcome

Walking and Biking	Public Transportation	Infill Development	Health Equity
EE 4.1	LUT 1.1	LUT 4.5	EE 1.3
EE 4.5	LUT 1.7	LUT 5.6	EE 1.4
LUT 1.1	LUT 4.1	GO 2.4	LUT 1.7
LUT 1.2	LUT 4.5	GO 5.5	EE 5.2
LUT 1.3	LUT 4.6		RE 3.2
LUT 1.4	GO 5.5		LUT 1.2
LUT 1.5			LUT 2.1
LUT 1.6			LUT 3.1
LUT 1.7			LUT 3.3
LUT 1.8			LUT 4.2
LUT 4.1			W 1.5
LUT 4.4			W 2.1
LUT 4.5			W 2.2
LUT 4.6			GO 5.5
GO 2.4			
GO 5.5			

1. Increased Walking and Biking

Health Indicators

This evaluation found the walking and biking improvement measures to be associated with four health indicators. By their nature, these actions improve physical activity, as well as make such activity safer. By shifting some trips from cars, bike and pedestrian improvements can also improve air quality. While these improvements are sometimes targeted toward recreation, they can also facilitate access to goods and services by making it easier and safer to walk or bike to jobs, schools, healthcare, family, transit stops, or other destinations. Finally, since lower-income people must often depend on walking (and to a lesser extent biking) to get around, investments in walking and biking have the potential to contribute to health equity.

Significant Impact

Physical activity has been shown to have a powerful influence on a variety of health outcomes including lower mortality, lower risk of cardiovascular diseases, lower risk of diabetes, lower risk of some cancers, improved mental

Health Co-Benefit Evaluation

health, and healthier bones, muscles and joints (see Section III for more details). A recent study estimated the potential cost savings from the health benefits of dramatically increasing Bay Area physical activity at \$34 billion annually.⁹¹

Improving walking and biking safety can also have a significant effect on injury rates. As of 2007, traffic accidents (involving cars, bikes, and pedestrians) were the leading cause of injury deaths in Contra Costa County.⁹² Investments in bike and pedestrian safety can dramatically reduce these rates.

Structural Change

In conjunction with other policies, such as infill development and transit service, improving walking and biking conditions can also help to alter the long-term patterns of automobile dependence and sprawl that exact high societal health costs such as air pollution, accidents/injuries, diabetes and obesity, cardiovascular disease, urban heat island effects, poor mental health, and exclusion from opportunity.⁹³

Contra Costa Health Services Mission Consistency

Improving biking and walking conditions is consistent with the goals and strategies of the Community Wellness and Prevention Program's Injury Prevention and Physical Activity Promotion Project.⁹⁴

Community Input

"Diverse, low-cost transportation options" received extremely high public support during the open house process, as did "bicycle and pedestrian improvements" specifically.

Priority Walking and Biking Measures

EE 4.1 - Encourage multi-family residential and nonresidential development to increase use of higher-albedo materials for surfaces including roofs, parking areas, driveways, roads, and sidewalks.

EE 4.5 - Support community programs to plant and maintain trees in urban and rural areas.

LUT 1.1 - Collaborate with local transportation, land use agencies, nonprofits, and other stakeholders to expand bicycle and pedestrian facilities and existing public transportation (Bay Area Rapid Transit, Amtrak, AC Transit, County Connection, and Tri Delta Transit).

LUT 1.2 - Identify funding sources and assist with Safe Routes to School Program implementation.

LUT 1.3 - Work with the Contra Costa Transportation Authority, local school districts, and advocacy organizations such as the East Bay Bicycle Coalition to encourage bicycle safety classes in all schools.

⁹¹ Maizlish, Niel. 2011. Health Co-Benefits in Transportation-Related Reductions in Greenhouse Gas Emissions in the Bay Area: Technical Report. Richmond, Ca: Center for Chronic Disease Prevention and Health Promotion, California Department of Public Health.

⁹² Contra Costa Health Services. http://cchealth.org/health-data/hospital-council/2010/pdf/40_fatal_and_nonfatal_injury.pdf.

⁹³ Frumpkin, Howard. 2001. "Urban Sprawl and Public Health" *Public Health Reports* 117.

⁹⁴ See for instance: http://cchealth.org/injury-prevention/pdf/life_cycle.pdf

Health Co-Benefit Evaluation

A

LUT 1.4 - Update County road standards, as opportunities arise, to accommodate all modes of transportation in local street designs (i.e., complete streets). Implement standards as part of routine maintenance and striping.

LUT 1.5 - Through periodic updates to the Contra Costa Transportation Authority's Countywide Bicycle and Pedestrian Plan, identify opportunities to improve access to community-wide bicycle and pedestrian networks by closing gaps in the network, removing barriers, and providing additional bike- and pedestrian-oriented infrastructure.

LUT 1.6 - Cooperate with the Contra Costa Transportation Authority and adjoining jurisdictions in updating and implementing the Countywide Bicycle and Pedestrian Plan and local plans.

LUT 1.7 - Revise the County CEQA guidelines to reflect implementation of Senate Bill 743.

LUT 1.8 - Establish a 2020 mode share goal for bicycling by a Board of Supervisors resolution, identify specific actions to reach the goal, integrate the goal into future General Plan updates, and appeal to other agencies to adopt the same goal.

LUT 4.1 - Collaborate with BART and other transit providers to increase ridership in the county.

LUT 4.4 - Continue to promote voluntary trip reduction programs such as school buses, Rideshare, Spare-the-Air Days, Bike to Work Day, employer shuttles, and alternative work schedules.

LUT 4.5 - Work to increase densities within half a mile of BART and Amtrak stations, and within a quarter of a mile of stops for express bus routes.

LUT 4.6 - Prioritize alternative mode access to BART and other transit stations.

GO 2.4 - Site facilities that have more than 50 personnel in close proximity to infrastructure and services that support alternative commute modes.

GO 5.5 - Advocate for regional, state, and federal activities that support GHG emissions in the county, including but not limited to the following:

- Work with BAAQMD to support reductions in process emissions from industrial entities.
- Where appropriate, adopt language in the County's state and federal legislative platforms that directs support and lobbying for local GHG reductions.
- Advocate for additional transit funding sources concurrently with the development of priority development areas.

Implementation Recommendations to Best Support Health and Safety

There are a number of ways in which bike and pedestrian improvement measures can be implemented in such a way as to improve health and safety in Contra Costa County. Specifically, these measures should target areas where low rates of car-ownership, high biking and walking rates, and inappropriate infrastructure yield high injury rates. Improvements should also be targeted and designed to facilitate access for seniors and people with disabilities who might otherwise be unable to navigate their neighborhoods. Additionally, as more people begin to walk and bike, more people will be exposed to potential injury by automobiles. Therefore, GHG reduction measures should be implemented in a manner that makes it safer, as well as easier, to walk and bike. Finally, Contra Costa County should take every opportunity to provide additional green space when implementing bike and pedestrian plans, particularly in areas with few parks.

2. Increased Public Transportation

Health Indicators

This evaluation identified a wide range of health indicators associated with transit improvement measures. Specifically, public transit encourages physical activity because transit users usually walk or bike to their stop and helps to create an urban environment where it is possible to live without an automobile. Transit can also significantly improve air quality by shifting trips from cars. Perhaps most importantly, public transportation can help to improve access to jobs, healthcare and other services. Since transit often provides access to these necessities to those without cars or with limited mobility, it can also help to improve health equity.

Significant Impact

The effects above are likely to have a significant impact on human health. A 2005 study found that transit users spend an average of 19 minutes a day walking to transit, and that 29% met the Surgeon General's recommendation of 30 minutes of daily physical activity simply by riding transit.⁹⁵ As illustrated in the section above, increasing physical activity is expected to yield especially large health dividends.

Transit service can also have a large impact on health by providing access to essential goods and services. This is particularly true for Contra Costa households with no (6%) or only one (29%) household vehicle⁹⁶ (see Figure A.13). A number of researchers have found that good transportation is essential to finding and keeping jobs, facilitating the economic well-being that is essential for good health.^{97,98} Similarly, public buses (as opposed to yellow school buses) currently carry 6% of Contra Costa County students to school.⁹⁹

While many Contra Costa residents also depend on public transit to get to healthcare services and healthy food, significant improvements are needed. In a study of low-income Bay Area neighborhoods, researchers found that only 20% of Contra Costa neighborhoods studied had transit access to a hospital, and only 33% had access to a clinic.¹⁰⁰ These numbers are confirmed by another study that found that 24% of missed appointments at Contra Costa County

⁹⁵ Besser, L and Dannenberg, A. 2005. "Walking to Public Transit: Steps to Help Meet Physical Activity Recommendations." *American Journal of Preventative Medicine* 29(4),273-280.

⁹⁶ United States Census Bureau, 2006-2010 American Community Survey.

⁹⁷ Kawabata, M. 2002. "Job accessibility by travel mode in U.S. metropolitan areas." *Papers and Proceedings of the Geographic Information Systems Association*. Vol. 11, p115-120,

⁹⁸ Ong, P., D. Houston. 2002. "Transit, employment, and women on welfare." *Urban Geography* Vol. 23, p344-364.

⁹⁹ Contra Costa County Transportation Authority. 2012. *Contra Costa County Draft Safe Routes to School Master Plan*.

¹⁰⁰ Center for Third World Organizing, People United for a Better Oakland, and the Transportation and Land Use Coalition. 2002. *Roadblocks to Health*. Oakland, CA: Transportation and Land Use Coalition. <http://transformca.org/files/reports/roadblocks-to-health.pdf>.

Health Co-Benefit Evaluation

A

evening clinics were due to transportation difficulties.¹⁰¹ Similarly, many Contra Costa County neighborhoods have few affordable, healthy stores, forcing residents to shop at stores with higher prices and less healthy foods.¹⁰²

Structural Change

In conjunction with other policies, such as infill development and bike and pedestrian improvements, improving transit service can also help to alter the long-term patterns of automobile dependence and sprawl that exact high societal health costs such as air pollution, accidents/injuries, diabetes and obesity, cardiovascular disease, urban heat island effects, poor mental health, and exclusion from opportunity.¹⁰³

Contra Costa Health Services Mission Consistency

Improving public transit is consistent with the goals and strategies of the Community Wellness and Prevention Program's Injury Prevention and Physical Activity Promotion Project.¹⁰⁴

Community Input

"Diverse, low-cost transportation options" received extremely high public support during the open house process.

Priority Public Transit Measures

LUT 1.1 - Collaborate with local transportation, land use agencies, nonprofits, and other stakeholders to expand bicycle and pedestrian facilities and existing public transportation (Bay Area Rapid Transit, Amtrak, AC Transit, County Connection, and Tri-Delta Transit).

LUT 1.7 - Revise the County CEQA guidelines to reflect implementation of Senate Bill 743.

LUT 4.1 - Collaborate with BART and other transit providers to increase ridership in the county.

LUT 4.5 - Work to increase densities within half a mile of BART and Amtrak stations, and within a quarter of a mile of stops for express bus routes.

LUT 4.6 - Prioritize alternative mode access to BART and other transit stations.

GO 5.5 - Advocate for additional transit funding sources concurrently with the development of priority development areas.

Implementation Recommendations to Best Support Health and Safety

This evaluation suggests that improving public transit has the potential to dramatically improve the health of Contra Costa residents. However, these potential benefits will only be realized if these measures are implemented

¹⁰¹ Butrick, Elizabeth. 1999. "Factors in Nonattendance in Extended Evening Clinics in Contra Costa County." Unpublished paper for Contra Costa Health Services. This study examined the reasons patients missed appointments at CCHS's Extended Evening Clinics located in Richmond, Martinez, and Pittsburg.

¹⁰² Morland, Kimberly, et al. 2002. "Access to Healthy Foods Limited in Poor Neighborhoods." *American Journal of Preventative Health*.

¹⁰³ Frumpkin, Howard. 2001. "Urban Sprawl and Public Health." *Public Health Reports* 117.

¹⁰⁴ http://cchealth.org/injury-prevention/pdf/planning_healthy_communities.pdf

Health Co-Benefit Evaluation

strategically and with an attention to health. In order to accomplish this goal, CCHS suggests public transit measures be implemented with the following considerations in mind:

- First, the health benefits of public transit accrue only to the extent that people use it. Therefore, the County should prioritize cost-effective transit service (such as basic bus service) that maximizes patronage for a minimum investment.
- Second, since transit improves health largely by increasing access, investments should be focused on areas with low access—where car ownership is low (see Figure A.13) and where people with disabilities and seniors are concentrated (see Figure A-10).
- Third, the potential negative health effects of public transit also deserve consideration. By its nature, transit encourages walking or biking, exposing more people to automobile traffic. Transit improvements should therefore be accompanied by investments in bike and pedestrian safety. While many transit vehicles produce no or few emissions, many still burn diesel fuel. Every effort should be made to encourage clean fuel use, and to assign cleaner vehicles to areas already overburdened by poor air quality.¹⁰⁵

3. Increased Infill Development

Health Indicators

This evaluation found the infill development measures to be associated with four health indicators. Dense neighborhoods have been consistently found to increase physical activity by bringing people closer to destinations, making it easier to travel by foot or by bike,¹⁰⁶ and improving access,¹⁰⁷ particularly for those without cars. In the same way, these neighborhoods discourage car trips, improving regional air quality. Finally, by focusing growth in defined centers rather than sprawling outward, infill development can help to preserve open space.

Significant Impact

While changes to urban form often take decades to solidify, infill development is likely to have a significantly positive long-term impact on human health. In an exhaustive analysis of existing literature, Ewing and Cervero found that doubling density yields, on average, a 7% increase in walking and a 5% decrease in vehicle miles traveled.¹⁰⁸ This suggests that long-term changes to Contra Costa County's built environment are likely to yield significant, if modest, increases in physical activity and decreases in air pollution.

¹⁰⁵ See for instance: Muni's Clean Air Programs : <http://www.sfmta.com/cms/rclean/cleanairb.htm>

¹⁰⁶ Ewing, Reid and Robert Cervero. 2010. "Travel and the Built Environment: A Meta-Analysis." *Journal of the American Planning Association* 6(3) 265-294.

¹⁰⁷ Walker, Jarrett. 2011. *Human Transit*. Island Press, Washington.

¹⁰⁸ Ewing, Reid and Robert Cervero. 2010. "Travel and the Built Environment: A Meta-Analysis." *Journal of the American Planning Association* 6(3) 265-294.

Health Co-Benefit Evaluation

A

Structural Change

In conjunction with other policies, such as enhanced transit service and bike and pedestrian improvements, increasing infill development can also help to alter the long-term patterns of automobile dependence and sprawl that exact high societal health costs such as air pollution, accidents/injuries, diabetes and obesity, cardiovascular disease, urban heat island effects, poor mental health, and exclusion from opportunity.¹⁰⁹

Contra Costa Health Services Mission Consistency

Encouraging infill development is consistent with the goals and strategy of the Community Wellness and Prevention Program's Injury Prevention and Physical Activity Promotion Project.¹¹⁰

Community Input

Most measures encouraging infill development received moderate to high public support during the open house process.

Priority Infill Development Actions

LUT 4.5 - Work to increase densities within half a mile of BART and Amtrak stations, and within a quarter of a mile of stops for express bus routes.

LUT 5.6 - Continue to discourage schools being sited in agricultural areas.

GO 2.4 - Site facilities that have more than 50 personnel in close proximity to infrastructure and services that support alternative commute modes.

GO 5.5 - Advocate for additional transit funding sources concurrently with the development of priority development areas.

Implementation Recommendations to Best Support Health and Safety

While infill development has the potential to dramatically improve the health of Contra Costa County residents, it can also negatively impact health if implemented without proper protections. When cities are successful in attracting new, dense, walkable, mixed-use neighborhoods, lower-income residents—those most vulnerable to health problems—are often pushed out by new, unaffordable housing and rising rents. These residents are therefore not able to benefit from the new, healthier environment. They may be separated from jobs, schools, healthcare, healthy food access, social and familial networks, and are often displaced to a neighborhood or community with its own specific health risks. Dislocation itself may also expose former residents to isolation, stress, injuries, violence, and other health impacts. As the risks of displacement are well documented in the Bay Area,¹¹¹ Contra Costa County should be careful to implement infill development in low-income neighborhoods only when accompanied by

¹⁰⁹ Frumpkin, 2001

¹¹⁰ See for instance: http://cchealth.org/injury-prevention/pdf/planning_healthy_communities.pdf.

¹¹¹ Cravens, M., et al. 2009. Development Without Displacement, Development with Diversity. Oakland, CA: Association of Bay Area Governments.

Health Co-Benefit Evaluation

measures to stabilize renters and homeowners, and to encourage the development of housing affordable to all income levels—especially current residents.

Care must also be taken to mitigate the potential for infill development to increase exposure to air pollution. While infill development has been shown to decrease regional vehicle travel and emissions, by placing more people close to streets, highways, transit and freight lines, it can increase local exposure to pollutants.^{112, 113} Several of the unincorporated areas currently designated for infill development (Priority Development Areas, or PDAs) such as North Richmond are already considered by the Bay Area Air Quality Management District to be burdened by high air pollution.¹¹⁴ Nearly all other PDAs in Contra Costa County are adjacent to freeways, industrial uses, and/or freight facilities. Further analysis should be conducted to evaluate the relative risks in these areas and determine areas appropriate for development. In the absence of such detailed analysis, the County should require developers to use appropriate mitigation measures when building within 500 feet of freeways or designated truck routes, 1,000 feet of distribution centers or rail yards, or adjacent to ports, refineries or similar facilities, as per CARB's recommendations.¹¹⁵

4. Health Equity

Health Indicators

Unlike the other priority measure types discussed above, which focused on single issues, a wide variety of measures may influence health equity by placing the emphasis on the most vulnerable populations in the county. These may include young children, the elderly and disabled, the poor, and minorities. The 13 measures in the CAP that directly contributed to improving health equity did so through programs that protected vulnerable populations from indoor and outdoor air pollution and targeted job creation. However, 25 other measures had the potential to improve health equity if they were modified appropriately, primarily by targeting the benefit of the action more specifically to a vulnerable population or area. These modifications include such factors as targeting training programs specifically in low-income areas, targeting built environment improvements toward vulnerable populations, emphasizing increased bus ridership, and incorporating crime prevention measures.

¹¹² Schweitzer, Lisa and Jiangping Zhou. 2010. "Neighborhood Air Quality, Respiratory Health, and Vulnerable Populations in Compact and Sprawled Regions." *Journal of the American Planning Association* 76(3) 363-371.

¹¹³ Downs, A. 2004. "Remedies that increase residential densities." In A. Downs (ed.), *Still stuck in traffic: Coping with peak-hour traffic congestion* (pp. 200-227). Washington, D.C.: Brookings Institution Press.

¹¹⁴ Garzón, Catalina and The Ditching Dirty Diesel Freight Transport Committee. 2011. *At a Crossroads in Our Region's Health: Freight Transport and the Future of Community Health in the San Francisco Bay Area*. Oakland, CA: Pacific Institute.

¹¹⁵ See: <http://www.arb.ca.gov/ch/handbook.pdf>

Health Co-Benefit Evaluation

A

Significant Impact

The Bay Area Regional Health Inequities Initiative has created a model for understanding that health inequities are primarily caused by social and environmental conditions, called the social determinants of health.¹¹⁶ Social determinants of health are conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks. Conditions (e.g., social, economic, and physical) in these various environments and settings (e.g., school, church, workplace, and neighborhood) have been referred to as “place.” In addition to the more material attributes of “place,” the patterns of social engagement and sense of security and well-being are also affected by where people live. Resources that enhance quality of life can have a significant influence on population health outcomes. Examples of these resources include safe and affordable housing, access to education, public safety, availability of healthy foods, local emergency/health services, and environments free of life-threatening toxins.¹¹⁷ Therefore, prioritizing actions that address these resources can have a significant impact on reducing health inequity.

¹¹⁶ Bay Area Regional Health Inequities Initiative. 2008. Health Inequities in the Bay Area. http://www.barhii.org/press/download/barhii_report08.pdf.

¹¹⁷ US Department of Health and Human Services. Healthy People 2020. <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=39>.

Structural Change

The root causes of most health disparities are the broader, long-term inequalities within society including poverty and discrimination. Health disparities are often called health inequities, because they result from these broader inequities within society. Poverty and discrimination lead to stress, greater exposure to environmental toxins and poor air quality and less access to high-quality goods and services including education, health services, transportation, food and recreation. Health studies have shown that these inequalities and injustices are strongly related to higher rates of injury, illness, and premature death.¹¹⁸ Therefore, prioritizing measures that counter the effects of these social inequities can help change the underlying conditions that contribute to poor health.

Contra Costa Health Services Mission Consistency

In April 2003, after extensive review and discussion, CCHS adopted a department-wide plan called Reducing Health Disparities: Diversity and Cultural and Linguistic Competence in Contra Costa Health Services.¹¹⁹ CCHS is committed to eliminating health disparities because its mission is to care for and improve the health of all who live in Contra Costa County with special attention to those who are most vulnerable to health problems. Disparities based on race, ethnicity, language, socioeconomic status, or other reasons are inconsistent with the CCHS mission.¹²⁰ One of the goals of this plan for reducing health disparities is to engage and partner with other public entities to support healthier environments.¹²¹ The evaluation of each GHG reduction measure in the CAP for its potential to reduce health inequities was added as a health indicator in response to this element of CCHS' mission. This is especially appropriate since many of the impacts of climate change such as increased death, disease and injury from heat waves, floods, storms, and fires; decreased food quality and security; and increased morbidity and mortality associated with air pollution are predicted to disproportionately affect those who are socially and economically disadvantaged.¹²²

¹¹⁸ Contra Costa Health Services, Health Disparities Working Group: http://cchealth.org/groups/rhdi/pdf/health_disparities_in_cc.pdf

¹¹⁹ Reducing Health Disparities: Diversity and Cultural and Linguistic Competence in Contra Costa Health Service. 2003. http://cchealth.org/groups/rhdi/pdf/reducing_health_disparities_article_nov03.pdf.

¹²⁰ Contra Costa County Health Services. 2006. *Reducing Health Disparities Initiative Progress Report and Plan for 2005 and 2006*. http://cchealth.org/groups/rhdi/pdf/rhdi_report_2005_09.pdf

¹²¹ Contra Costa County Health Services. 2007. Overview of Five-year Plan for Reducing Health and Health Care Disparities, 2007-2012. http://cchealth.org/groups/rhdi/pdf/5_year_plan_pullout_2007.pdf

¹²² California Office of Environmental Health Hazard Assessment. 2010. Indicators of Climate Change in California: Environmental Justice Impacts.

Health Co-Benefit Evaluation

A

Community Input

“Reducing health disparities” received extremely high support during the open house process and from the Public and Environmental Health Advisory Board.

Priority Health Equity Actions

EE 1.3 - Increase participation in the existing low-income weatherization program and seek additional program funding.

EE 1.4 - Identify disadvantaged individuals and households for increased participation in energy efficiency programs.

EE 5.2 - Create a framework for revenues from cap-and-trade offsets or allocations to fund energy efficiency and resource conservation programs, such as those proposed in this CAP, to be used locally, particularly within recognized impacted communities or areas.

RE 3.2 - Connect low-income homeowners with renewable energy rebate and financing programs.

LUT 1.2 - Identify funding sources and assist with Safe Routes to School Program implementation.

LUT 1.7 - Revise the County CEQA guidelines to reflect implementation of Senate Bill 743.

LUT 2.1 - As opportunities arise, include alternative-fuel use goals in franchise agreements for waste hauling and contracts with other vehicle fleets.

LUT 3.1 - Work with BAAQMD to incentivize the use of battery-powered lawn and garden equipment.

LUT 3.3 - Work with BAAQMD to increase the use of alternatively fueled equipment in agricultural operations through education, incentives, or revisions to existing regulations.

LUT 4.2 - Partner with waste haulers and other fleets with regular routes to reduce the frequency of routes where possible.

W 1.5 - Identify best practices and reduce the amount of wastewater treatment sludge (biosolids) that is disposed of in landfills.

W 2.1 - Annually verify compliance with the California Air Resource Board’s landfill methane control measures.

W 2.2 - Request that landfill operators consider implementing additional reduction actions, including but not limited to:

- Reducing landfilled materials with high methane-generation potential.
- Reducing idling time for diesel equipment.

Health Co-Benefit Evaluation

- Encouraging adequate maintenance of rolling stock.
- Establishing standards beyond those required by regulation for landfill gas collection system leak detection and prevention.
- Excluding the use of green waste as a material for alternative daily cover (ADC), consistent with AB 1594.

GO 5.5 - Work with BAAQMD to support reductions in process emissions from industrial entities.

Implementation Recommendations to Best Support Health and Safety

Health inequities in Contra Costa County are significant, and will only be exacerbated by the effects of climate change. County government should take steps in all of its plans and programs to address these increased pressures on health inequities, including in this CAP. The state of California has embarked upon a similar process called Health in All Policies.¹²³

To enable the GHG reduction actions in this plan to more thoroughly address health inequities in the unincorporated portions of the county to which the plan applies, steps need to be taken to better document those inequities, identify vulnerable populations, and prioritize actions that can have the greatest benefit. The Contra Costa Health Services Department has been a recipient of the California Department of Public Health BRACE (Building Resilience Against Climate Change Effects) grant. Through this grant, the department produced a report describing heat vulnerability in the County and the potential health risks of excessive heat and high heat days predicted in Climate Change. Through BRACE, the County is encouraged to begin an adaptation planning process.

The analysis carried out by CCHS on vulnerability to heat employs biological, socio-economic, medical and living condition indicators to assess heat vulnerability at the census tract and city/place level. Several unincorporated places rank high for vulnerability to heat, including, North Richmond, Bay Point, and Bethel Island. These areas rank highly for biological and socio-economic vulnerabilities which indicate that other climate change effects will impact these populations as well. However, a more thorough analysis to expand to all climate change impacts and specific to health disparities and vulnerable populations is necessary for the rest of the unincorporated parts of the county. While it is beyond the scope of this document to conduct this analysis, it can begin to lay the groundwork for further study. Toward this end, the maps at the end of this report illustrate some of the areas with characteristics making them particularly susceptible to the impacts of climate change. Poverty, low educational attainment, race, age, social isolation, housing quality, and linguistic isolation are characteristics that have been identified as being vulnerable to the impacts of climate change.^{124, 125} Once a better understanding of the populations and areas most vulnerable to

¹²³ Health in All Policies Task Force. 2010. Health in All Policies Task Force Report to the Strategic Growth Council Executive Summary, Sacramento, CA.

¹²⁴ Climate Change: Mastering the Public Health Role. 2011. American Public Health Association pp. 79.

¹²⁵ Joint Center for Political and Economic Studies. 2012. Climate Change, Environmental Challenges and Vulnerable Communities: Assessing Legacies of the Past, Building Opportunities for the Future. http://www.jointcenter.org/docs/Climate_Change_Full_Report.pdf

Health Co-Benefit Evaluation

A

the impacts of climate change and health inequities is established, actions can be modified to address these populations and areas.

Figure A.1 identifies the percent of individuals living below two times the federal poverty level for the census tracts in the unincorporated areas of the county. **Figure A.2** identifies the percent of the population over 25 years old with less than a high school education in the census tracts of the unincorporated areas of the county. **Figures A.3 through A.6** identify the percent of individuals that are non-Hispanic white, non-Hispanic black, non-Hispanic Asian/Pacific Islanders and Hispanic respectively by census tract in the unincorporated areas of the county.

Figure A.7 identifies the percent of population under 5 years old by census tract in the unincorporated areas of the county. **Figure A.8** identifies the percent of population age 60 and older by census tract in the unincorporated areas of the county. **Figure A.9** identifies the percent of household with individuals 65 years and older living alone by census tract in the unincorporated areas of the county. **Figure A.10** identifies the percent of the population 65 years and older living alone by census tract in the unincorporated areas of the county.

Figure A.11 identifies the percent of population in renter-occupied housing by census tract in the unincorporated areas of the county. **Figure A.12** identifies median home values by census tract in the unincorporated areas of the county. **Figure A.13** identifies the percent of occupied housing units with at least one vehicle available by census tract in the unincorporated areas of the county. **Figure A.14** identifies percent of the population 5 years and older in linguistically isolated households by census tract in the unincorporated areas of the county.

Transportation access has also been identified as an indicator of vulnerability to the impacts of climate change,¹²⁶ but creating this map for the unincorporated portions of the county was outside the scope of this report.

CONCLUSIONS AND NEXT STEPS

This CAP represents an opportunity to contribute to the global effort to slow and reduce climate change. It is also an opportunity to improve the short- and long-term health of county residents. By carefully considering and integrating health concerns into the actions proposed above, the County can maximize these opportunities.

This evaluation sought to meet this goal by identifying and prioritizing actions with the highest health co-benefits, and by working alongside planners to integrate a health focus into as many actions as possible. Health-promoting actions were identified based on their capacity to influence any of the nine health indicators, as described in the methods section. These health indicators each have a demonstrable link to improved health benefits. The detailed results of this analysis were presented in **Table A.1** at the end of this report. Additionally, this evaluation identified four types of actions (Increased Walking and Biking, Increased Public Transportation, Increased Infill Development, and Health Equity) with particularly high health co-benefits. Since many health benefits follow only from careful implementation, this analysis also suggests strategies the County should follow to ensure these benefits.

¹²⁶ ASTHO Climate Change Population Vulnerability Screening Tool. California Department of Public Health. http://www.ehib.org/projects/ehss01/Climate%20change%20vulnerability%20report_ASTHO.pdf

Health Co-Benefit Evaluation

Unfortunately, however successful Contra Costa County is in reducing regional GHG emissions and maximizing health co-benefits, the fact is that the climate will nonetheless change. Decreased air quality, increased average and extreme temperatures, severe weather events such as flooding and wildfires, increased risks to food security from drought, and changing patterns and yields of crops are all likely as climate change unfolds.¹²⁷ The County will need to take strong steps and adapt to these impacts. A number of efforts are already underway. Already the County has a heat plan¹²⁸ in place and is in the process of developing a heat monitoring checklist. The heat checklist will incorporate addressing vulnerable populations. The County's Hazard Mitigation Plan addresses climate change as a subset, or secondary impact, for each identified hazard of concern¹²⁹ and updates to that plan will continue to consider climate change.

These efforts will need to be augmented by efforts to specifically understand the threats posed by climate change and to identify strategies to minimize these threats. The California Department of Public Health has published guidelines for developing local adaptations plans for climate change¹³⁰ and the County should use this guide to participate in regional adaptation efforts currently getting underway,¹³¹ and to develop its own specific adaptation plan.

¹²⁷ California Department of Public Health. 2012. Climate Action for Health: Integrating Public Health into Climate Action Planning.

¹²⁸ Contra Costa County Office of the Sheriff, Emergency Services Division. 2010. Contra Costa County Operational Area Excessive Heat Emergency Plan.

¹²⁹ Contra Costa County Hazard Mitigation Plan update, Vol. 1 Planning area wide updates. 2011. Prepared by Tetra Tech, Project #135-23736-08-090.

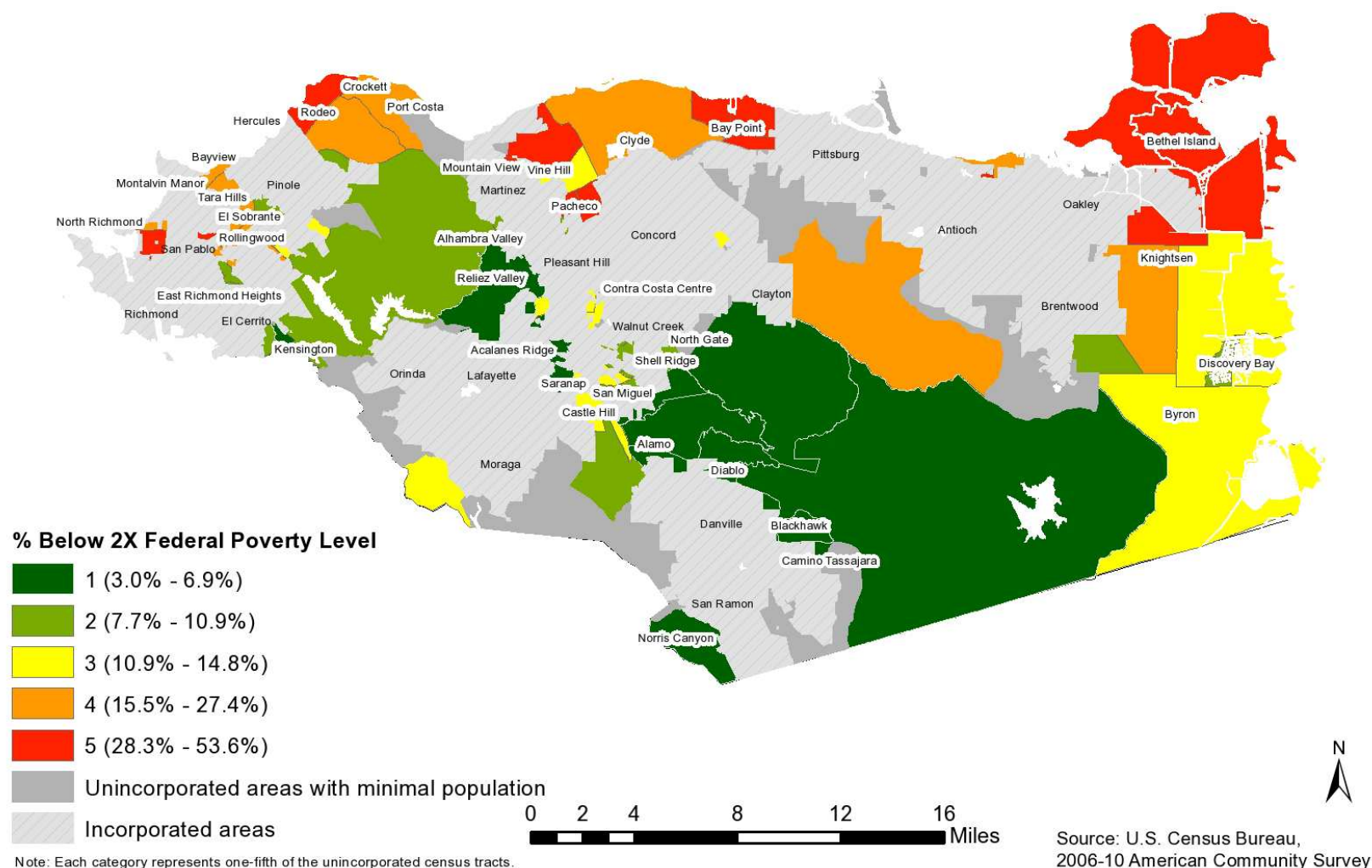
¹³⁰ California Adaptation Planning Guide. 2012.
http://www.resources.ca.gov/climate_adaptation/local_government/adaptation_policy_guide.html.

¹³¹ Bay Area Joint Policy Committee, Bay Area Climate & Energy Resilience Project. <http://www.abag.ca.gov/jointpolicy/projects.html#climate>.

Health Co-Benefit Evaluation

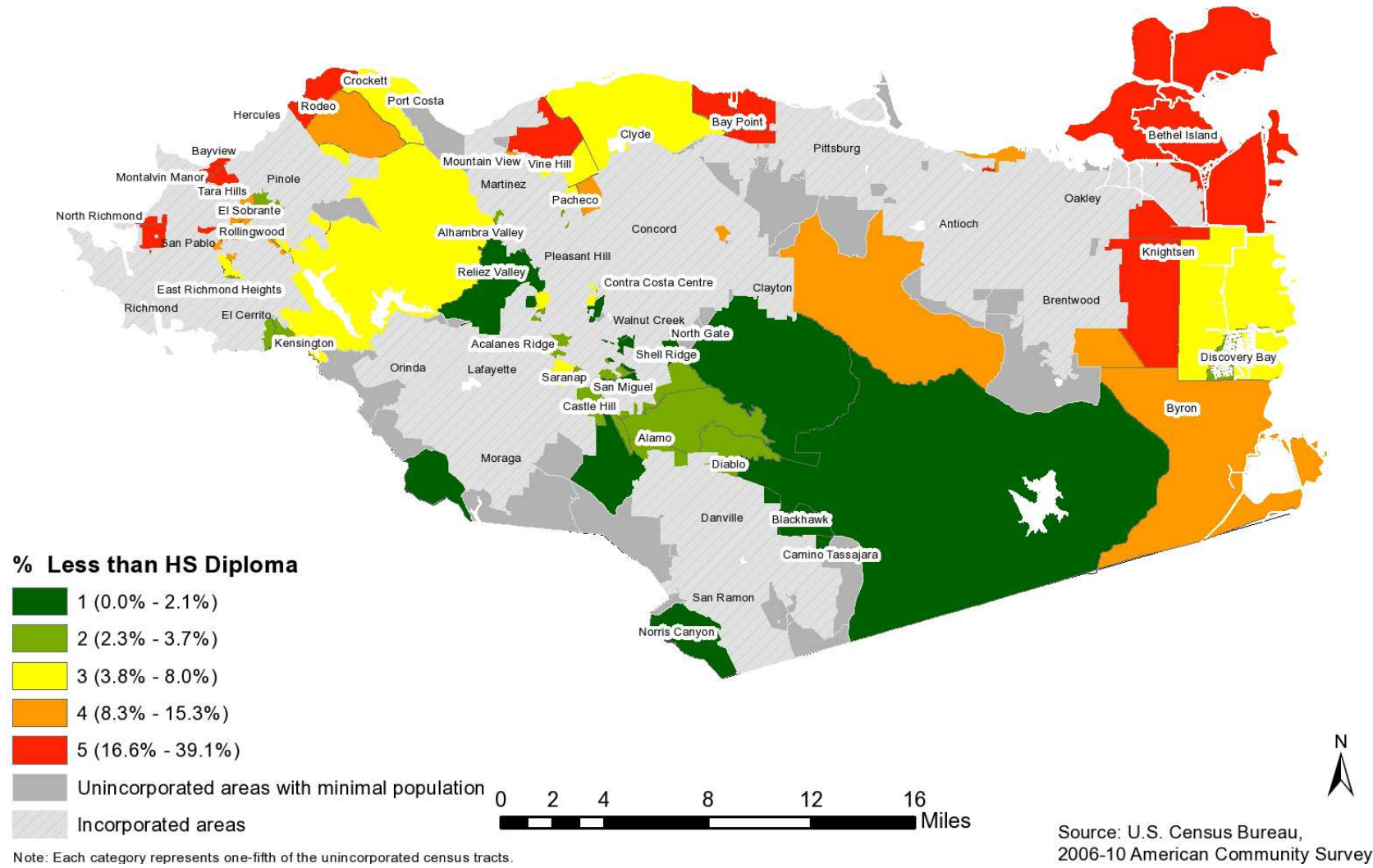
A

Figure A.1. Percent of Individuals Living Below Two Times the Federal Poverty Level, 2006-2010



Health Co-Benefit Evaluation

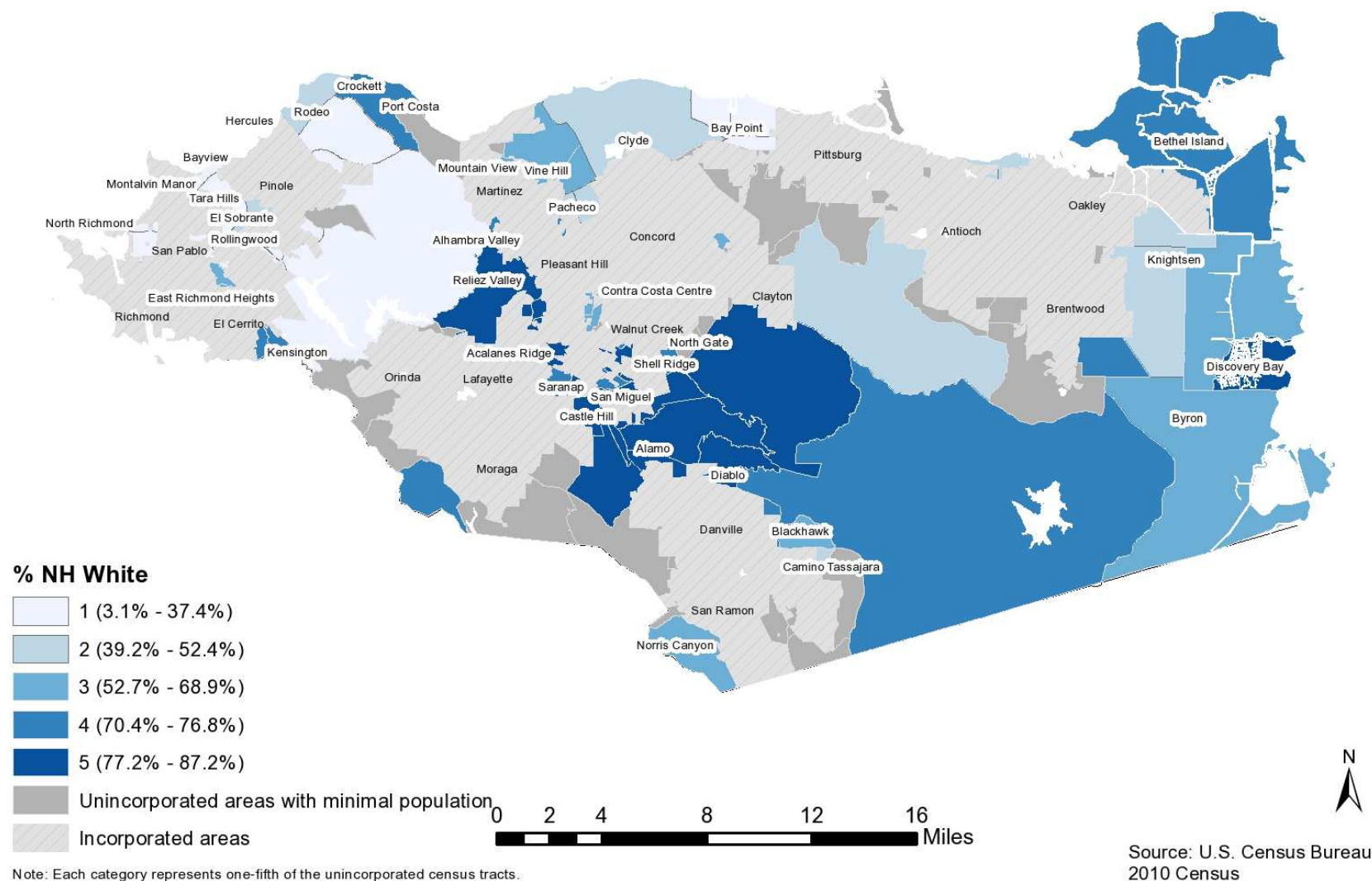
Figure A.2. Percent of Individuals over 25 Years with Less than a High School Education, 2006-2010



Health Co-Benefit Evaluation

A

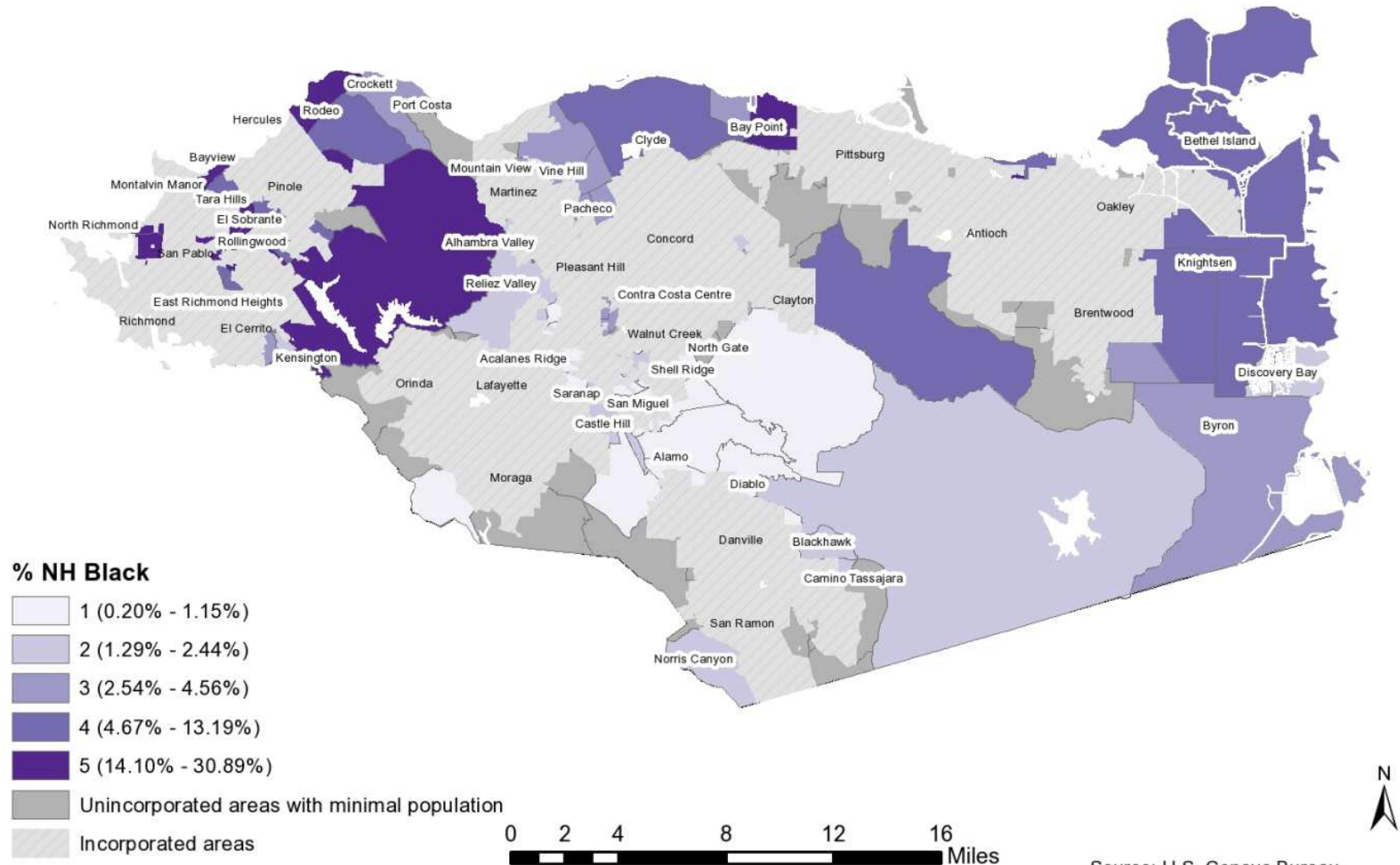
Figure A.3. Percent of Non-Hispanic White, 2010



Note: Each category represents one-fifth of the unincorporated census tracts.

Health Co-Benefit Evaluation

Figure A.4. Percent of Non-Hispanic Black, 2010

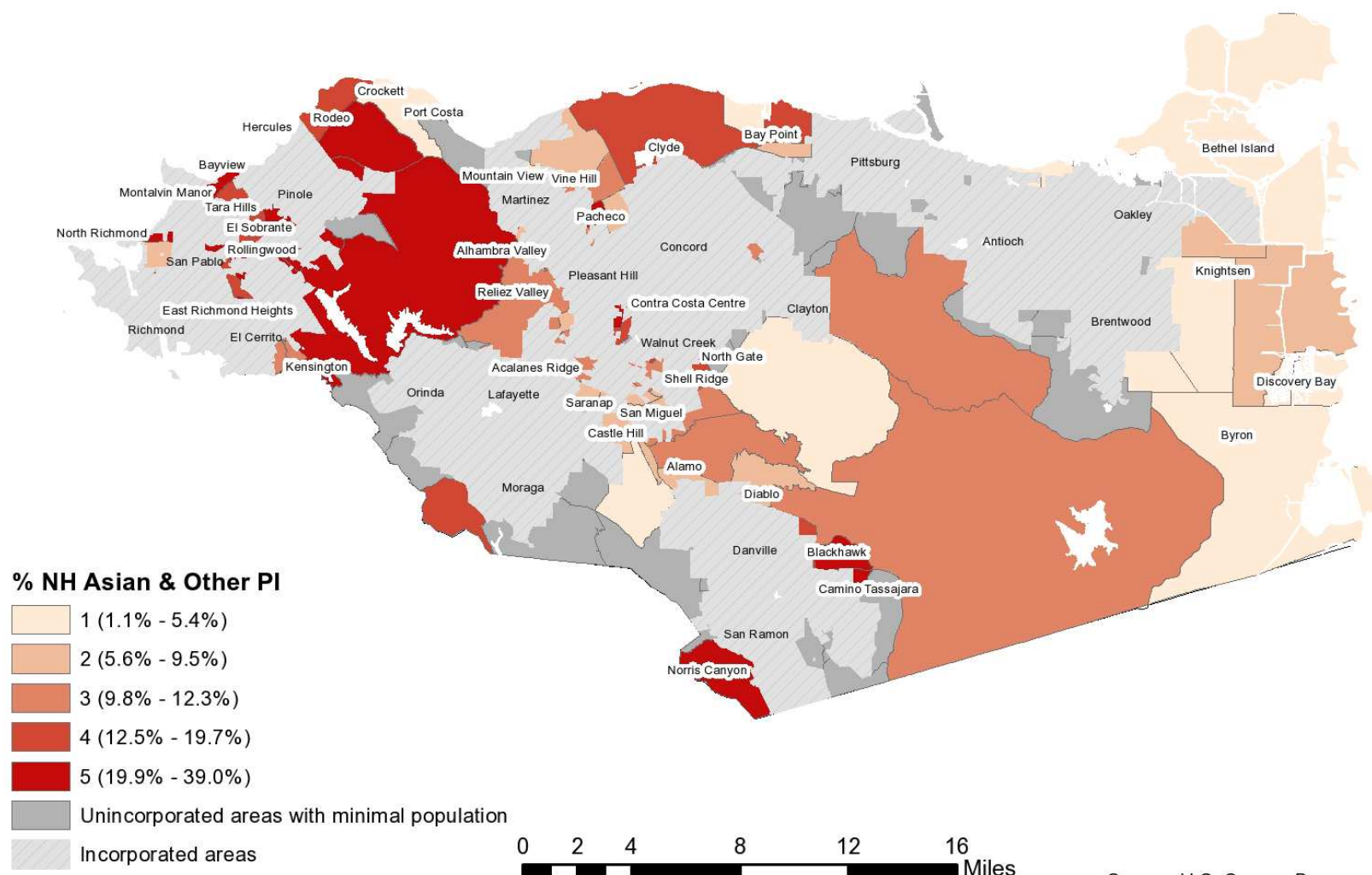


Note: Each category represents one-fifth of the unincorporated census tracts.

Health Co-Benefit Evaluation

A

Figure A.5. Percent of Non-Hispanic Asian/Pacific Islander, 2010

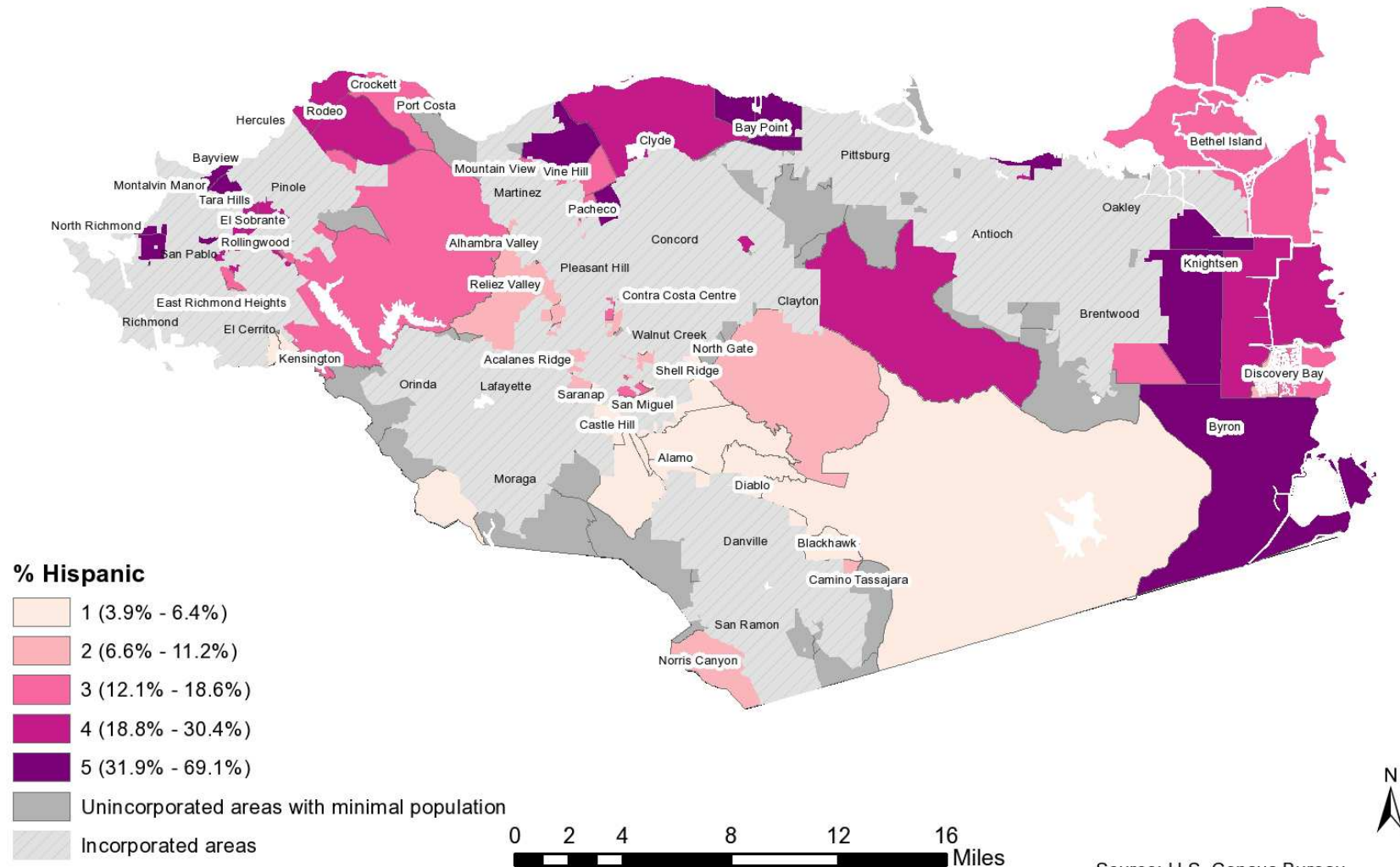


Note: Each category represents one-fifth of the unincorporated census tracts.

Source: U.S. Census Bureau, 2010 Census

Health Co-Benefit Evaluation

Figure A.6. Percent of Hispanic, 2010

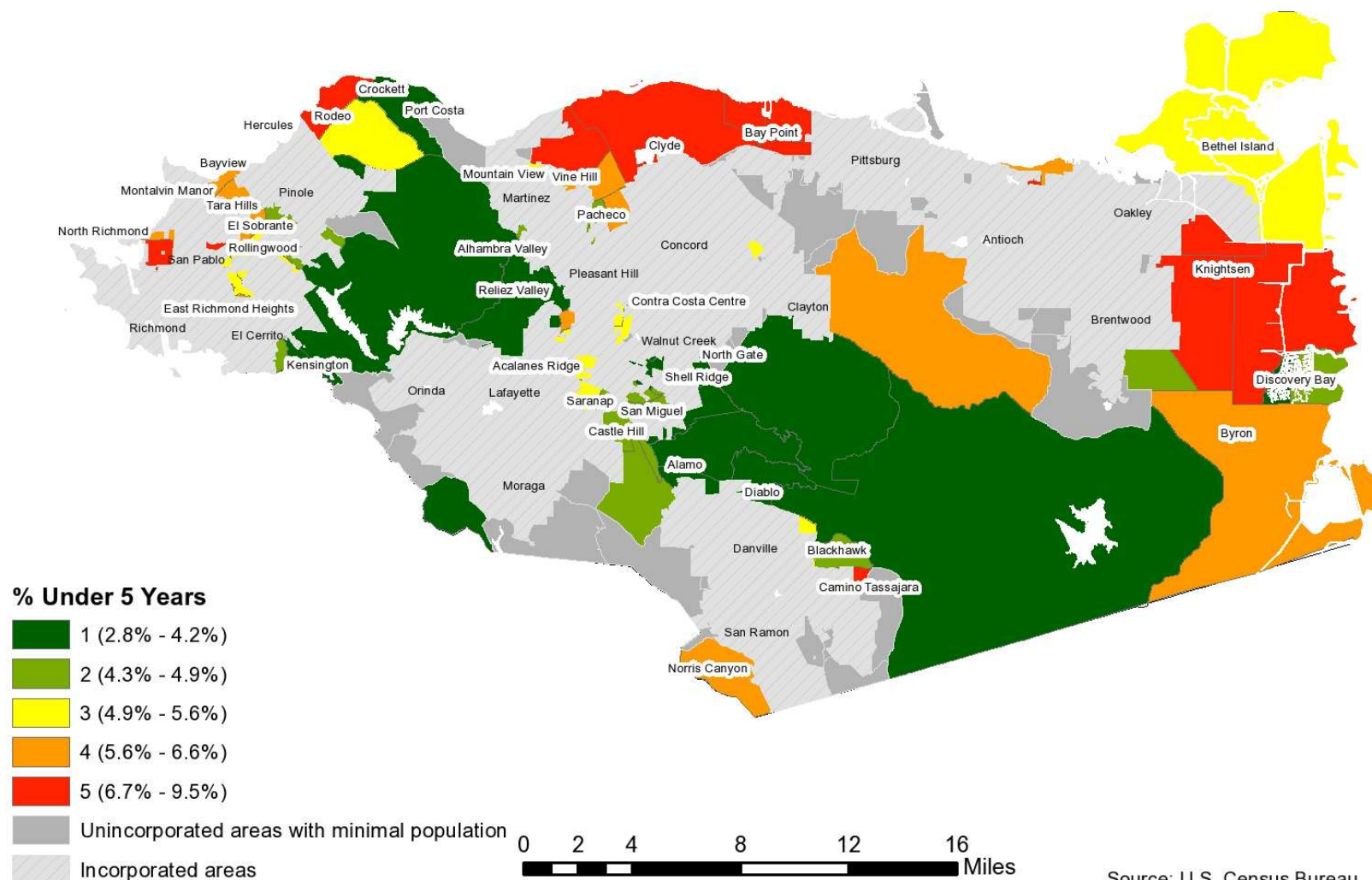


Note: Each category represents one-fifth of the unincorporated census tracts.

Health Co-Benefit Evaluation

A

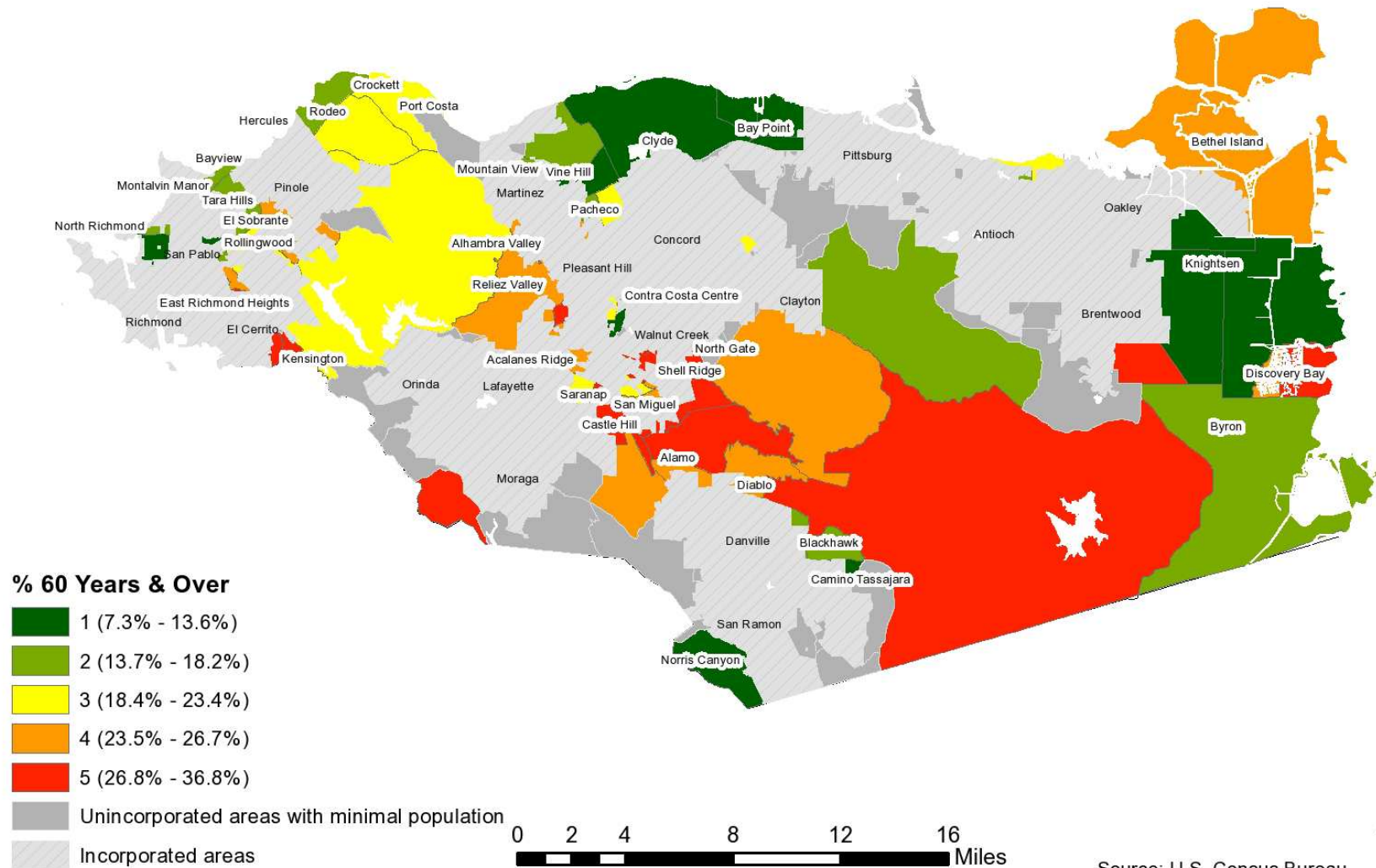
Figure A.7. Percent of Population Under 5 Years Old, 2010



Note: Each category represents one-fifth of the unincorporated census tracts.

Health Co-Benefit Evaluation

Figure A.8. Percent of Population 60 Years and Older, 2010

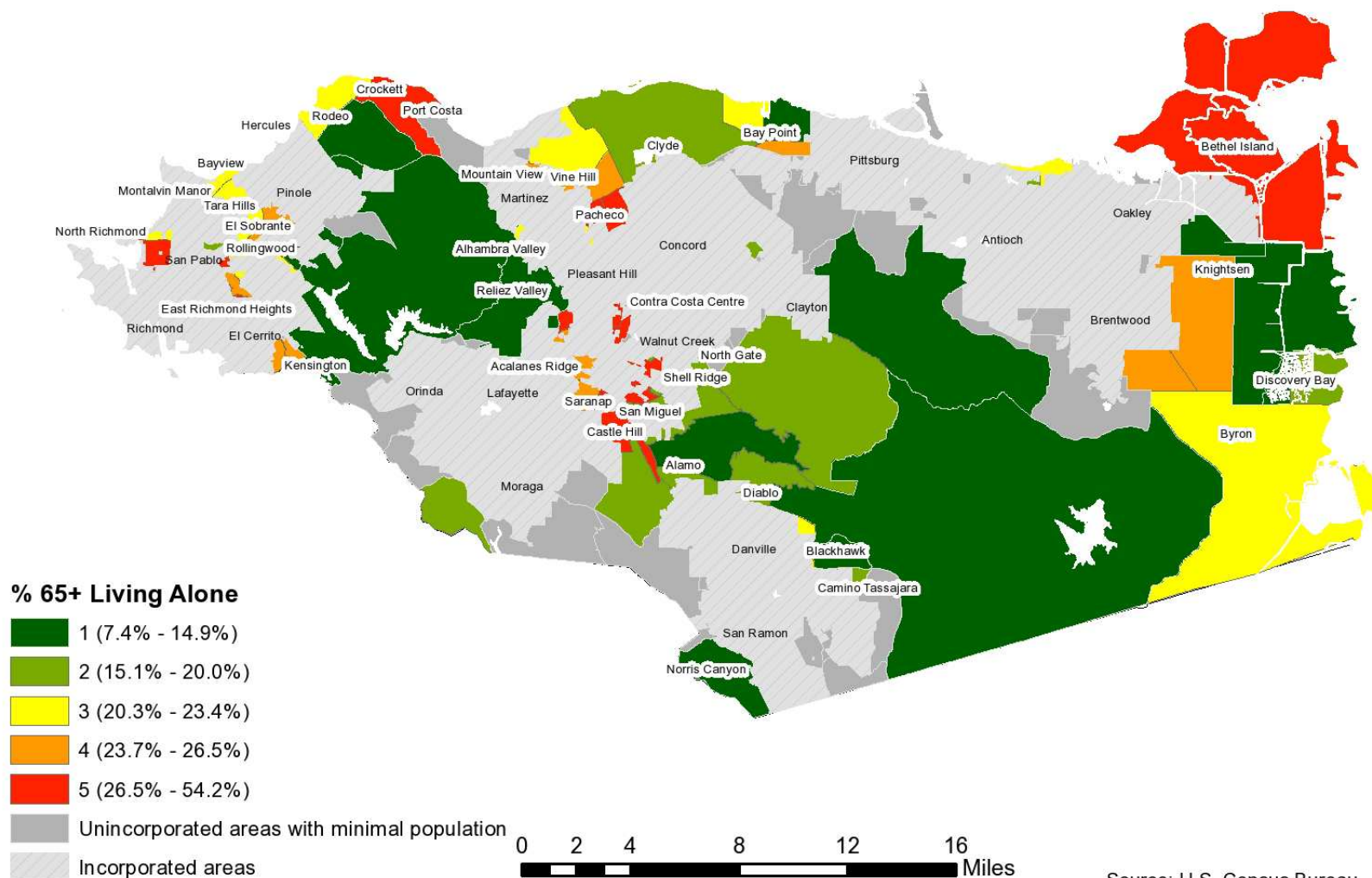


Note: Each category represents one-fifth of the unincorporated census tracts.

Health Co-Benefit Evaluation

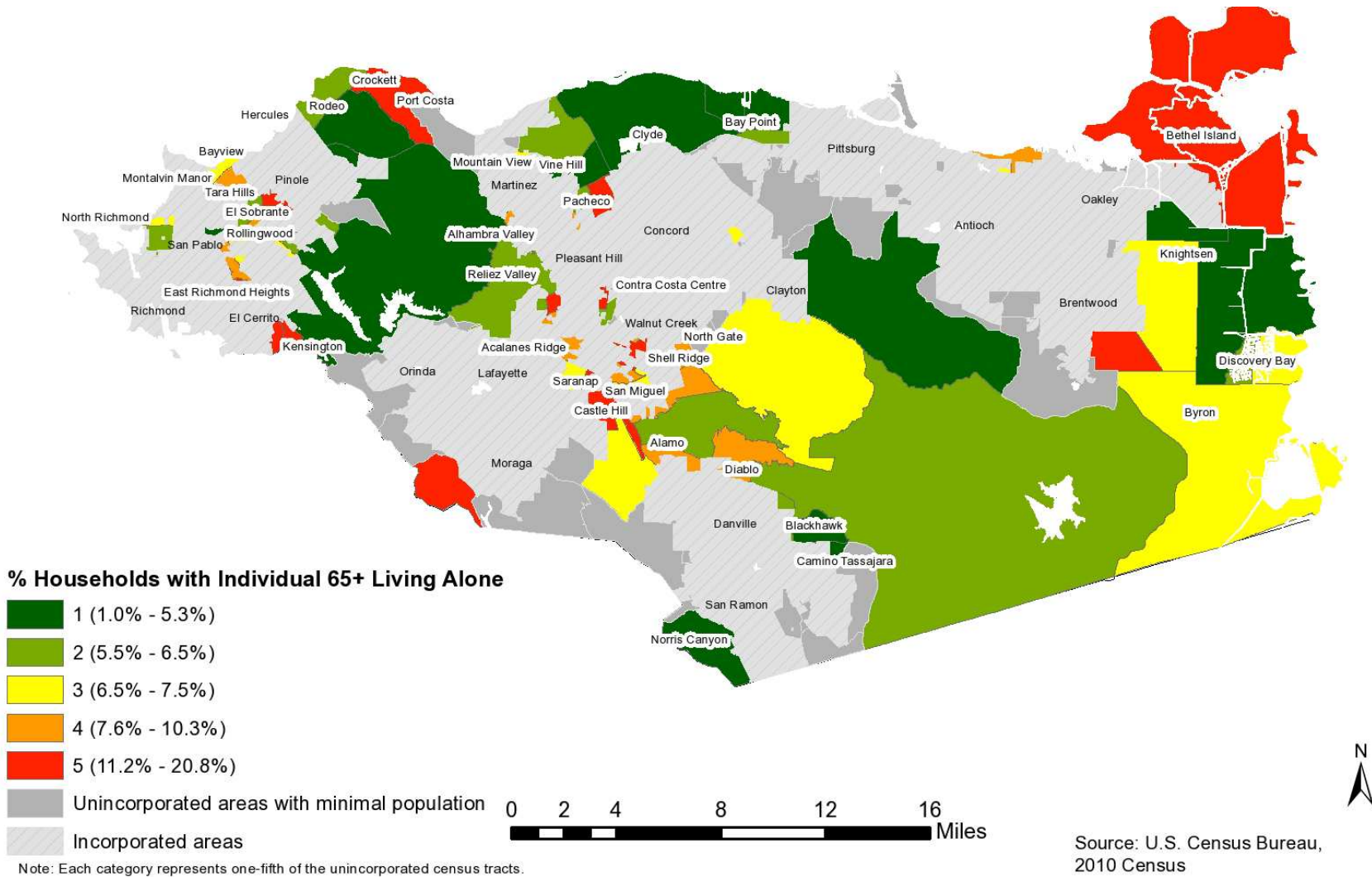
A

Figure A.9. Percent of Households with Individuals 65 Years and Older Living Alone, 2010



Note: Each category represents one-fifth of the unincorporated census tracts.

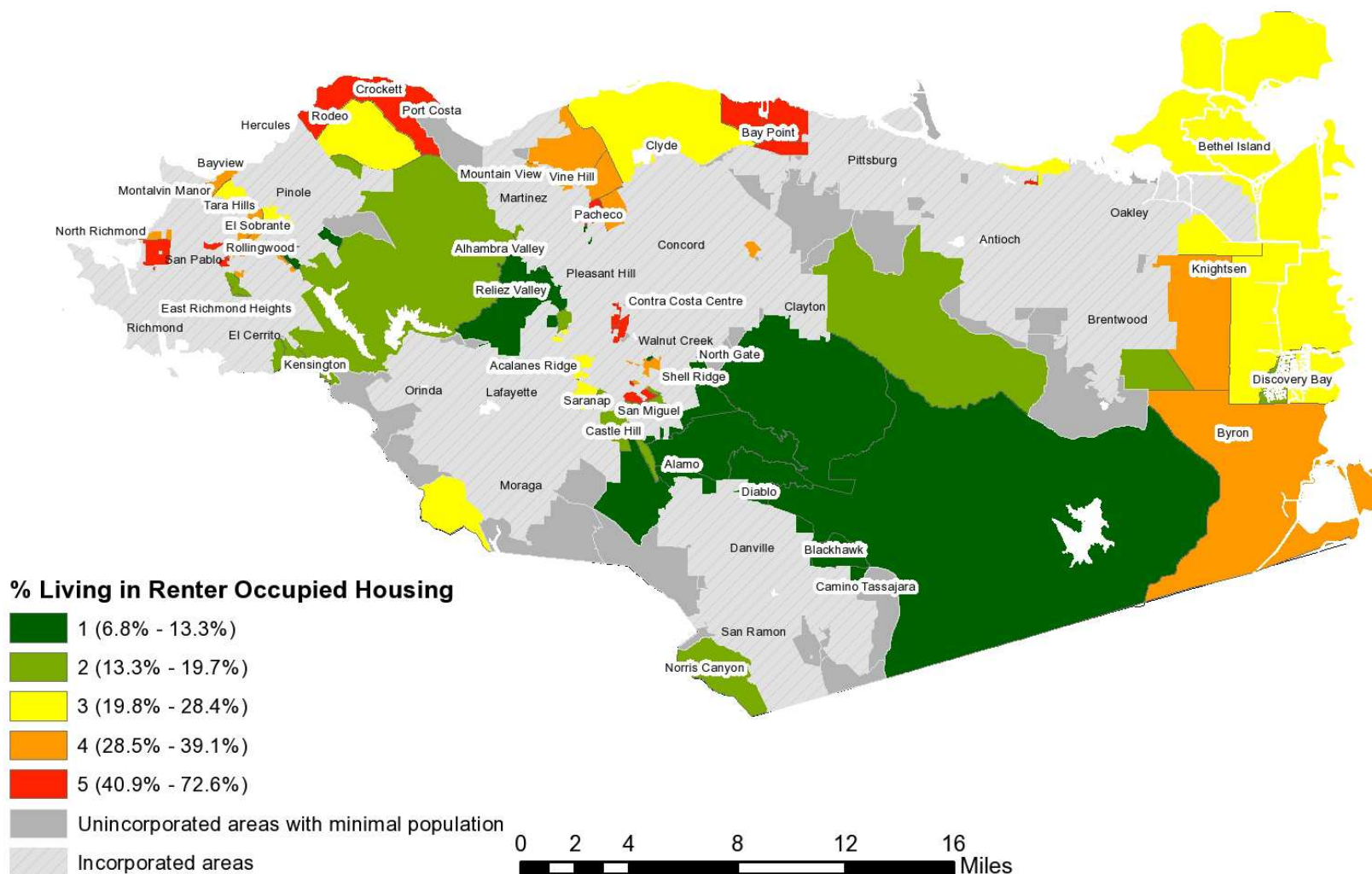
Health Co-Benefit Evaluation



Health Co-Benefit Evaluation

A

Figure A.11. Percent of Population in Renter-Occupied Housing, 2010

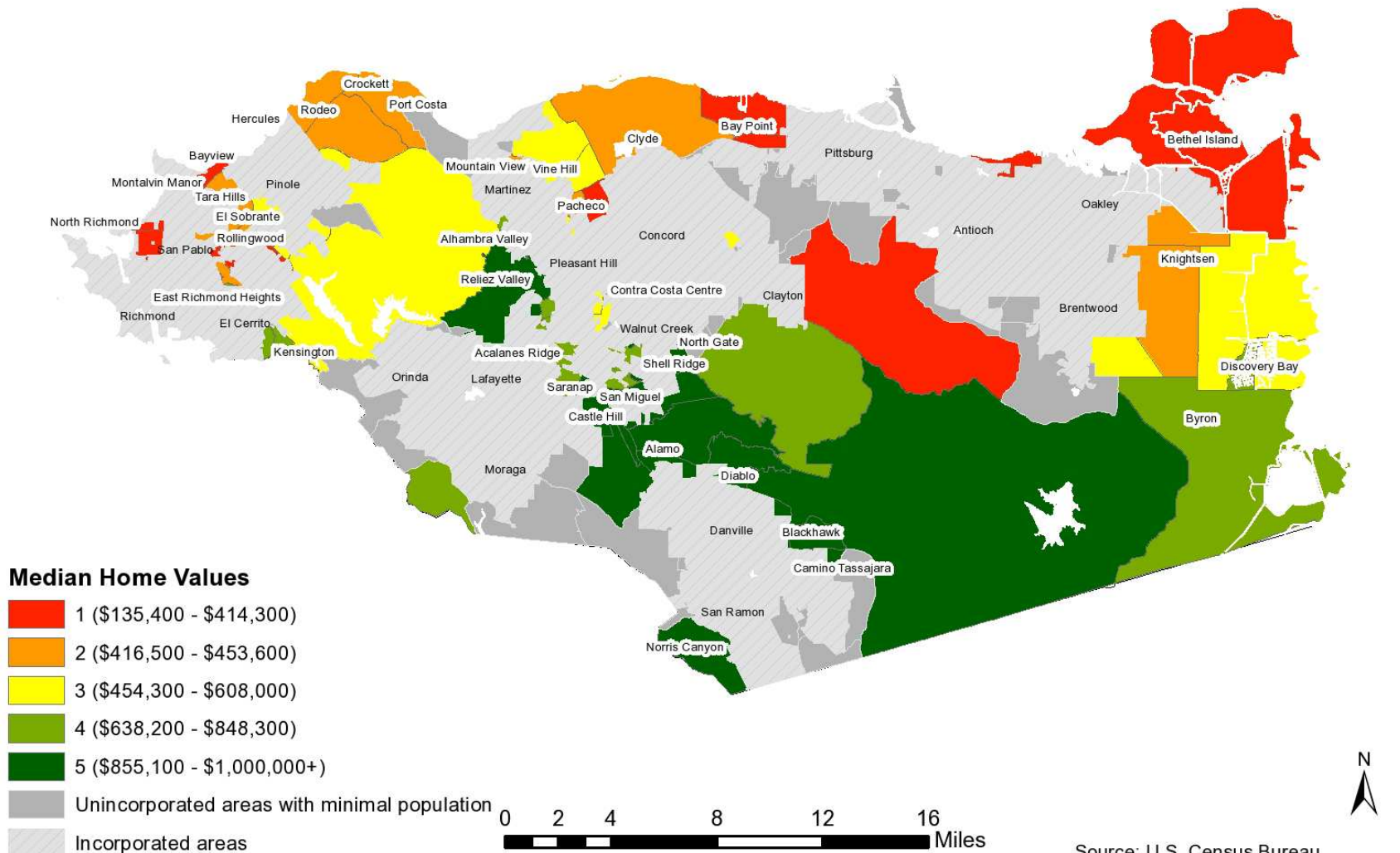


Note: Each category represents one-fifth of the unincorporated census tracts.

Source: U.S. Census Bureau, 2010 Census

Health Co-Benefit Evaluation

Figure A.12. Median Home Values, 2006-2010

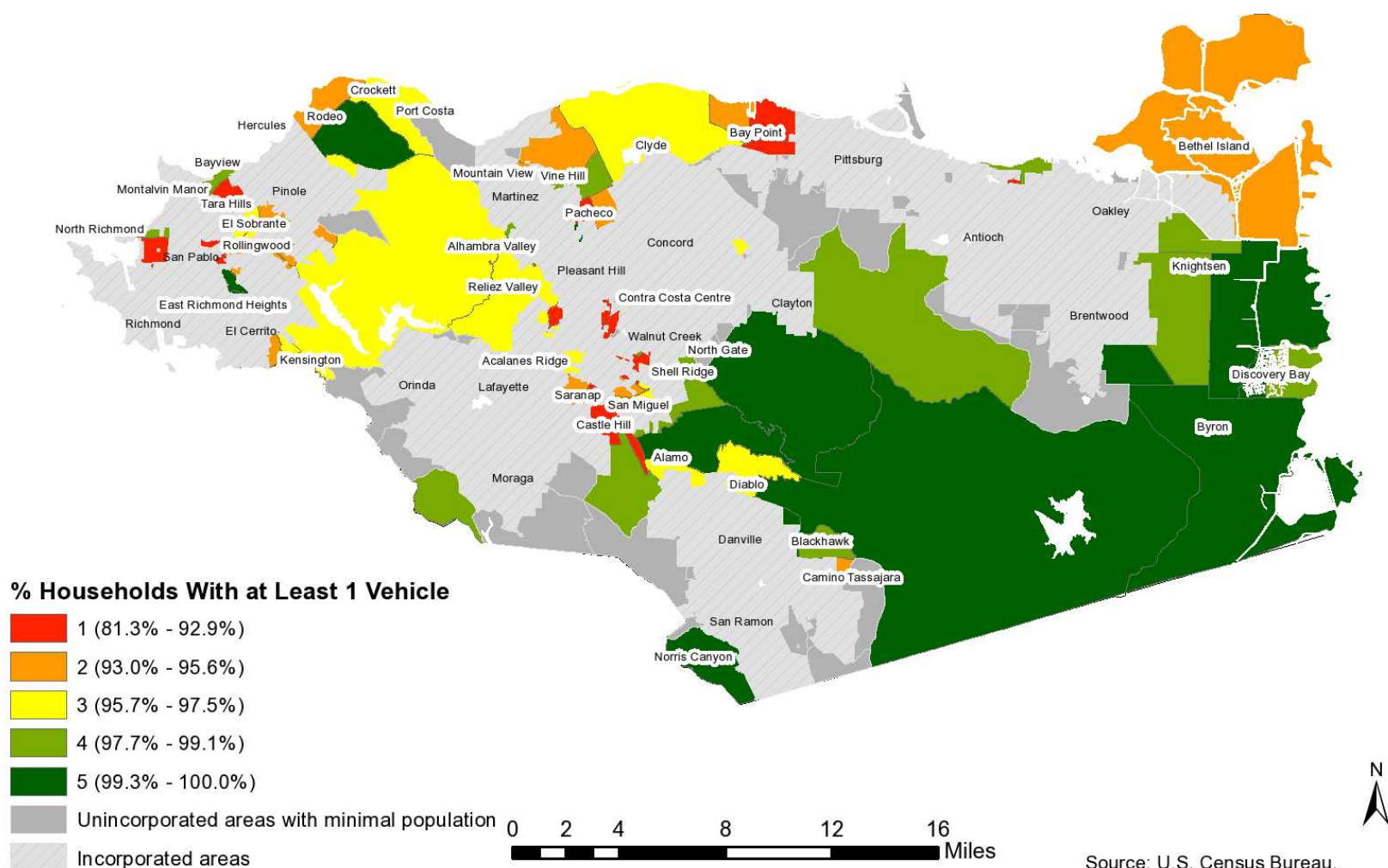


Note: Each category represents one-fifth of the unincorporated census tracts.

Health Co-Benefit Evaluation

A

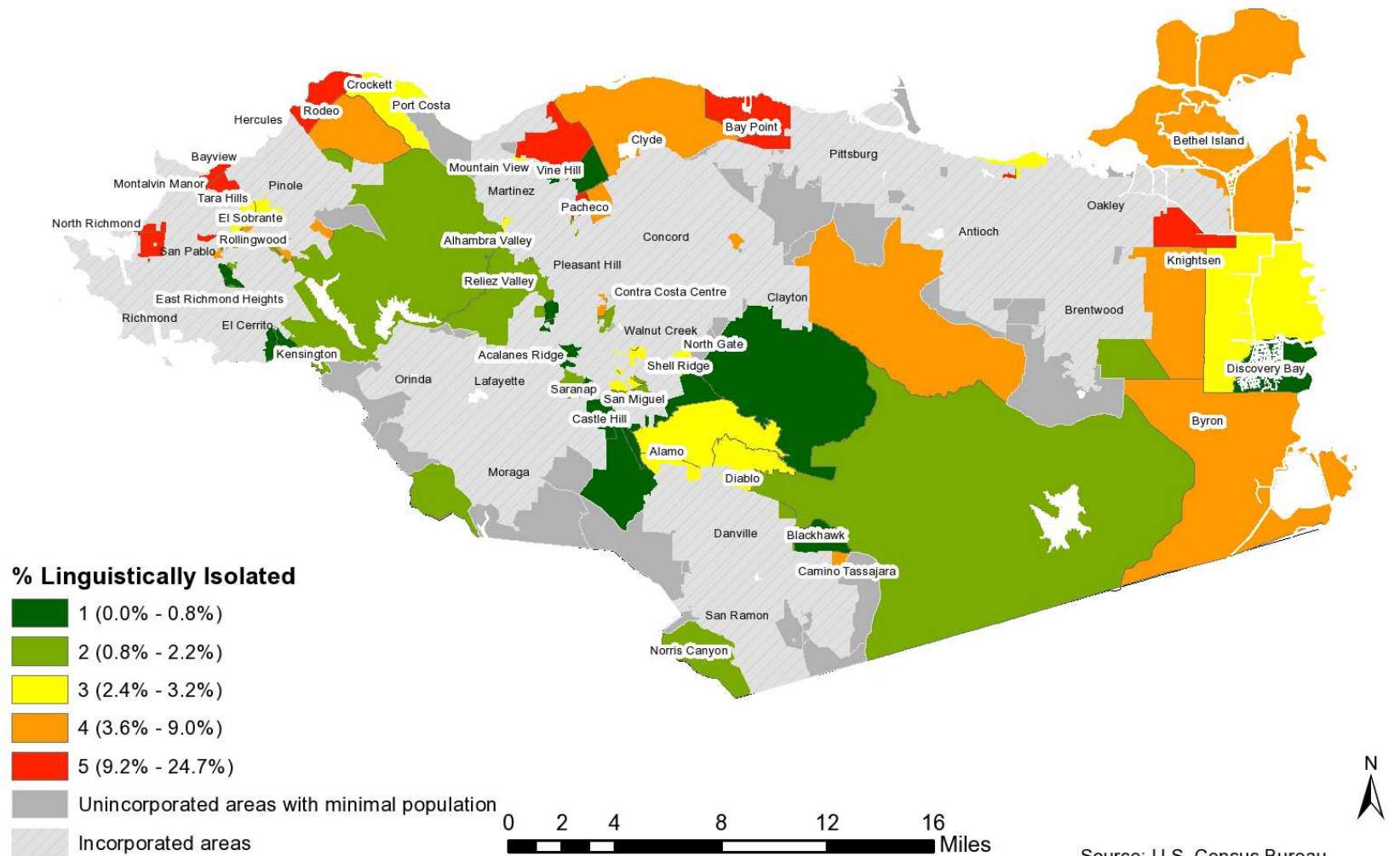
Figure A.13. Percent of Occupied Housing Units with at Least One Vehicle Available, 2006-2010



Note: Each category represents one-fifth of the unincorporated census tracts.

Health Co-Benefit Evaluation

Figure A.14. Percent of Population 5 Years and Older in Linguistically Isolated Households, 2006-2010



Note: Each category represents one-fifth of the unincorporated census tracts.

Appendix B: BAAQMD Appendix

B



Contra Costa County developed this Climate Action Plan (CAP) to meet the requirements of the Bay Area Air Quality Management District's (BAAQMD) criteria for a Qualified Greenhouse Gas Reduction Strategy as defined in the BAAQMD's California Environmental Quality Act (CEQA) Air Quality Guidelines. The CEQA Air Quality Guidelines were updated in 2010 in response to the state of California's amendment to the State CEQA Guidelines through Senate Bill (SB) 97. SB 97 requires all projects subject to CEQA to analyze and mitigate the greenhouse gas (GHG) emissions that will occur.

The purpose of the BAAQMD CEQA Air Quality Guidelines is to assist lead agencies in evaluating the air quality impacts of proposed projects and plans within the San Francisco Bay Area Air Basin. The guidelines were updated to establish thresholds of significance for impacts related to GHG emissions to be consistent with the requirements of CEQA. These thresholds can be used to assess plan-level and project-level impacts and allow a lead agency to determine that a project's impact on GHG emissions is less than significant if it is in compliance with a Qualified Greenhouse Gas Reduction Strategy.

The County's CAP follows both the State CEQA Guidelines (Section 15183.5(b)) and BAAQMD's guidelines by incorporating the standard elements of a Qualified Greenhouse Gas Reduction Strategy into the CAP. The standard elements of a Qualified Greenhouse Gas Reduction Strategy include the following steps:

- Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic range.
- Establish a level, based on substantial evidence below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable.
- Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area.

- Specify measures or a group of measures, including performance standards that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level.
- Monitor the plan's progress.
- Adopt the greenhouse gas reduction strategy in a public process following environmental review.

This appendix describes in detail how the County's CAP has been developed to satisfy the requirements of BAAQMD's guidelines on the standard elements of a Qualified Greenhouse Gas Reduction Strategy.

GHG EMISSIONS INVENTORY

The first component of a Qualified Greenhouse Gas Reduction Strategy is to inventory GHG emissions within a specified geographic boundary. Contra Costa County's GHG inventory utilizes a baseline year of 2005 to inventory carbon dioxide (CO₂), nitrous oxide (N₂O), and methane (CH₄) generated from activities by Contra Costa County community members in unincorporated areas of the county.

The emissions sources calculated in the baseline GHG inventory include commercial, residential, and industrial electricity and natural gas use, on-road transportation, solid waste disposal, energy use related to water and wastewater, agricultural off-road equipment and emissions associated with fertilizer application, and off-road equipment use for construction and lawn and garden activities. GHG emissions from these activities were calculated from activity data such as kilowatt hours of electricity (kWh), therms of natural gas, tons of waste disposed, and vehicle miles traveled (VMT) from trips with an origin or destination in Contra Costa County.

To comply with updates to the regulatory structure and incentives to address GHG emissions since the creation of this initial inventory, changes have been incorporated in the 2005 inventory to comply with the US Community Protocol, BAAQMD's suggested guidelines for a Qualified Greenhouse Gas Reduction Strategy, and the state CEQA Guidelines Section 15185.5(b). The 2005 inventory has been updated to include the following:

- New emissions sources not previously inventoried (off-road equipment, BART, water and wastewater, and agriculture).
- Emissions from direct access customers in the commercial/industrial sector as reported by Pacific Gas and Electric Company (PG&E).
- Analysis of stationary source emissions (note that these emissions are analyzed, but not included in the baseline inventory).
- Calculation of waste emissions using the California-specific 2009 Landfill Emissions Tool developed by the California Air Resources Board (CARB).
- Updates to the global warming potentials (GWP) of emissions to account for the most recent scientific understanding.

BAAQMD Appendix

B

- Integration of improved emissions factors from the US Community Protocol and the Local Government Operations Protocol.

Additionally, the County prepared a 2013 inventory to provide an interim update on GHG emissions in unincorporated Contra Costa County, approximately halfway between the 2005 baseline year and the target year of 2020. It includes all of the same sectors as the 2005 inventory and uses the same methods. Like the 2005 inventory, the 2013 inventory is consistent with the US Community Protocol and with BAAQMD guidance. Emissions from the 2005 inventory are shown below in **Table B.1** and **Figure B.1** and emissions from the 2013 inventory are shown in **Table B.2** and **Figure B.2**.

Table B.1. 2005 Community-Wide Baseline Emissions by Sector

Sector	Metric Tons CO ₂ e/year	Percentage of Total
Residential Energy	274,690	20%
Nonresidential Energy	118,740	8%
Solid Waste	48,450	3%
Landfill	193,950	14%
On-road Transportation	628,200	45%
Off-Road Equipment	71,880	5%
Water and Wastewater	8,080	1%
BART	2,300	<1%
Agriculture	57,320	4%
TOTAL	1,403,610	100%

* Due to rounding, the total may not be the sum of component parts.

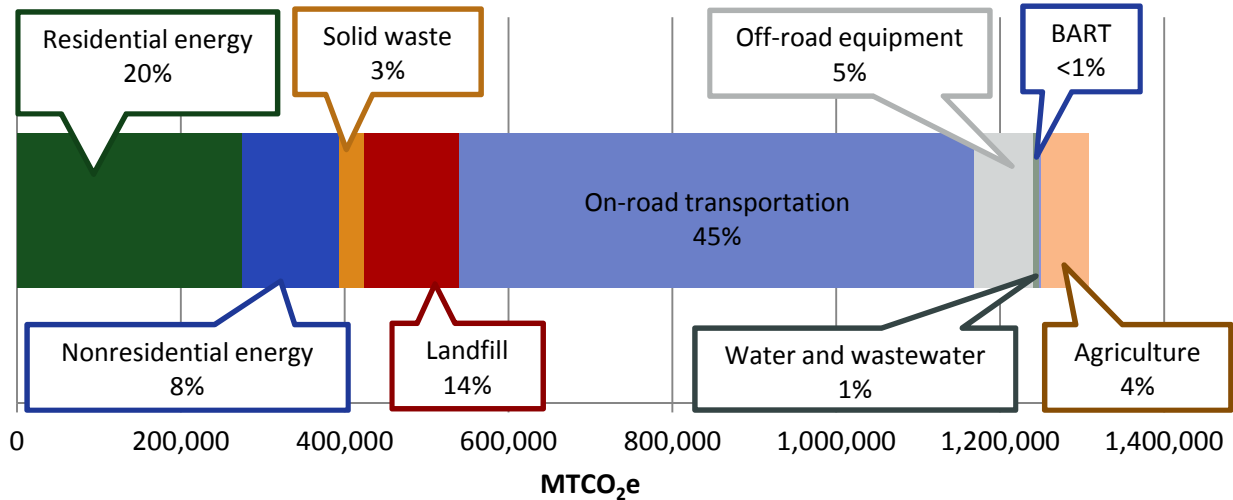
Table B.2. 2013 Community-Wide Baseline Emissions by Sector

Sector	Metric Tons CO ₂ e/year	Percentage of Total
Residential Energy	258,420	19%
Nonresidential Energy	125,350	9%
Solid Waste	26,540	2%
Landfill	196,500	14%
On-road Transportation	651,130	47%
Off-Road Equipment	66,230	5%
Water and Wastewater	7,400	1%
BART	2,680	<1%
Agriculture	58,200	4%
TOTAL	1,392,450	100%

* Due to rounding, the total may not be the sum of component parts.

BAAQMD Appendix

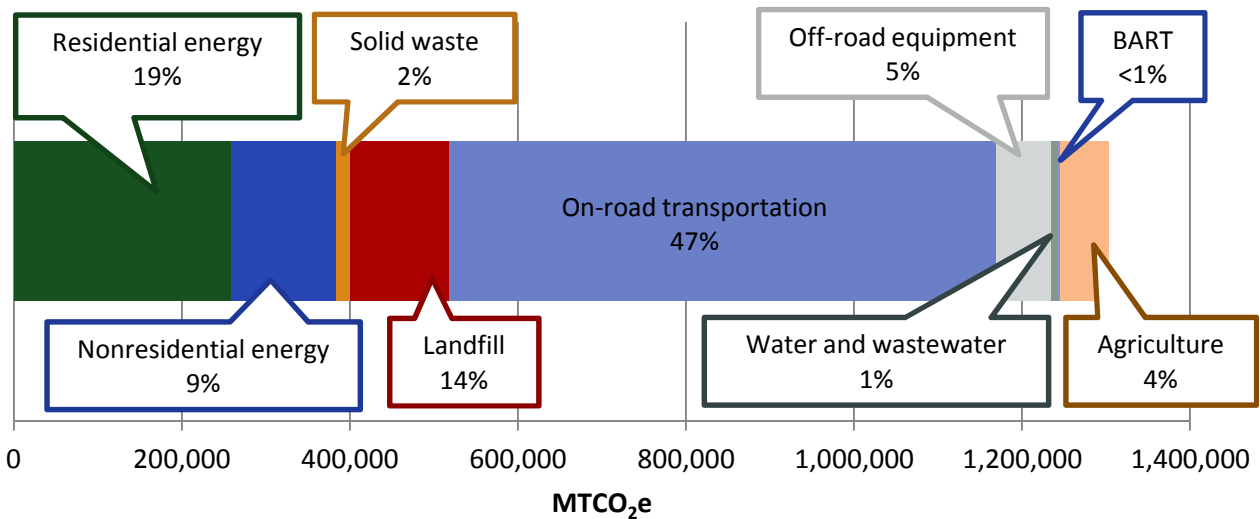
Figure B.1. 2005 Community-Wide Baseline Emissions by Sector*



Source: Michael Baker International 2015

*Due to rounding, the total may not equal the sum of component parts.

Figure B.2. 2013 Community-Wide Baseline Emissions by Sector*



Source: Michael Baker International 2015

*Due to rounding, the total may not equal the sum of component parts.

BAAQMD Appendix

B

Reflecting the unique characteristics of the unincorporated county, the inventory excludes several emissions sources as described below:

- **Stationary Source GHG Emissions**—Direct process emissions and energy used by industrially classified uses including refineries, power plants, chemical manufacturing plants, and wastewater treatment plants in the unincorporated county.
- **Energy Use by Power Plants and Refineries**—Electricity and natural gas use by power generation plants or refineries in the unincorporated county.

Refinery and power-generating facilities in Contra Costa County use electricity and natural gas in response to market demand for petroleum and electricity. The power-generating facilities in Contra Costa County primarily utilize natural gas to generate electricity, resulting in much higher than average natural gas use in the jurisdictions where these facilities are located.

When including stationary sources and all electricity and natural gas, the GHG emissions from all other sectors are overshadowed, as shown in **Table B.3**, and total roughly 18.7 million MTCO₂e annually from the unincorporated county.

Table B.3. Emissions from Excluded Sectors

	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)
Stationary sources	13,983,030	11,873,500
Energy use of major industrial facilities	3,344,000	5,026,560
Total of excluded sectors	17,327,030	16,900,060
Included sectors	1,403,610	1,392,450
Total of included and excluded sectors	18,730,640	18,292,510
Percent of emissions from excluded sectors	93%	92%

There are several factors outside of the County's control that influence the energy use at these facilities. The County has therefore elected to exclude the energy use at these facilities from consideration of a GHG reduction target for the following reasons:

- These facilities are regulated primarily through the Federal Energy Regulatory Commission and the California Energy Commission, and are subject to air quality and emissions standards set forth by the Environmental Protection Agency, California Air Resources Board, and BAAQMD.
- The energy used at these facilities fluctuates from year to year, making it difficult to accurately forecast, depending on the demand for resources and the availability of other electricity-generating sources such as hydropower or renewable resources.
- The County has limited jurisdictional authority to reduce GHG emissions from these sources as they will be subject to cap and trade regulations set forth by the California Air Resources Board.

- Inclusion of these facilities, without an accurate reflection of how emissions will be reduced through cap-and-trade regulation, would make it difficult for the County to set an achievable GHG reduction target to comply with Assembly Bill (AB) 32 and SB 97 and use the CAP for future CEQA tiering or streamlining.
- The approach to excluding energy from sources that are outside of the County's jurisdictional control is consistent with ICLEI's Draft Community-wide Protocol.

The resultant jurisdictional inventory more accurately reflects the natural gas use from nonresidential customers in unincorporated Contra Costa County and allows the County to focus on actions that are within its control. **Appendix C** provides further justification for excluding these sources.

GHG EMISSIONS PROJECTIONS

The basis for all growth scenarios is a business-as-usual (BAU) projection. The BAU scenario forecasts emissions to reflect the County's growth projections without regulatory or technical intervention to reduce GHG emissions. The BAU forecast for all other sectors rely on the demographic projections from the Association of Bay Area Governments (ABAG) 2013 regional forecasts (see **Table B.4**).

Table B.4. Unincorporated Contra Costa County Growth Indicators, 2005-2035

	2005	2013	2020	2035	2005–2035 Change
Population	159,650	162,230	166,100	173,500	6%
Households	57,980	58,550	59,720	61,740	9%
Jobs	41,270	43,210	47,670	50,330	22%
Service Population	200,920	205,440	213,770	223,830	11%

Source: Association of Bay Area Governments 2009, 2013

Under the growth projections identified by ABAG, emissions in the unincorporated area are forecasted to increase to 1,483,720 MTCO₂e by 2020, a 6% increase from 2005 levels. Emissions in 2035 are projected to rise to 1,545,980 MTCO₂e, a 10% increase from 2005 levels. **Table B.5** and **Figure B.3** show emissions by sector for the 2005 baseline inventory and the two forecasted years.

BAAQMD Appendix

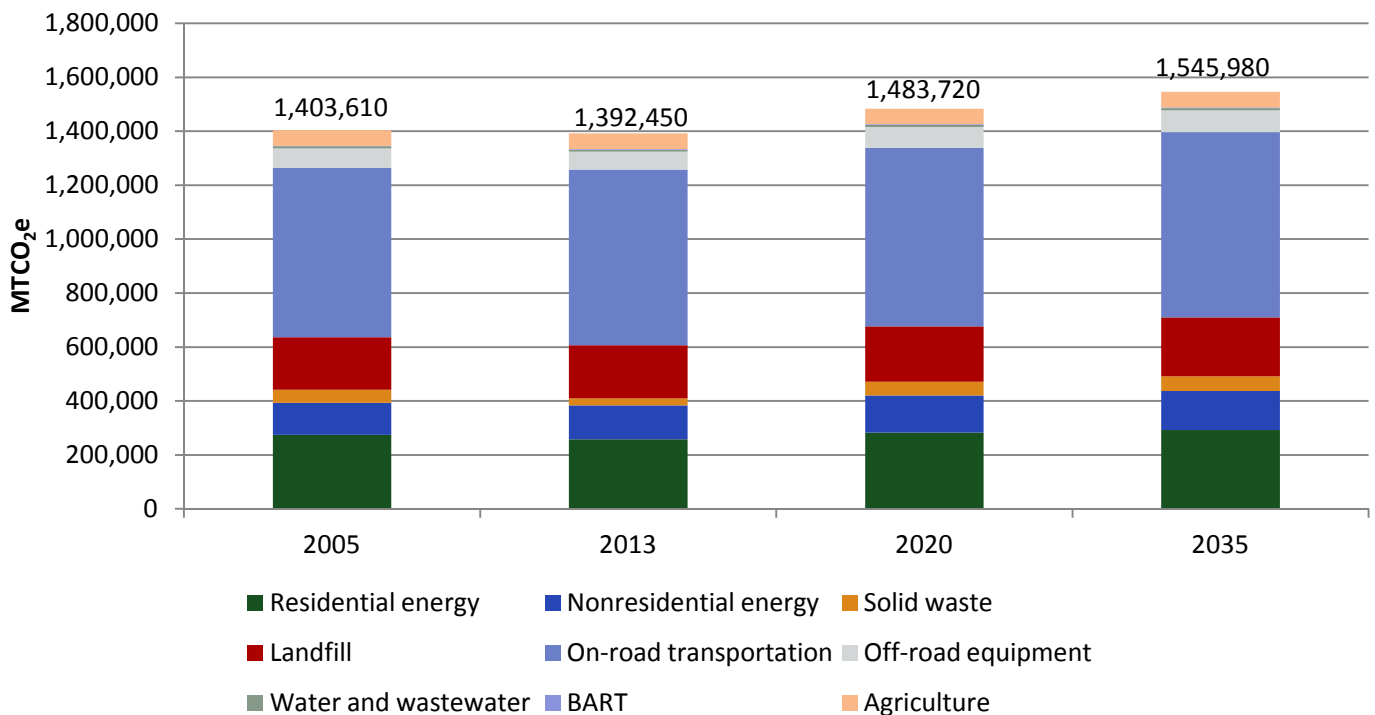
B

Table B.5. Contra Costa Community GHG Emissions Forecast

Sector	2005 MTCO ₂ e	2013 MTCO ₂ e	2020 MTCO ₂ e	2035 MTCO ₂ e	Percent Change, 2005–2035
Residential energy	274,690	258,420	282,930	292,500	6%
Nonresidential energy	118,740	125,350	137,150	144,810	22%
Solid waste	48,450	26,540	51,550	53,970	11%
Landfill	193,950	196,500	204,560	218,560	13%
On-road transportation	628,200	651,130	662,820	687,370	9%
Off-road equipment	71,880	66,230	76,340	79,890	11%
Water and wastewater	8,080	7,400	8,600	9,000	11%
BART	2,300	2,680	2,450	2,560	11%
Agriculture	57,320	58,200	57,320	57,320	0%
TOTAL	1,403,610	1,392,450	1,483,720	1,545,980	10%
Percent Change from 2005	-	-1%	6%	10%	-

Source: Michael Baker International 2015

Figure B.3. Business-As-Usual GHG Forecast 2005–2035



Source: Michael Baker International 2015

BAAQMD Appendix

In addition to AB 32, California has adopted and started to implement several state-level programs that will impact local GHG emissions. In order to effectively determine the emissions reductions that will need to be implemented at the local level to meet the County's emissions reduction target, the impact of state-level programs has been incorporated into an adjusted BAU forecast. The state-level programs included in this adjusted forecast include the Renewables Portfolio Standard (RPS), updates to Title 24 Energy Efficiency Standards, Low Carbon Fuel Standards, and the implementation of the Clean Car Fuel Standard, commonly referred to as the Pavley standards. The impact of these state programs (shown in **Table B.6**) will play a critical role in helping Contra Costa achieve the emissions reduction target.

Table B.6. State Reductions Summary, 2020 and 2035

State Policy or Program	2020 (MTCO ₂ e)	2035 (MTCO ₂ e)
Renewables Portfolio Standard	-41,620	-78,030
Clean Car Standard and LCFS	-173,480	-236,270
Title 24 Standards	-2,840	-7,970
TOTAL	-217,940	-322,270

The regulations implemented by the state will help further reduce Contra Costa's GHG emissions. As shown in **Table B.7**, reductions from state activities are expected to reduce emissions below baseline levels by 2020, and to continue to decrease emissions by 2035 despite population growth.

Table B.7. State Reductions Summary, 2020 and 2035

Sector	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)	2020 (MTCO ₂ e)	2035 (MTCO ₂ e)	Percent Change, 2005–2035
Residential energy	274,690	258,420	257,310	242,280	-12%
Nonresidential energy	118,740	125,350	119,980	112,170	-6%
Solid waste	48,450	26,540	51,550	53,970	11%
Landfill	193,950	196,500	204,560	218,560	13%
On-road transportation	628,200	651,130	489,340	451,100	-28%
Off-road equipment	71,880	66,230	76,340	79,890	11%
Water and wastewater	8,080	7,400	6,930	5,860	-27%
BART	2,300	2,680	2,450	2,560	11%
Agriculture	57,320	58,200	57,320	57,320	0%
TOTAL	1,403,610	1,392,450	1,265,780	1,223,710	-13%
Percent Change from 2005	-	-1%	-10%	-13%	-

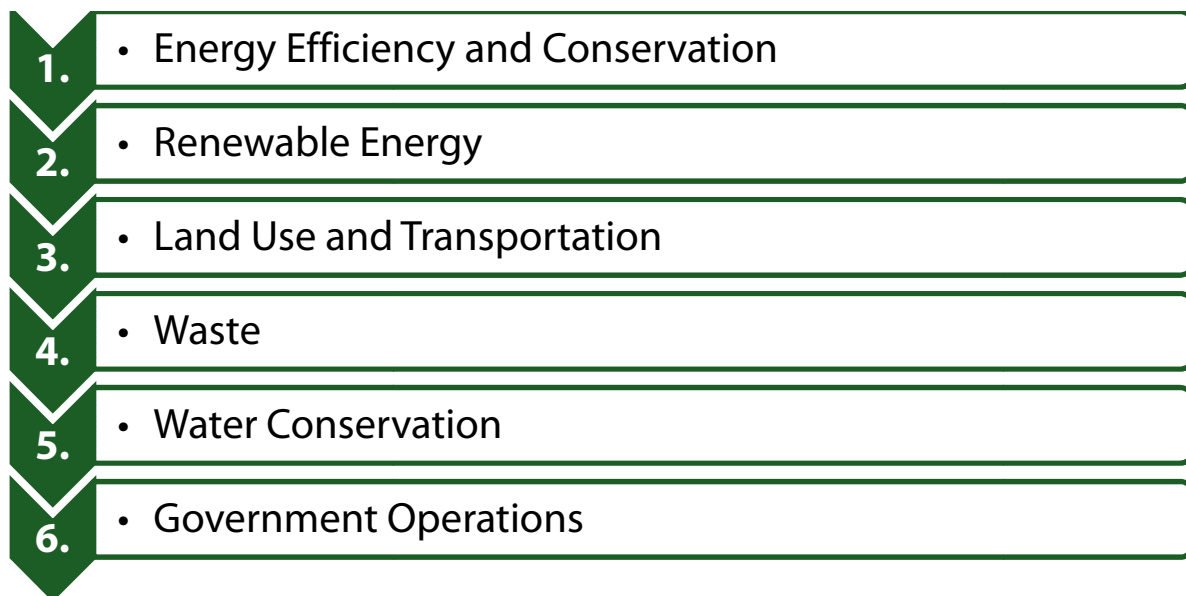
Source: Michael Baker International 2015

GHG EMISSIONS REDUCTION TARGET

Contra Costa is following state guidelines by seeking to achieve a GHG emissions reduction target of 15% below 2005 baseline levels by 2020.

The GHG reduction measures included in this CAP demonstrate the County's ability to reach the GHG reduction target of 15% below 2005 levels by 2020. Emissions reductions were quantified for two different years: 2020 and 2035. The 2020 and 2035 emissions reductions are the potential reductions that will be achieved through the implementation of these measures. The GHG reduction strategies are separated by goal or topic area to correspond with the sectors and sources of GHG emissions, as identified in **Figure B.4**.

Figure B.4. GHG Reduction Topics



It is important to identify how the County will meet or exceed the minimum GHG reduction target of 15% below baseline levels by 2020 to ensure the County can utilize the CAP as a Qualified Greenhouse Gas Reduction Strategy for use in environmental review of projects. This plan identifies a clear path to allow the County to reach the community-wide GHG reduction target of 15% below baseline levels which, in turn, meets the state targets as well.

The CAP contains a diverse mix of incentive-based reduction measures. The reduction measures aim to reduce GHG emissions from each source to avoid reliance on any one strategy or sector to achieve the target. As shown in **Table B-8**, after state reductions, local measures must reduce 72,550 MTCO₂e by 2020. Table B-9 demonstrates that the measures detailed in this CAP are expected to reduce 86,300 MTCO₂e by 2020, achieving the target of 15% below baseline by 2020. Achievement of the County's adopted target by 2020 will meet state recommendations and BAAQMD threshold requirements for developing a Qualified Greenhouse Gas Reduction Strategy.

Table B.8. Baseline GHG Emissions, Forecast, and Reduction Goals

	2020 MTCO ₂ e	2035 MTCO ₂ e
2005 Baseline Emissions	1,403,610	1,403,610
Forecasted Emissions	1,483,720	1,545,980
Emissions with Statewide Reductions	1,265,620	1,223,170
Reduction Target	1,193,070	596,540
Local Reductions Needed	-72,550	-626,630

Source: Michael Baker International 2015

Table B.9. GHG Reduction Summary by Topic (MTCO₂e)

Topic	2020	2035
Energy Efficiency	7,510	14,000
Renewable Energy	9,090	15,470
Land Use and Transportation	12,630	23,380
Solid Waste	55,280	79,430
Water	1,210	940
Government Operations ¹	580	450
Total	86,300	133,670

¹Not quantified; supportive goal topic

In addition to quantifying the emissions reductions associated with each strategy in the CAP, BAAQMD guidance recommends that the County clearly specify the measures within the CAP applicable to new construction projects to demonstrate compliance with the County's GHG emissions reduction strategy and determine that the project's GHG emissions are less than significant. To ensure that each new construction project complies with the County's CAP, a checklist has been developed to be submitted by an applicant for each new development project (**Appendix E**).

IMPLEMENTATION AND MONITORING

To ensure the timely implementation of the CAP, the County will identify staff to coordinate implementation of GHG reduction strategies and progress toward GHG reduction targets (see Implementation Action Item 1.4 in **Chapter 5**) and prepare annual reports to the Board of Supervisors on CAP implementation and progress. To assist in this reporting, the CAP contains an implementation matrix that identifies actions necessary to implement the CAP, the responsible agency, and the implementation time frame. The CAP implementation chapter also outlines the necessary procedures to update the inventory and reduction measures every 3–5 years. The implementation matrix,

combined with the reduction measure workbook, will serve as the primary instrument in measuring the County's progress toward achieving emissions reduction targets and to ensure timely implementation occurs.

PUBLIC PROCESS AND ENVIRONMENTAL REVIEW

The final component of a Qualified Greenhouse Gas Reduction Strategy is to adopt the plan through a public hearing process following environmental review. The County has involved numerous stakeholders throughout the development of the CAP. The CAP will undergo environmental review as part of the public hearing and adoption process.

Appendix C: Inventory & Forecast Report

C



The greenhouse gas emissions (GHG) inventory identifies the major sources of GHG emissions from activities occurring within the unincorporated areas of Contra Costa County in 2005 and 2013, and provides a baseline against which future progress can be measured. Specifically, the inventory:

- Presents GHG emissions from community-wide activities in the calendar years of 2005 and 2013.
- Identifies GHG emissions from activities which the County can reasonably influence, and excludes all other sources that are primarily regulated by other agencies (e.g., major industrial facilities).
- Summarizes GHG emissions by sector to compare the relative impact between sectors.
- Provides forecasts of how emissions will grow in the community under various scenarios.
- Provides County decision-makers and the community with adequate baseline and forecast information to inform policy decisions.

INVENTORY BACKGROUND

In California, and as recommended by the Governor's Office of Planning and Research, many communities use the *US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* (the US Community Protocol) to identify and assess GHG emissions. This protocol provides guidance on how to measure and report community-wide GHG emissions, including identification of relevant sources or activities and methods used to calculate emissions. The Bay Area Air Quality Management District (BAAQMD) has issued a GHG Plan Level Quantification Guidance document, which also provides recommendations for Bay Area communities to develop GHG inventories. The 2005 and 2013 inventories are consistent with the recommended practices in these two documents. The 2005 and 2013 inventories also assist in allowing this Climate Action Plan (CAP) to function as a Qualified GHG Reduction Strategy for Contra Costa County, allowing for the streamlining of the environmental review process for projects located in the

Climate Action Plan

unincorporated area, in accordance with the standards identified in the state California Environmental Quality Act (CEQA) Guidelines Section 15183.5(b). Under these guidelines, a qualified strategy must meet the following requirements:

- Quantify GHG emissions, both existing and forecast over a set time period, from activities within a defined geographic area.
- Establish a level below which GHG emissions from activities covered by the plan are not cumulatively considerable, based on substantive evidence.
- Identify and analyze the GHG emissions as a result of specific actions or categories of actions anticipated within the defined geographic area.
- Specify measures or a group of measures, including performance standards, which would collectively achieve the specified emissions level if implemented on a project-by-project basis, as demonstrated by substantive evidence.
- Establish a mechanism to monitor the plan's progress toward achieving the level and to require revisions to the plan if it is not achieving the specified levels.
- Be adopted in a public process following environmental review.

The 2005 and 2013 inventories discussed in this appendix meet the first of the three requirements identified above. In accordance with the US Community Protocol and BAAQMD guidance, these inventories include emissions from the following sources, or sectors:

- **Residential energy:** Electricity and natural gas used in residential buildings.
- **Nonresidential energy:** Electricity and natural gas used in nonresidential buildings, including offices, retail stores, government facilities, institutional facilities, and some industrial buildings.
- **Solid waste:** Emissions from waste produced in the county for the inventory year.
- **Landfills:** Emissions from the decomposition of waste deposited in landfills from prior years.
- **On-road transportation:** On-road vehicle trips, including cars and trucks.
- **Off-road equipment:** Portable equipment and vehicles not used for transportation on roads, including construction and landscaping equipment.
- **Water and wastewater:** Energy used to pump and treat water and wastewater, and emissions from the processing of wastewater.
- **BART:** Energy used by BART trips beginning or ending in the unincorporated area.
- **Agriculture:** Emissions from fertilizer use, farming equipment, and the digestive processes of livestock.

Inventory & Forecast Report

C

DATA COLLECTION METHODS AND ANALYSIS

The GHG emissions inventory starts with collecting activity data for each sector listed above. Activity data includes the amounts of electricity used (measured in kilowatt-hours or kWh), vehicle miles traveled (VMT), or gallons of water used. This information is for all activities occurring within the unincorporated areas of Contra Costa County and comes from multiple sources, including private utilities, local governments, and state and regional agencies. The activity data is converted into GHG emissions using an emissions factor, which is a numerical constant that describes how many GHGs are emitted per unit of activity data (for example, how many GHGs per kWh of electricity used). Utility companies or other providers of activity data may also provide emissions factors for their data. Alternatively, state or federal agencies or the US Community Protocol may recommend specific emissions factors in their guidance documents. The emissions factors include the three primary GHGs: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O).

These GHGs have different global warming potentials (GWPs), which refers to how much heat each gas can trap over a 100-year period, relative to CO₂. For example, methane traps 28 times as much heat as CO₂, and so methane has a GWP of 28. GHG emissions are presented as units of carbon dioxide equivalent (CO₂e), which accounts for the varying GWPs of each gas type. A metric ton (MT) of methane will trap 28 times as much heat as an MT of CO₂, and so one MT of methane is equal to 28 MTCO₂e. The GWPs in the 2005 and 2013 inventories are from the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report.

In keeping with best practices and recommended guidance, the 2005 and 2013 inventories include emissions resulting from activities occurring within the unincorporated areas of Contra Costa County, even if the emissions themselves do not occur in the unincorporated areas. For example, if a home in Bay Point uses electricity, the power plant that provides the electricity may not be located within the unincorporated areas, and so any emissions from generating the electricity (e.g., the burning of natural gas to run the generators) may occur in a distant community. However, because the activity resulting in these emissions occurred within the unincorporated areas of Contra Costa County, it is included in the County's GHG inventory.

2005 INVENTORY

This Inventory builds on an inventory prepared by the County evaluating 2005 community-wide GHG emissions for the unincorporated areas of Contra Costa County. Changes to the regulatory structure and incentives to address GHG emissions since the creation of this initial inventory have been incorporated in this Inventory to comply with the US Community Protocol, BAAQMD's suggested guidelines for a Qualified GHG Reduction Strategy, and the state CEQA Guidelines Section 15185.5(b). The 2005 inventory has been updated to include the following:

- New emissions sources not previously inventoried (off-road equipment, BART, water and wastewater, and agriculture).
- Emissions from direct access customers in the commercial/industrial sector as reported by Pacific Gas and Electric Company (PG&E).

Climate Action Plan

- Analysis of stationary source emissions (note that these emissions are analyzed, but not included in the baseline inventory).
- Calculation of waste emissions using the California-specific 2009 Landfill Emissions Tool developed by the California Air Resources Board (CARB).
- Updates to the GWPs of emissions to account for the most recent scientific understanding.
- Integration of improved emissions factors from the US Community Protocol and the Local Government Operations Protocol.

2013 INVENTORY

The County prepared the 2013 inventory to provide an interim update on GHG emissions in unincorporated Contra Costa County, approximately halfway between the 2005 baseline year and the target year of 2020. It includes all of the same sectors as the 2005 inventory and uses the same methods. Like the 2005 inventory, the 2013 inventory is also consistent with the US Community Protocol and with state and regional guidance.

EXCLUDED SECTORS

The inventories were developed with the best available tools, data, and methods; however, as with any GHG inventory, there are limitations to representing all sources of emissions in a local jurisdiction. There are two emissions sources which were analyzed for Contra Costa County and are presented here for informational purposes, but are not included in the official inventory:

- **Stationary Source GHG Emissions**—Direct process emissions and energy used by industrially classified uses including petroleum refineries, power plants, chemical manufacturing plants, and wastewater treatment plants in the unincorporated county.
- **Energy Use by Major Industrial Facilities**—Electricity and natural gas use by refineries, chemical facilities, and major manufacturing plants in the unincorporated county.

The stationary source totals identified by BAAQMD for facilities in unincorporated Contra Costa County, as well as the electricity and natural gas used by these facilities, have been excluded from the County's GHG Inventory.

When deciding which sectors to include in an inventory for a local community, the US Community Protocol recommends including those which are subject to "significant local government influence." There are five criteria for determining this influence; a source which satisfies at least one of these criteria is deemed subject to significant local government influence and so should be included in the inventory:

- Ownership (does the local government own the emissions source?)
- Operational control (does the local government operate or manage the emissions source?)
- Regulatory authority (does the local government have the authority to enact regulations, incentive programs, or other mechanisms that could reduce emissions?)

Inventory & Forecast Report

- Enforcement authority (does the local government enforce regulations that could reduce emissions?)
- Budgetary authority (does the local government have monetary influence over the emissions source?)

Most sectors included in the 2005 and 2013 inventories are subject to regulatory and enforcement authority by Contra Costa County, even if the County chooses not to enact policies to reduce emissions from these sources. However, the stationary sources and major industrial facilities are primarily subject to regulation by other agencies, including CARB, BAAQMD, and the US Environmental Protection Agency (EPA), and so fall generally outside of the County's regulatory and enforcement authority.

Exclusion of these emission sources allows the County to prepare a CAP that focuses on actions within its control. Emissions from many of these facilities are being reduced under California's statewide cap and trade program.

Stationary Sources

BAAQMD provided emissions from stationary sources for the 2005 inventory; CARB provided stationary source emissions data for the 2013 inventory. The list of facilities included in the 2005 stationary source data do not match those in the 2013 data, as facilities open and close and regulatory standards change.

Major Industrial Activities

PG&E provided information on energy use by major industrial facilities. Although PG&E was unable to provide data on the specific amounts of energy used by major industrial facilities, it did provide information on the relative amount of energy used by various types of nonresidential facilities. The County used this information to identify the proportion of nonresidential electricity and natural gas used by major industrial activities, including petroleum refining, chemical and mineral processing, and manufacturing. This information was used in conjunction with PG&E data on total nonresidential energy use in the unincorporated areas to identify the energy use of major industrial facilities. The percent of nonresidential energy use used by major industrial activities is shown in **Table C.1**.

Table C.1. Energy Use of Major Industrial Facilities

	2005		2013	
	Electricity (kWh)	Natural Gas (therms)	Electricity (kWh)	Natural Gas (therms)
All nonresidential activities	675,513,630	621,939,360	741,594,630	940,717,040
Major industrial activities	390,955,560	611,688,000	475,377,970	926,932,630
All other nonresidential activities	284,558,070	10,251,360	266,216,660	13,784,410
Percent from major industrial activities	58%	98%	64%	99%

Source: Michael Baker International 2015

Climate Action Plan

The emissions from stationary sources and energy use of major industrial facilities, relative to the emissions of all other included activities, is shown in **Table C.2**.

Table C.2. Emissions from Excluded Sectors

	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)
Stationary sources	13,983,030	11,873,500
Energy use of major industrial facilities	3,344,000	5,026,560
Total of excluded sectors	17,327,030	16,900,060
Included sectors	1,403,610	1,392,450
Total of included and excluded sectors	18,730,640	18,292,510
Percent of emissions from excluded sectors	93%	92%

Source: Michael Baker International 2015

Additional Activities

Emissions from some additional sectors were not analyzed, and so cannot be included. These sectors were excluded because their emissions cannot be accurately analyzed using available data and/or methods, or because emissions from these sectors are negligible in the unincorporated areas of Contra Costa County. The exclusion of these additional sectors is consistent with the US Community Protocol and with state and regional guidance:

- **Propane use:** Propane is occasionally used by homes (and, more rarely, by nonresidential buildings) as a fuel, typically as a substitute for natural gas for heating and cooking purposes. Although propane is largely unregulated and so data on its sales and use are not tracked, methods do exist to estimate emissions from propane use. However, US Census data indicates that propane is not widely used in Contra Costa County to any significant degree. As emissions from this source likely have a minimal contribution to community-wide emissions, propane-related emissions were not estimated.
- **Refrigerants:** Refrigerants are materials commonly used in machinery designed to keep people and equipment cool, such as air conditioning units in buildings and vehicles. There are numerous types of refrigerants, including CFCs (chlorofluorocarbons, now being phased out due to the damage they cause to the ozone layer), HFCs (hydrofluorocarbons), and PFCs (perfluorocarbons). Even in normal conditions, a small amount of refrigerant material leaks from the equipment it is used in or from the containers it is stored in, creating what are called “fugitive emissions.” Refrigerants often have very high GWPs (thousands of times as potent as CO₂ in some instances) and these fugitive emissions contribute to climate change; approximately 4% of California’s 2013 GHG emissions were from refrigerants. However, refrigerants are not generally regulated in California, and no reliable data source exists to estimate fugitive refrigerant emissions in Contra Costa County.

Inventory & Forecast Report

- Life cycle emissions: Industry protocol at this time does not recommend inclusion of life-cycle emissions in community-wide local government GHG inventories. A protocol for estimating life-cycle emissions is under development. Life-cycle emissions are emissions associated with the production and disposal of items consumed by a community (i.e., “cradle-to-grave”). For instance, a life-cycle assessment of vehicle emissions would include those from designing, extracting raw materials, producing, delivering, and disposing of each car in the county. In contrast, this analysis only captures how much that car is driven in the county consistent with standard protocol.
- Other sources: Other GHG emissions sectors have been excluded from the 2005 and 2013 inventories, as they are negligible in size or relevance. Amtrak operates within Contra Costa County but only passes through unincorporated areas briefly along its route, and there are no stations located within the unincorporated areas. Considering the amount of time and effort it would take to quantify these emissions with marginal impact in the baseline emissions inventory and limited control over Amtrak operations, these emissions have been omitted. Emissions from air travel are also currently excluded from countywide inventories due to lack of accepted methodology and data to apportion the emissions to the county and its residents.

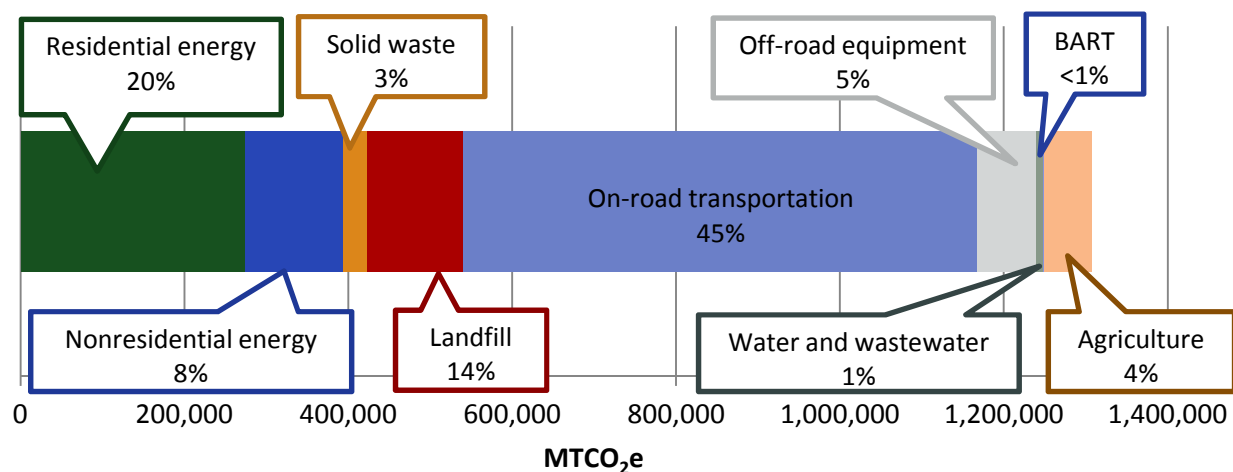
INVENTORY RESULTS

2005 INVENTORY

This section provides a brief overview of the baseline GHG emissions for unincorporated Contra Costa County. In 2005, activities in the unincorporated county and within the County’s jurisdictional land use control generated approximately 1,403,610 metric tons of carbon dioxide equivalents (MTCO₂e). On-road transportation was the largest source of 2005 GHG emissions in Contra Costa County, contributing approximately 628,200 MTCO₂e, or 45% of emissions. The next largest source of emissions, residential energy use, contributed approximately 274,690 MTCO₂e, or 20% of emissions. Landfills were the third-largest sector, contributing 193,950 MTCO₂e or 14% of emissions. The nonresidential energy use sector was the fourth-largest emissions source, contributing 118,740 MTCO₂e (8%); off-road emissions were the fifth-largest emissions source (71,880 MTCO₂e, or 5%); agriculture was the sixth-largest emissions source (57,320 MTCO₂e, or 4%). The solid waste, water and wastewater, and BART sectors represented 3%, 1%, and less than 1% of emissions, respectively. 2005 emissions by sector are shown in **Figure C.1**, and **Table C.3** shows 2005 activity data and emissions by sector and subsector.

Climate Action Plan

Figure C.1. 2005 GHG Emissions by Sector



Source: Michael Baker International 2015

Table C.3. 2005 Activity Data and GHG Emissions by Sector and Subsector

Sector	Subsector	Activity Data	Unit	MTCO ₂ e	Total MTCO ₂ e	Percent of Total MTCO ₂ e
Residential energy	Residential electricity	488,236,740	kWh	110,120	274,690	20%
	Residential natural gas	30,919,160	Therms	164,570		
Nonresidential energy	Nonresidential electricity	284,558,070	kWh	64,180	118,740	8%
	Nonresidential natural gas	10,251,360	Therms	54,560		
Solid waste	Waste disposed	170,780	Tons disposed	48,450	48,450	3%
Landfill	Waste in place	34,455,010	Tons in place	193,950	193,950	14%
On-road transportation	On-road transportation	1,291,819,230	Annual VMT	628,200	628,200	45%
Off-road equipment	Lawn and garden equipment	-	None	3,820	71,880	5%
	Construction equipment	-	None	68,060		
Water and wastewater	Indirect water use	26,443,770	kWh	5,960	8,080	1%
	Indirect wastewater use	6,199,120	kWh	1,400		
	Direct wastewater emissions	-	None	720		
BART	BART trips	38,111,050	Passenger miles	2,300	2,300	<1%
Agriculture	Fertilizer application	200,980	Crop acres	3,920	57,320	4%
	Agriculture equipment	-	None	23,960		
	Livestock	16,500	Heads of livestock	29,440		
TOTAL					1,403,610	100%

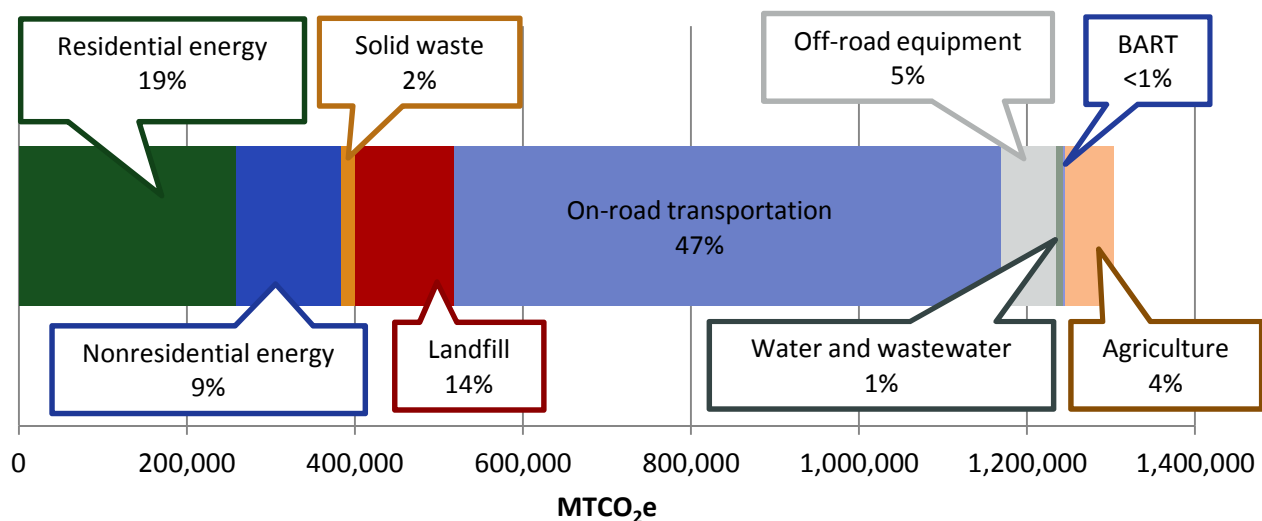
Inventory & Forecast Report

C

2013 INVENTORY

In 2013, activities in the unincorporated areas of Contra Costa County within the County's jurisdictional control resulted in 1,392,450 MTCO₂e, a 1% decrease from 2005 levels. The on-road emissions sector was again the largest, contributing 651,130 MTCO₂e, or 47% of the county's emissions. Residential energy was the second-largest source of emissions with approximately 258,420 MTCO₂e or 19% of emissions, followed by landfills with approximately 196,500 MTCO₂e or 14% of emissions. Nonresidential energy was the fourth-largest source of emissions with approximately 125,350 MTCO₂e (9%); off-road equipment contributed approximately 66,230 MTCO₂e (5%) and agriculture contributed approximately 58,200 MTCO₂e (4%). The smallest sources of emissions, solid waste, water and wastewater, and BART, were responsible for 2%, 1%, and less than 1% of emissions, respectively. 2013 emissions by sector are shown in **Figure C.2**, and activity data and emissions by subsector for 2013 are shown in **Table C.4**. **Table C.5** shows the difference in emissions by sector between 2005 and 2013.

Figure C.2. 2013 GHG Emissions by Sector



Source: Michael Baker International 2015

Climate Action Plan

Table C.4. 2013 Activity Data and GHG Emissions by Sector and Subsector

Sector	Subsector	Activity Data	Unit	MTCO ₂ e	Total MTCO ₂ e	Percent of Total MTCO ₂ e
Residential energy	Residential electricity	478,219,710	kWh	93,380	258,420	19%
	Residential natural gas	31,007,110	Therms	165,040		
Nonresidential energy	Nonresidential electricity	266,216,660	kWh	51,980	125,350	9%
	Nonresidential natural gas	13,784,410	Therms	73,370		
Solid waste	Waste disposed	92,780	Tons disposed	26,540	26,540	2%
Landfill	Waste in place	41,785,650	Tons in place	196,500	196,500	14%
On-road transportation	On-road transportation	1,349,279,980	Annual VMT	651,130	651,130	47%
Off-road equipment	Lawn and garden equipment	-	None	3,180	66,230	5%
	Construction equipment	-	None	63,050		
Water and wastewater	Indirect water use	28,004,290	kWh	5,470	7,400	1%
	Indirect wastewater use	6,198,590	kWh	1,210		
	Direct wastewater emissions	-	None	720		
BART	BART trips	44,417,320	Passenger miles	2,680	2,680	<1%
Agriculture	Fertilizer application	204,030	Crop acres	4,280	58,200	4%
	Agriculture equipment	-	None	18,910		
	Livestock	19,110	Heads of livestock	35,010		
TOTAL					1,392,450	100%

Source: Michael Baker International 2015

Table C.5. Comparison of 2005 and 2013 GHG Emissions by Sector

Sector	2005 MTCO ₂ e	2013 MTCO ₂ e	Percent Change, 2005–2013
Residential energy	274,690	258,420	-6%
Nonresidential energy	118,740	125,350	6%
Solid waste	48,450	26,540	-45%
Landfill	193,950	196,500	1%
On-road transportation	628,200	651,130	4%
Off-road equipment	71,880	66,230	-8%
Water and wastewater	8,080	7,400	-8%
BART	2,300	2,680	17%
Agriculture	57,320	58,200	2%
Total	1,403,610	1,392,450	-1%

Inventory & Forecast Report

C

GHG EMISSIONS ANALYSIS BY SECTOR ACTIVITY

RESIDENTIAL AND NONRESIDENTIAL ENERGY

The residential and nonresidential energy use sectors include the natural gas and electricity consumed by residents and various nonresidential facilities (excluding major industrial facilities) in the unincorporated county. Both electricity and natural gas services are provided in Contra Costa County by PG&E. PG&E provided both the activity data and the emissions factors for the residential and nonresidential energy sectors.

PG&E also supplied data on the relative amount of nonresidential energy used in petroleum refining, chemical processing, and manufacturing; the 2005 and 2013 inventories exclude energy used by these three sectors, as previously discussed. **Table C.6** shows activity data for the residential and nonresidential energy sectors, while **Table C.7** shows emissions from these activities.

Table C.6. Residential and Nonresidential Energy Activity Data, 2005 and 2013

Subsector	2005	2013	Units	Percent Change, 2005–2013
Residential electricity	488,236,740	478,219,710	kWh	-2%
Nonresidential electricity	284,558,070	266,216,660	kWh	-6%
Residential natural gas	30,919,160	31,007,110	Therms	<1%
Nonresidential natural gas	10,251,360	13,784,410	Therms	34%

Source: Michael Baker International 2015

Table C.7. Residential and Nonresidential Energy GHG Emissions, 2005 and 2013

Subsector	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)	Percent Change, 2005–2013
Residential electricity	110,120	93,380	-15%
Nonresidential electricity	64,180	51,980	-19%
Residential natural gas	164,570	165,040	<1%
Nonresidential natural gas	54,560	73,370	34%
Total	393,430	383,770	-2%

Source: Michael Baker International 2015

SOLID WASTE

Solid waste refers to all material thrown away in the unincorporated area of Contra Costa County during the inventory year that is deposited in a landfill. As organic material decomposes in a landfill, it produces methane, some of which escapes into the atmosphere. These emissions may occur anywhere the community sends its waste, whether it is in the unincorporated areas of Contra Costa County or not. These emissions occur over the lifetime of the waste, not only in the calendar year of the inventory, but they are included in the inventory because the activity responsible for these emissions occurred in the specific calendar year (2005 or 2013).

The California Department of Resources Recycling and Recovery provided data on the amount of solid waste generated in Contra Costa County. CARB's publicly available landfill modeling tool was used to calculate emissions resulting from this waste. In accordance with guidance from CARB and EPA, it is assumed that 25% of the methane generated by a landfill escapes to the atmosphere (the rest is captured and used for energy). **Table C.8** shows activity data and emissions for solid waste.

Table C.8. Solid Waste Activity Data and GHG Emissions, 2005 and 2013

	2005	2013	Units	Percent Change, 2005–2013
Activity data	170,780	92,780	Tons disposed	-46%
Emissions	48,450	26,540	MTCO ₂ e	-45%

Source: Michael Baker International 2015

LANDFILL

Landfill emissions are also emissions resulting from the decomposition of organic material in a landfill, although they differ from solid waste emissions in a few regards. Landfill emissions include all emissions at landfills in the unincorporated area of Contra Costa County, regardless of where the waste in the landfills came from. Additionally, these emissions occur in a specific calendar year regardless of when the waste creating the emissions was originally deposited in the landfill (by contrast, solid waste emissions occur over the lifetime of all decomposing waste deposited in the landfill during a specific calendar year).

The landfill sector includes emissions from the two remaining operating landfills located within the unincorporated county, Keller Canyon Landfill and Acme Landfill, as well as from the West Contra Costa Sanitary Landfill, which ceased accepting waste in 2006 but which continues to generate emissions as the waste decomposes. The California Department of Resources Recycling and Recovery provided data on the amount of waste deposited in these landfills; in some instances, this data had to be estimated based on the best available information on the total volume of waste-in-place, or based on the amount disposed in particular years which was used to estimate annual disposal amounts back to the date that the landfill first began accepting waste (or was known to accept waste).

Future projections of disposed waste are based on recent disposal levels, assumed rates of increase, and the estimated closure date for the remaining operating landfills. Disposed waste volumes used as model inputs included

Inventory & Forecast Report

C

those materials used as alternative daily cover that generate methane, including green waste, compost, and sewage sludge (biosolids). CARB's landfill model was used to calculate emissions from all waste deposited in the landfills, again assuming 25% of all emissions enter the atmosphere in accordance with EPA and CARB recommendations.

Table C.9 shows activity data and emissions for the landfill sector.

Table C.9. Landfill Activity Data and GHG Emissions, 2005 and 2013

	2005	2013	Units	Percent Change, 2005–2013
Activity data	34,455,010	41,785,650	Tons in place	21%
Emissions	193,950	196,500	MTCO ₂ e	1%

Source: Michael Baker International 2015

ON-ROAD TRANSPORTATION

On-road transportation generates GHG emissions from the combustion of gasoline and diesel fuel use by vehicles operating on roads within Contra Costa County. The Contra Costa Transportation Authority's Travel Demand Model was used to calculate activity data for on-road transportation; this model generated three types of vehicle trips:

- Internal-Internal: Vehicle trips that remained in the unincorporated county.
- Internal-External and External-Internal: Vehicle trips that have an ending or a beginning in the unincorporated and another within an incorporated city or outside of Contra Costa County.
- External-External: Vehicle trips with neither end of the trip beginning or ending in the unincorporated county.

In accordance with best industry practice, all internal-internal trips and half of the internal-external/external-internal are included in these inventories. External-external trips are excluded because the County cannot directly influence these activities, even though part of the trip occurs within the unincorporated area. CARB provided the emissions factors through the EMFAC 2011 emissions database, which provides these factors based on the unique vehicle composition of each county in California. Weekday VMT and emissions are converted to annual figures using a conversion factor of 347 days/year to account for lessened travel on weekends, per the Assembly Bill (AB) 32 Technical Appendix. Individual GHGs such as carbon dioxide, methane, and nitrous oxide are converted to CO₂e by multiplying the CO₂ emissions by a conversion factor of 100/95. Activity data and emissions for on-road transportation are shown in **Table C.10**.

Table C.10. On-Road Transportation Activity Data and GHG Emissions, 2005 and 2013

	2005	2013	Units	Percent Change, 2005–2013
Activity data	1,291,819,230	1,349,279,980	Annual VMT	4%
Emissions	628,200	651,130	MTCO ₂ e	4%

Source: Michael Baker International 2015

OFF-ROAD EQUIPMENT

Off-road equipment includes vehicles and portable equipment used for construction and lawn and garden activities (agricultural off-road equipment is included in the agriculture sector). There is no activity data for off-road equipment. CARB provides countywide emissions using the OFFROAD2007 software. In accordance with the Community Protocol, BAAQMD guidance, and best practices, a portion of the countywide emissions was attributed to the unincorporated areas using the following methods:

- Countywide construction equipment emissions were accredited to the unincorporated county using the proportion of the service population in the unincorporated county compared to the entire county using data provided by the Association of Bay Area Governments (ABAG).
- Total County lawn and garden emissions were attributed to the unincorporated county using the proportion of existing households within the unincorporated county compared to the entire county, according to ABAG figures.

Table C.11 shows the emissions from off-road equipment in 2005 and 2013.

Table C.11. Off-Road Equipment Emissions, 2005 and 2013

Subsector	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)	Percent Change, 2005–2013
Lawn and garden equipment	3,820	3,180	-17%
Construction equipment	68,060	63,050	-7%
Total	71,880	66,230	-8%

Source: Michael Baker International 2015

Inventory & Forecast Report

C

WATER AND WASTEWATER

The water and wastewater sector includes three subsectors: (1) indirect water emissions, (2) indirect wastewater emissions, and (3) direct wastewater emissions. Indirect water emissions result from the energy used to transport and process water, while indirect wastewater emissions occur as a result of the energy used to transport and process wastewater. Direct wastewater emissions occur at the wastewater treatment plant as a result of the decomposition of organic materials in the wastewater.

Water providers supplied information on the amount of water used in the unincorporated areas and the sources of this water, while the California Energy Commission (CEC) provided information on the amount of energy used per gallon depending on the source. CEC data was used to calculate indirect wastewater energy used, based on estimates of wastewater volume that were calculated from water usage figures. PG&E provided the emissions factors to convert energy use factors into emissions. Direct wastewater emissions were calculated from information provided by wastewater service providers and data in the US Community Protocol. **Table C.12** shows activity data for indirect water and wastewater emissions (there is no activity data for direct emissions), while **Table C.13** shows GHG emissions for the water and wastewater sectors.

Table C.12. Water and Wastewater Activity Data, 2005 and 2013

Subsector	2005	2013	Units	Percent Change, 2005–2013
Indirect water	26,443,770	28,004,290	kWh	6%
Indirect wastewater	6,199,120	6,198,590	kWh	-<1%

Source: Michael Baker International 2015

Table C.13. Water and Wastewater GHG Emissions, 2005 and 2013

Subsector	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)	Percent Change, 2005–2013
Indirect water	5,960	5,470	-8%
Indirect wastewater	1,400	1,210	-14%
Direct wastewater	720	720	0%
Total	8,080	7,400	-8%

Source: Michael Baker International 2015

BART

Emissions from BART (the Bay Area Rapid Transit District's mass transit system) occur as a result of the energy used to power the trains and operate the system's facilities. Activity data for BART is measured in passenger miles, which BART publishes monthly. Although there are ten BART stations in Contra Costa County, only the Pleasant Hill/Contra Costa Centre station is located within the unincorporated area. In accordance with best practices, only half of all passenger miles from trips beginning or ending at this station are included in the 2005 and 2013 inventories; the other half are attributed to the other station where the trip began/ended. BART also supplied an emissions factor for

trips on the system, and although this factor has not been updated since 2007, it has been verified by BAAQMD and remains the most accurate available factor. Activity data and emissions for BART are shown in **Table C.14**.

Table C.14. BART Activity Data and GHG Emissions, 2005 and 2013*

	2005	2013	Units	Percent Change, 2005–2013
Activity data	38,111,050	44,417,320	Passenger miles	17%
Emissions	2,300	2,680	MTCO ₂ e	17%

Source: Michael Baker International 2015

*Note: Activity data is for the Pleasant Hill/Contra Costa Centre station only

AGRICULTURE

The agriculture sector includes an analysis of the GHG emissions occurring from fertilizer application on crops, the use of agricultural equipment, and from livestock, which produce methane and N₂O through digestive processes.

The Contra Costa County Agriculture Department provided information on crop acreage and heads of livestock in the unincorporated area. The University of California Cooperative Extension provided information on the amounts of fertilizer applied to various types of crops, while the US Community Protocol supplied additional data needed to calculate emissions from fertilizer use. CARB, the EPA, and the IPCC supplied information on the amounts of GHGs produced per head of livestock due to digestive processes. CARB's OFFROAD2007 software supplied emissions for agricultural equipment; there is no activity data for agricultural equipment. Activity data for agricultural activities is shown in **Table C.15** and GHG emissions for agricultural activities are included in **Table C.16**.

Table C.15. Agriculture Activity Data, 2005 and 2013

Subsector	2005	2013	Units	Percent Change, 2005–2013
Fertilizer application	200,980	204,030	Crop acres	2%
Livestock	16,500	19,110	Heads of livestock	16%

Source: Michael Baker International 2015

Table C.16. Agriculture GHG Emissions, 2005 and 2013

Subsector	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)	Percent Change, 2005–2013
Fertilizer application	3,920	4,280	9%
Agriculture equipment	23,960	18,910	-21%
Livestock	29,440	35,010	19%
Total	57,320	58,200	2%

Source: Michael Baker International 2015

Inventory & Forecast Report

GHG EMISSIONS FORECAST

A GHG emissions forecast is an estimate of how emissions will change in the future based on anticipated population and jobs growth in the unincorporated areas of Contra Costa County, absent of any actions taken at the federal, state, regional, or local level to reduce emissions. This forecast is often referred to as a business-as-usual forecast. A GHG emissions forecast allows elected officials, County staff, and community members to determine the volume of reductions needed to meet GHG reduction goals.

Consistent with state and regional guidance, as well as widely accepted forecasting methods including the Association of Environmental Professionals white paper on GHG forecasts, the GHG emissions forecast for Contra Costa County assumes that per capita activity data remains constant at 2005 baseline levels. Association of Bay Area Governments (ABAG) demographic growth projections is the primary data source used to forecast GHG emissions. These growth projections are given in **Table C.17**.

Table C.17. ABAG Projections for Unincorporated Contra Costa County, 2005–2035

	2005	2013	2020	2035	2005–2035 Change
Population	159,650	162,230	166,100	173,500	6%
Households	57,980	58,550	59,720	61,740	9%
Jobs	41,270	43,210	47,670	50,330	22%
Service Population	200,920	205,440	213,770	223,830	11%

Source: Association of Bay Area Governments 2009, 2013

Under the growth projections identified by ABAG, emissions in the unincorporated area are forecasted to increase to 1,483,720 MTCO₂e by 2020, a 6% increase from 2005 levels. Emissions in 2035 are projected to rise to 1,545,980 MTCO₂e, a 10% increase from 2005 levels. **Table C.18** and **Figure C.3** show emissions by sector for the 2005 baseline inventory and the two forecasted years.

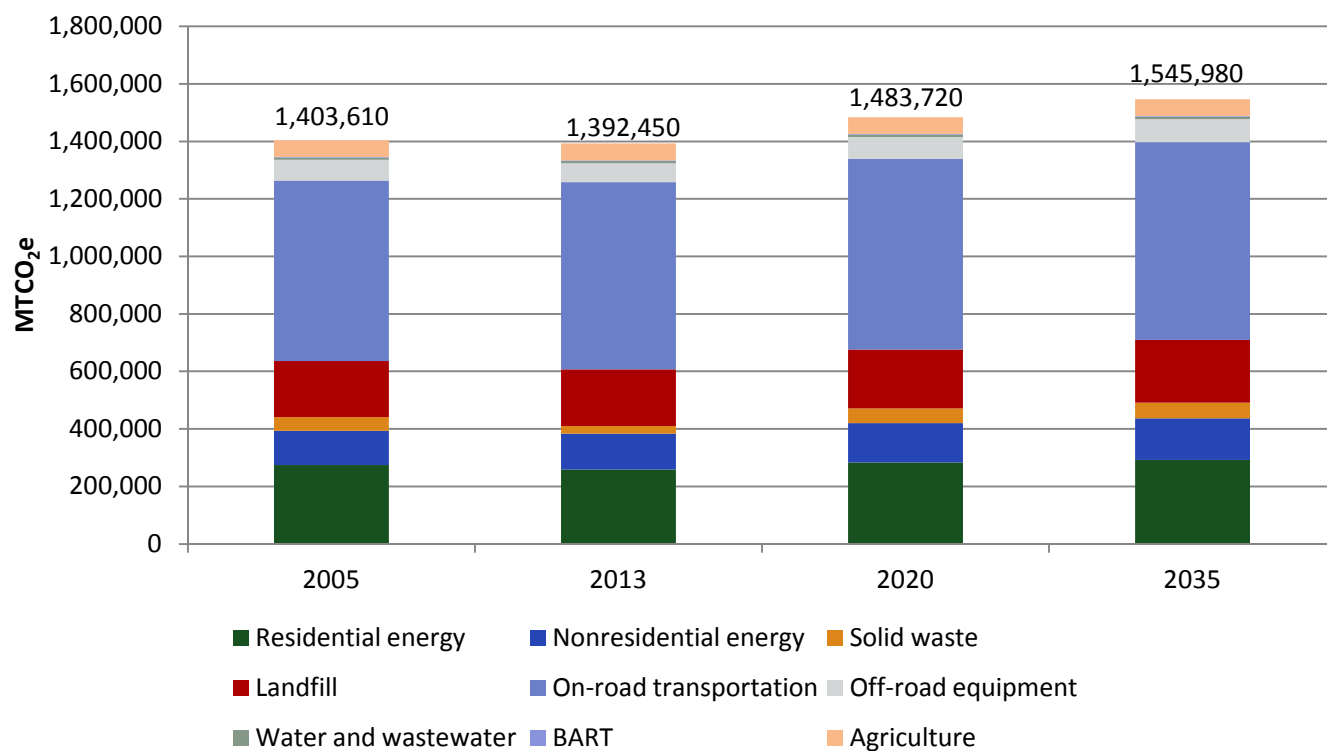
Climate Action Plan

Table C.18. GHG Emissions by Sector, 2005–2035

Sector	2005 MTCO ₂ e	2013 MTCO ₂ e	2020 MTCO ₂ e	2035 MTCO ₂ e	Percent Change, 2005–2035
Residential energy	274,690	258,420	282,930	292,500	6%
Nonresidential energy	118,740	125,350	137,150	144,810	22%
Solid waste	48,450	26,540	51,550	53,970	11%
Landfill	193,950	196,500	204,560	218,560	13%
On-road transportation	628,200	651,130	662,820	687,370	9%
Off-road equipment	71,880	66,230	76,340	79,890	11%
Water and wastewater	8,080	7,400	8,600	9,000	11%
BART	2,300	2,680	2,450	2,560	11%
Agriculture	57,320	58,200	57,320	57,320	0%
TOTAL	1,403,610	1,392,450	1,483,720	1,545,980	10%
Percent Change from 2005	-	-1%	6%	10%	-

Source: Michael Baker International 2015

Figure C.3. GHG Emissions by Sector, 2005–2035



Source: Michael Baker International 2015

Inventory & Forecast Report

Emissions associated with energy, water, wastewater, BART, solid waste, and off-road equipment are anticipated to grow linearly with household, employment, and service population growth. Emissions from the landfill subsector were forecasted using the landfill modeling software developed by CARB to estimate net fugitive methane emissions in 2020 and 2035, based on the total amount of waste disposed in the landfills located in the unincorporated county. On-road VMT in the GHG forecast were modeled using the Contra Costa Transportation Authority's Travel Demand Forecasting Model and include regional transportation improvements identified in the Comprehensive Transportation Project List. The forecast assumes that agricultural activities (including off-road agricultural equipment) do not change from baseline levels.

EXISTING STATE GHG REDUCTION PROGRAMS

The state of California has been proactive in reducing GHG emissions. Several regulations and efforts at the state level will lessen Contra Costa County's future GHG emissions, including vehicle standards, building standards, and the renewable energy content of electricity. As a result, an initial step in the assessment of GHG reductions in the unincorporated county is to apply the potential effects of these activities on Contra Costa County's forecasted emissions. The state programs analyzed are limited to those programs that have been formally adopted by the state legislature and governor and implemented by state agencies, except as noted. These results are detailed in **Table C.19**.

California's Renewables Portfolio Standard (RPS)

One of the most ambitious renewable energy standards in the country, RPS mandates that 33% of electricity delivered in California be generated by renewable sources like solar, wind, and geothermal by 2020. The California RPS was first codified in 2002 by Senate Bill (SB) 1078 (requiring 20% renewable electricity mix by 2010) and further strengthened in April 2011 with the adoption of SB X 1-2 (requiring 33% renewable electricity mix by 2020). The RPS intended to boost the economy and establish California as a center for the development and use of renewable energy.

Governor Jerry Brown established a goal to increase the RPS to 50% by 2030, and on September 11, 2015, the California legislature passed Senate Bill 350 to codify the governor's executive order. This forecast assumes the RPS goal of 50% by 2030.

AB 1493 Clean Car Standards and the Low Carbon Fuel Standard

California's Clean Car Standards were established by AB 1493 in 2002, requiring new passenger vehicles to reduce tailpipe GHG emissions from 2009 to 2020. These standards are also often referred to as the Pavley standards, after State Senator Fran Pavley who authored AB 1493 when she was a member of the state assembly. A related program, the Low Carbon Fuel Standard (LCFS), establishes a goal of a 10% reduction in carbon intensity in transportation fuels. Reductions from the Clean Car Standards and the LCFS were calculated using the EMFAC2011 modeling software created by CARB, which provides an emissions coefficient that accounts for the impact of these state policies. Emissions reductions per model year and vehicle class were applied to Contra Costa County's transportation emissions.

Emissions reductions per model year and vehicle class were applied to Contra Costa County's transportation emissions.

Title 24, Energy Efficiency Standards

California's Title 24 (CalGreen) energy standards are updated every few years (the most recent update went into effect on July 1, 2014). These are statewide standards applied at the local level by city and county agencies through project review. The CEC provides information on the energy efficiency of each new set of Title 24 standards relative to the previous standards. The calculation of CalGreen energy reductions assumes that all development occurring after 2005 will comply with the version of the Title 24 standards which apply at the time of construction. It also assumes that all growth in natural gas and electricity sectors is from new construction. As a conservative estimate and to avoid creating additional uncertainty in the forecast, reductions from Title 24 assume that the requirements do not become stricter after the 2022 standards go into effect.

Table C.19. GHG Reductions from State Policies, 2020 and 2035

State Policy or Program	2020 (MTCO ₂ e)	2035 (MTCO ₂ e)
Renewables Portfolio Standard	-41,620	-78,030
Clean Car Standard and LCFS	-173,480	-236,270
Title 24 Standards	-2,840	-7,970
TOTAL	-217,940	-322,270

Source: Michael Baker International 2015

The regulations implemented by the state will have a profound impact on Contra Costa's GHG emissions. As shown in **Table C.20**, reductions from state activities are expected to reduce emissions below baseline levels by 2020, and to continue to decrease emissions by 2035 despite population growth.

Table C.20. GHG Emissions with State Reduction Actions, 2005–2035

Sector	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)	2020 (MTCO ₂ e)	2035 (MTCO ₂ e)	Percent Change, 2005–2035
Residential energy	274,690	258,420	257,310	242,280	-12%
Nonresidential energy	118,740	125,350	119,980	112,170	-6%
Solid waste	48,450	26,540	51,550	53,970	11%
Landfill	193,950	196,500	204,560	218,560	13%
On-road transportation	628,200	651,130	489,340	451,100	-28%
Off-road equipment	71,880	66,230	76,340	79,890	11%
Water and wastewater	8,080	7,400	6,930	5,860	-27%
BART	2,300	2,680	2,450	2,560	11%
Agriculture	57,320	58,200	57,320	57,320	0%
TOTAL	4,403,610	1,392,450	1,265,620	1,223,170	-13%

Inventory & Forecast Report

C

Sector	2005 (MTCO ₂ e)	2013 (MTCO ₂ e)	2020 (MTCO ₂ e)	2035 (MTCO ₂ e)	Percent Change, 2005–2035
Percent Change from 2005	-	-1%	-10%	-13%	-

Source: Michael Baker International 2015

GHG REDUCTION TARGETS

The CEQA Guidelines require that a Qualified GHG Reduction Strategy contain a goal for substantive GHG reductions. The California Global Warming Solutions Act (AB 32) established a statewide GHG reduction goal of returning to 1990 levels by 2020. The AB 32 Scoping Plan, which lays out the strategy to achieve the AB 32 reduction goal, identifies a goal of 15% below baseline levels by 2020 for local communities as being comparable to the 1990 statewide goal for GHG reductions. Executive Order (EO) S-03-05, signed by former Governor Schwarzenegger in 2005, establishes a statewide GHG reduction goal of 80% below 1990 levels by 2050. A 2015 executive order by Governor Brown, EO B-30-15, establishes a statewide reduction goal of 40% below 1990 levels by 2030; legislation codifying both goals is currently being considered by the state legislature. No current or pending legislation would create a statewide goal for 2035. A potential option for a 2035 goal is one that reduces emissions to the level specified in EO B-30-15 by 2030, then continues to reduce emissions on a trajectory that would meet the 2050 target. For 2035, such a goal is equal to 50% below 1990 levels, or approximately 57% below baseline levels. **Table C.21** and **Figure C.4** show the difference between the baseline, forecast, and forecast with state reductions relative to the recommended goals, along with the volume of GHG reductions needed from local activities.

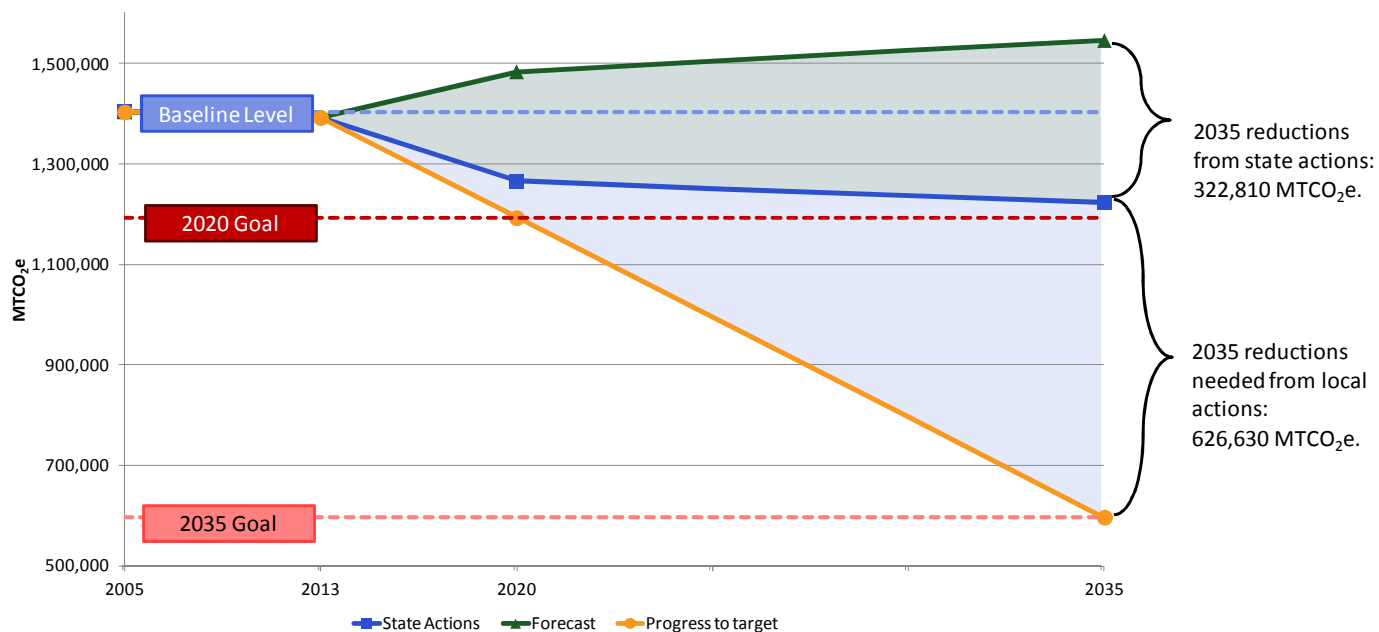
Table C.21. Baseline GHG Emissions, Forecasts, and Reduction Goals

	2020 MTCO ₂ e	2035 MTCO ₂ e
2005 Baseline Emissions	1,403,610	1,403,610
Forecasted Emissions	1,483,720	1,545,980
Emissions with Statewide Reductions	1,265,620	1,223,170
Reduction Target	1,193,070	596,540
Local Reductions Needed	-72,550	-626,630

Source: Michael Baker International 2015

Climate Action Plan

Figure C.4. Baseline GHG Emissions, Forecasts, and Reduction Goals



Source: Michael Baker International 2015

Appendix D: GHG Reduction Tech Appendix

D



This technical appendix provides a summary of the data sources, assumptions, and performance metrics used in this Climate Action Plan (CAP) for the County of Contra Costa to quantify estimated greenhouse gas (GHG) reductions. The sources and metrics are organized by policy and rely on four primary types of data and research: (1) the County's GHG emissions inventory and forecast, (2) government agency tools and reports, (3) case studies in similar jurisdictions, and (4) scholarly research. The approach to quantification is consistent with the guidance provided by the Bay Area Air Quality Management District (BAAQMD) for the development of a Qualified GHG Reduction Strategy.

The baseline GHG inventory and forecast serve as the foundation for the quantification of the County's GHG reduction measures. Activity data from the inventory forms the basis of measure quantification, including vehicle miles traveled, kilowatt-hours (kWh) of electricity or therms of natural gas consumed, and tons of waste disposed. Activity data was combined with the performance targets and indicators identified by the County and Michael Baker International staff. Together, the metrics of activity data and performance targets and indicators were used throughout the quantification process to calculate the GHG reduction benefit of each measure. This approach ensures that the County's GHG reductions are tied to the baseline and future activities that are actually occurring within Contra Costa County. The approach to quantification is further described in **Chapter 4**.

Measure EE 1: Energy-Efficient Retrofits – Residential Buildings

Policy Language: Provide opportunities for residential buildings to become more energy efficient.

GHG Reduction Action items:

1. Continue and expand single-family participation in established energy efficiency rebate programs, including BayREN and East Bay Energy Watch.
 - Collaborate with local organizations like Contra Costa County Climate Leaders and PG&E to develop comprehensive and appropriate outreach efforts that effectively reach all segments of the community.
 - Monitor participation in energy efficiency programs.
2. Continue and expand multi-family participation in established energy efficiency rebate programs, including BayREN and East Bay Energy Watch.
3. Increase participation in the existing low-income weatherization program and seek additional program funding.
4. Identify disadvantaged individuals and households for increased participation in energy efficiency programs.
5. Work with PG&E to advertise and promote a residential appliance rebate program with a focus on properties with potential high appliance energy use (e.g., homes with pools would receive a flyer about available pool pump rebates and return on investment information).
6. Participate in one or more Property Assessed Clean Energy (PACE) financing programs.

GHG Reduction Tech Appendix

D

Measure EE 1 Continued

Participation Assumptions:

	2020	2035
SFR basic retrofit participation rate	7%	10%
SFR advanced retrofit participation rate	0.5%	1%
MFR retrofit participation rate	5%	10%
Homes undergoing appliance upgrades	5%	10%
Home appliance upgrade infiltration rate	25%	25%

Performance Targets:

	2020	2035
Number of single -family homes receiving basic retrofits	3,000 (average reduction of 840 kWh and 50 therms per home)	4,290 (average reduction of 840 kWh and 50 therms per home)
Number of single-family homes receiving advanced retrofits	210 (average of 3,370 kWh and 210 therms per home)	430 (average of 3,370 kWh and 210 therms per home)
Number of multi-family homes receiving retrofits	700	1,400
Number of single-family homes receiving pool pump upgrades	150	150
Number of homes receiving appliance upgrades	2,010	4,030

GHG Reduction Tech Appendix

Measure EE 1Continued

2020 GHG Reductions (MTCO ₂ e)	2,140
2035 GHG Reductions (MTCO ₂ e)	3,160
GHG Method:	Reductions are based on expected increases in energy efficiency as a result of residential participation in educational and incentive programs. Reductions were applied to forecasted energy usage. Reduction rates for low-income weatherization, whole-house retrofits, and energy-efficient appliances were identified from case studies and program-specific information. These reductions were applied to participating households, which were identified by applying target participation rates to relevant residential building types. The sum of these reductions was then converted to MTCO ₂ e.
GHG Sources:	<p>BayREN. 2015. Advanced Home Upgrade Assessment Incentive. https://www.bayareaenergyupgrade.org/sites/default/files/BayRenAdvancedHomeUpgradeInfov9.pdf</p> <p>Brown, Rich, Sam Borgeson, Jon Koomey, and Peter Biermayer. 2008. U.S. Building-Sector Energy Efficiency Potential. Ernest Orlando Lawrence Berkeley National Laboratory, University of California. http://enduse.lbl.gov/info/LBNL-1096E.pdf</p> <p>Energy Upgrade CA. 2013. Bay Area Multifamily Program. http://multifamily.energyupgradeca.org/#bayarea</p> <p>KEMA, Inc. 2010. 2009 California Residential Appliance Saturation Study, Volume 2: Results. CEC-200-2010-004 http://www.energy.ca.gov/appliances/rass/</p> <p>Pacific Gas and Electric Company and Sempra Energy. 2007. Draft Report: Residential Swimming Pools. http://www.energy.ca.gov/title24/2008standards/prerulemaking/documents/2007-02-26-27_workshop/supporting/PGE-DRAFT_REPORT_RESIDENTIAL_SWIMMING_POOL.PDF</p>
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Provides Educational Opportunities
Community Co-Benefit 3:	Saves Money
Community Co-Benefit 4:	Improves Public Health
Community Co-Benefit 5:	Adaptive Measure

GHG Reduction Tech Appendix

D

Measure EE 2: Energy-Efficient Retrofits – Nonresidential Buildings

Policy Language: Provide opportunities for nonresidential buildings to become more energy efficient.

Action Items:

1. Continue expanding nonresidential participation in energy efficiency rebate and financing programs, including East Bay Energy Watch, BayREN, low-interest California Energy Commission (CEC) loans, and PG&E on-bill financing opportunities. Create a prioritized list of energy-intense facilities to target for additional education and/or financial support for energy efficiency improvements, while complying with existing privacy regulations.
2. Provide focused outreach to local businesses describing PACE program opportunities, constraints, and benefits.
3. Develop outreach materials that explain the opportunities for financing energy efficiency retrofits such as a PACE program, low-interest energy efficiency loans through the CEC, integration of energy efficiency retrofit projects into capital lease structures, and mortgage refinancing.
4. Identify staffing and a revenue stream to develop a shared landlord-tenant program to support the financing of energy efficiency retrofits to renter-occupied buildings.
5. Inform nonresidential building owners about the savings potentials from retrocommissioning, retrofits, and deep retrofits.
6. Inform the business community about the monetary benefits associated with energy-efficient appliances.
7. Collaborate with local organizations like 4CL and PG&E to develop and implement the outreach approaches outlined in this measure.

Participation Assumptions:

	2020	2035
Percent of existing businesses undergoing retrocommissioning	8%	15%
Percent of existing businesses undergoing standard retrofits	4%	10%
Percent of existing businesses undergoing deep retrofits	1%	3%
Businesses completing appliance upgrades	10%	20%
Appliance upgrade infiltration rate	25%	25%

GHG Reduction Tech Appendix

Measure EE 2 Continued

Performance Targets:

	2020	2035
Number of businesses receiving retrocommissioning	240 (average of 23,190 kWh and 840 therms per business)	450 (average of 23,190 kWh and 840 therms per business)
Number of businesses receiving standard retrofits	120 (average of 39,280 kWh and 1420 therms per business)	300 (average of 39,280 kWh and 1420 therms per business)
Number of businesses receiving deep retrofits	30 (average of 49,690 kWh and 1,790 therms per business)	90 (average of 49,690 kWh and 1,790 therms per business)
Number of businesses receiving appliance upgrades	300 (average of 2,560 kWh and 90 therms per business)	600 (average of 2,560 kWh and 90 therms per business)

2020 GHG Reductions (MTCO₂e)	4,630
2035 GHG Reductions (MTCO ₂ e)	9,310
GHG Method:	Reductions are based on expected increases in energy efficiency as a result of nonresidential participation in educational and incentive programs. Reductions were applied to forecasted energy usage.
GHG Sources:	<p>Brown, Rich, Sam Borgeson, Jon Koomey, and Peter Biermayer. 2008. U.S. Building-Sector Energy Efficiency Potential. Ernest Orlando Lawrence Berkeley National Laboratory, University of California. http://enduse.lbl.gov/info/LBNL-1096E.pdf</p> <p>Itron, Inc. 2007. California Commercial End-use Survey - Results Page. http://capabilities.itron.com/CeusWeb/Chart.aspx</p> <p>Pacific Northwest National Laboratory. 2011. Advanced Energy Retrofit Guide - Practical Ways to Improve Energy Performance: Office Buildings. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-20761.pdf</p>
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Supports Local Economy
Community Co-Benefit 3:	Provides Educational Opportunities
Community Co-Benefit 4:	Saves Money
Community Co-Benefit 5:	Improves Public Health

GHG Reduction Tech Appendix

D

Measure EE 3: Energy Conservation Awareness

Policy Language: Provide education and outreach highlighting the benefits of energy conservation.

Action Items:

1. Engage with PG&E to provide multilingual and culturally relevant educational material to residents and businesses to increase the community's awareness and utilization of real-time energy consumption data available through the SmartMeter program.
2. Work with the Bay Area Green Business Program to highlight examples of energy-efficient local businesses.

Participation Assumptions:

	2020	2035
Residential Participation Rate	5%	10%
Commercial Participation Rate	2%	5%
Residential energy reduction rate	3%	3%
Nonresidential energy reduction rate	2.5%	2.5%

Performance Targets:

	2020	2035
Number of participating homes	2,900 (annual average of 250 kWh and 20 therms per home)	5,800 (annual average of 250 kWh and 20 therms per home)
Number of participating businesses	60 (average of 2,370 kWh and 90 therms per business)	150 (average of 2,370 kWh and 90 therms per business)

GHG Reduction Tech Appendix

Measure EE 3 Continued

2020 GHG Reductions (MTCO₂e)	430
2035 GHG Reductions (MTCO ₂ e)	810
GHG Method:	A participation rate was applied to baseline kWh. Studies of energy reductions from energy use awareness campaigns for both residential and nonresidential buildings were used to guide estimate reductions.
GHG Sources:	<p>Green, J. & Skumatz, L. 2000. "Evaluating the Impacts of Education/Outreach Programs: Lessons of Impacts, Methods, and Optimal Education." http://aceee.org/files/proceedings/2000/data/papers/SS00_Panel8_Paper10.pdf</p> <p>US Department of Energy. 2013. "Leading by Example: Better Buildings Challenge Partners Cut Energy Use". http://energy.gov/articles/leading-example-better-buildings-challenge-partners-cut-energy-use</p>
Implementation Time Frame:	Near-Term (by 2018)
Responsible Agencies:	Conservation & Development, Health Services
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Supports Local Economy
Community Co-Benefit 3:	Provides Educational Opportunities
Community Co-Benefit 4:	Saves Money

GHG Reduction Tech Appendix

D

Measure EE 4: Urban Forestry and Paving and Roofing Materials

Policy Language: Reduce urban heat islands through vegetation management and cool surfaces.

Action Items:

1. Encourage multi-family residential and nonresidential development to increase use of higher-albedo materials for surfaces including roofs, parking areas, driveways, roads, and sidewalks.
2. Encourage developments with parking lot areas to shade these areas with vegetation or solar panels when appropriate.
3. Continue to promote the use of low-impact development (LID) strategies and reduction in impervious surface area of new development.
4. Encourage increased use of cool roof materials on new and existing buildings to reduce the urban heat island effect and corresponding cooling energy consumption.
5. Support various programs to plant and maintain trees in urban and rural areas.

Participation Assumptions:

	2020	2035
Percent of existing houses adding a cool roof	3%	5%
Percent of existing nonresidential buildings adding a cool roof	2%	4%
Number of new shade trees planted	500	1,000

Performance Targets:

	2020	2035
Number of existing homes completing cool roof retrofits	1,790 (average of 10 kWh per home)	3,090 (average of 10 kWh per home)
Number of existing businesses completing cool roof retrofits	9 (average of 1,450 kWh per business)	17 (average of 1,450 kWh per business)
Number of new shade trees	500 (average of 200 kWh per tree)	1,000 (average of 200 kWh per tree)

Measure EE 4 Continued

2020 GHG Reductions (MTCO ₂ e)	20
2035 GHG Reductions (MTCO ₂ e)	40
GHG Method:	Reductions associated with lowering electricity for cooling use was applied to a proportion of homes and businesses retrofitting their buildings with cool roofs and surfaces. The Brown et al. and California End Use Survey (CEUS) studies were used to determine the percentage of residential and nonresidential energy used for cooling. These reductions were applied to households and businesses in 2020 and 2030. CAAPA 1.5 was used to determine the kWh saved from cooling as a result of planting shade trees.
GHG Sources:	California Energy Commission. 2012. Cool Roofs. http://www.energy.ca.gov/2012publications/CEC-400-2012-003/CEC-400-2012-003-BR.pdf ICLEI – Local Governments for Sustainability. n.d. "Climate and Air Pollution Planning Assistant v 1.5."
Implementation Time Frame:	Near-Term (by 2018)
Responsible Agencies:	Conservation & Development, Public Works
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Improves Air Quality
Community Co-Benefit 3:	Saves Money
Community Co-Benefit 4:	Improves Community Livability
Community Co-Benefit 5:	Improves Public Health
Community Co-Benefit 6:	Adaptive Measure

GHG Reduction Tech Appendix

D

Measure EE 5: Energy Efficiency Capacity Building

Policy Language: Increase Contra Costa County's capacity for energy efficiency through financing opportunities and workforce training.

Action Items:

1. Monitor grants from cap-and-trade revenue and other funding sources, and inform applicable County agencies.
2. Create a framework for revenues from cap-and-trade offsets or allocations to fund energy efficiency and resource conservation programs, such as those proposed in this CAP, to be used locally, particularly within recognized impacted communities or areas.
3. Work with the Contra Costa Community College District and the Contra Costa Workforce Development Board to encourage and develop workforce training programs for green jobs, including energy efficiency audits, energy retrofits, and renewable energy installation.

Participation Assumptions and Performance Targets:

Supportive Measure

2020 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
2035 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
GHG Method:	Supportive, not quantified
GHG Sources:	Supportive, not quantified
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development, Health Services, Public Works; additional departments depending on grant resources
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Supports Local Economy
Community Co-Benefit 3:	Provides Educational Opportunities
Community Co-Benefit 4:	Saves Money
Community Co-Benefit 5:	Improves Public Health

GHG Reduction Tech Appendix

Measure EE 6: Energy-Efficient New Buildings

Policy Language: Support the statewide transition to net zero energy construction for new residential buildings by 2020 and new nonresidential buildings by 2030.

Action Items:

1. Identify and remove barriers to zero net energy construction in the County's regulatory framework.
2. Work with developers, property owners, and financial donors to construct and publicize example zero net energy homes prior to the adoption of zero net energy building codes by the California Energy Commission.
3. Provide information about zero net energy buildings at public events, on the County website, and in the development review process, including publicizing information about the cost effectiveness of zero net energy buildings. Include information about zero net energy buildings in other energy efficiency education efforts.
4. Explore making new and significantly retrofitted County buildings zero net energy.

Participation Assumptions:

	2020	2035
ZNE retrofits - nonresidential	0.02%	0.04%
ZNE new construction - nonresidential	1.00%	3.00%
ZNE retrofits - residential	0.02%	0.04%
ZNE new construction - residential	3.00%	10.00%

Performance Targets:

	2020	2035
Number of new ZNE homes	30	100
Number of new ZNE businesses	3	10
Number of retrofitted ZNE homes	12	23
Number of retrofitted ZNE businesses	1	1

GHG Reduction Tech Appendix

D

Measure EE 6 Continued

2020 GHG Reductions (MTCO ₂ e)	290
2035 GHG Reductions (MTCO ₂ e)	680
GHG Method:	Reduction rates for zero net energy (ZNE) retrofits and construction were identified from program-specific information, namely projections of GHG reductions per home or business based on existing and future use. These reductions were applied to participating households and businesses which were identified by applying target participation rates to relevant residential and nonresidential building types. The sum of these reductions was then converted to MTCO ₂ e. Because ZNE depends on renewable energy generation, RE measures were adjusted to avoid double counting.
GHG Sources:	California Energy Commission and California Public Utilities Commission. 2015. California Zero Net Energy Residential Action Plan. http://www.californiaznehomes.com/ California Public Utilities Commission. 2015. "Zero Net Energy Buildings." http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Zero+Net+Energy+Buildings.htm
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development, Public Works
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Provides Educational Opportunities
Community Co-Benefit 3:	Saves Money
Community Co-Benefit 4:	Conserves Resources

GHG Reduction Tech Appendix

Measure RE 1: Alternative Energy Installations

Policy Language: Promote installation of alternative energy facilities on homes and businesses.

Action Items:

1. Amend the County Zoning Code to designate areas and development standards that are appropriate for and supportive of small- and medium-sized alternative energy and energy storage installations not covered by AB 2188.
2. Train planning staff to provide guidance and information on the streamlined process and available incentives.
3. Create development standards allowing for the ministerial approval of rooftop energy systems on commercial buildings, with a focus on warehouses and other structures with large surface area roofs.
4. Encourage participation in PG&E's green tariff program.

Participation Assumptions:

	2020	2035
Percent of new houses with solar arrays	5%	12%
Percent of existing houses with solar arrays	4%	8%
Percent of new businesses with solar arrays	3%	10%
Percent of existing businesses with solar arrays	2%	5%
Participation multiplier for PG&E Green Tariff program	1.5	1.5

Performance Targets:

	2020	2035
Number of new homes with solar arrays	50 (average of 7 kW per array)	350 (average of 7 kW per array)
Number of existing homes with solar arrays	2,500 (average of 7 kW per array)	4,690 (average of 7 kW per array)
Number of new businesses with solar arrays	10 (average of 154 kW per array)	50 (average of 154 kW per array)
Number of existing businesses with solar arrays	60 (average of 154 kW per array)	160 (average of 154 kW per array)
Number of kW supplied by PG&E Green Tariff program	3,740	3,740

GHG Reduction Tech Appendix

D

Measure RE 1 Continued

2020 GHG Reductions (MTCO₂e)	8,820
2035 GHG Reductions (MTCO ₂ e)	14,840
GHG Method:	Forecasted residential and nonresidential solar installations as a result of the California Solar Initiative and BayREN programs were used to identify solar installations in 2020 and 2035. The county identified a target increase from that number and reductions were estimated based on average kW by installation type. Green tariff reductions are based on expected increases in renewable energy as a result of residential and nonresidential participation in educational and incentive programs. Reductions were applied to forecasted energy usage. These reductions were applied to participating households and businesses, which were identified by applying target participation rates to relevant building types. The sum of these reductions was then converted to MTCO ₂ e.
GHG Sources:	<p>California Public Utilities Commission. 2015. Decision Approving Green Tariff Shared Renewables Program for San Diego Gas and Electric Company, Pacific Gas and Electric Company, and Southern California Edison Company Pursuant to Senate Bill 43. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M146/K250/146250314.PDF</p> <p>California Solar Initiative. 2014. Annual Program Assessment. http://www.cpuc.ca.gov/NR/rdonlyres/9FBE11AB-1120-4BE1-8C66-8C239E36A641/0/CASolarInitiativeReport2014_0701.pdf</p> <p>Go Solar California. 2015. "Current Working Dataset – California Solar Initiative." http://www.californiasolarstatistics.ca.gov/current_data_files/</p> <p>National Renewable Energy Laboratory. 2015. PVWatts Calculator. http://pvwatts.nrel.gov/</p>
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development
Community Co-Benefit 1:	Supports Local Economy
Community Co-Benefit2:	Provides Educational Opportunities
Community Co-Benefit3:	Conserves Resources
Community Co-Benefit4:	Adaptive Measure

GHG Reduction Tech Appendix

Measure RE 2: Alternative Energy Facilities

Policy Language: Promote installation of alternative energy facilities on public land.

Action Items:

1. Continue to install alternative energy facilities (e.g., photovoltaic panels and electric vehicle charging stations) on public buildings and lands in the unincorporated county.
2. Continue to participate in the Regional Renewable Energy Procurement Project or similar bulk purchasing programs to purchase solar photovoltaic systems for on-site generation at public facilities.
3. Work with East Bay Municipal Utilities District and other wastewater processors to install cogeneration infrastructure on wastewater treatment facilities.

Participation Assumptions:

	2020	2035
MW at public facilities in the unincorporated area	1	3

Performance Targets:

	2020	2035
MW at public facilities in the unincorporated area	1	3

2020 GHG Reductions (MTCO ₂ e)	270
2035 GHG Reductions (MTCO ₂ e)	630
GHG Method:	Assumptions of future solar photovoltaic installations on public land and facilities was applied to future energy use, demonstrating a reduction in kWh used from nonrenewable sources. These kWh savings were then converted into MTCO ₂ e.
GHG Sources:	National Renewable Energy Laboratory. 2015. PVWatts Calculator. http://pvwatts.nrel.gov/
Implementation Time Frame:	Near-Term (by 2018)
Responsible Agencies:	Conservation & Development, Public Works
Community Co-Benefit 1:	Supports Local Economy
Community Co-Benefit 2:	Provides Educational Opportunities
Community Co-Benefit 3:	Conserves Resources

GHG Reduction Tech Appendix

D

Measure RE 3: Alternative Energy Financing

Policy Language: Lower barriers to entry for the installation of alternative energy systems.

Action Items:

1. Improve participation in existing and planned financing mechanisms for renewable energy and energy storage systems, such as PACE and BayREN.
2. Connect low-income homeowners with renewable energy rebate and financing programs.
3. Work with local governments in Contra Costa County and neighboring areas to participate in a regional solar photovoltaic energy systems bulk-buying program.
4. Connect business owners with available finance and rebate programs.
5. Work with PG&E to identify areas where grid capacity may be insufficient to accommodate an increase in renewable energy capacity, and encourage PG&E to upgrade such areas to reduce barriers.
6. Continue exploring options for implementing Community Choice Aggregation within the unincorporated area of the county.

Participation Assumptions and Performance Targets:

Supportive Measure

2020 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
2035 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
GHG Method:	<u>Supportive, not quantified</u>
GHG Sources:	<u>Supportive, not quantified</u>
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation and Development
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Supports Local Economy
Community Co-Benefit 3:	Provides Educational Opportunities
Community Co-Benefit 4:	Saves Money

Measure LUT 1: Mobility and Land Uses

Policy Language: Maintain and expand access to goods, services, and other destinations through increased transportation alternatives (mobility improvements) and improved proximity (land use improvements).

Action Items:

1. Collaborate with local transportation, land use agencies, nonprofits, and other stakeholders to expand bicycle and pedestrian facilities and existing public transportation (BART, Amtrak, AC Transit, County Connection, and Tri Delta Transit).
2. Assist with Safe Routes to School program implementation.
3. Work with the Contra Costa Transportation Authority, local school districts, and advocacy organizations such as the East Bay Bicycle Coalition to encourage bicycle safety classes in all schools.
4. Update County road standards, as opportunities arise, to accommodate all modes of transportation in local street designs (i.e., complete streets). Implement standards as part of routine maintenance and striping.
5. Through periodic updates to the Contra Costa Transportation Authority's Countywide Bicycle and Pedestrian Plan, identify opportunities to improve access to community-wide bicycle and pedestrian networks by closing gaps in the network, removing barriers, and providing additional bike- and pedestrian-oriented infrastructure.
6. Cooperate with the Contra Costa Transportation Authority and adjoining jurisdictions in updating and implementing the Countywide Bicycle and Pedestrian Plan and local plans.
7. Revise the County CEQA guidelines to reflect implementation of Senate Bill 743.
8. Establish a 2020 mode share goal for bicycling by a Board of Supervisors resolution, identify specific actions to reach the goal, integrate the goal into future General Plan updates, and appeal to other agencies to adopt the same goal.
9. Identify funding sources to support increased walking and bicycling activity.

Performance Targets:

	2020	2035
Number of average countywide bike trips per weekday	33,630 (average of 3.3 vehicle miles replaced daily per trip)	67,260 (average of 3.3 vehicle miles replaced daily per trip)

GHG Reduction Tech Appendix

D

Measure LUT 1 Continued

2020 GHG Reductions (MTCO ₂ e)	910
2035 GHG Reductions (MTCO ₂ e)	2,680
GHG Method:	Projected vehicle miles traveled (VMT) based on increased transit, bicycling, and walking commuting was subtracted from adjusted business as usual VMT forecasts to identify VMT reductions as a result of this policy. Existing County Bicycle and Pedestrian Plan policies were used to guide estimates of VMT reductions.
GHG Sources:	Contra Costa Transportation Authority. 2009. Contra Costa Countywide Bicycle and Pedestrian Plan. www.ccta.net/about/download/5297adc44d334.pdf
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development, Health Services, Public Works
Community Co-Benefit 1:	Improves Air Quality
Community Co-Benefit2:	Improves Mobility
Community Co-Benefit3:	Improves Community Livability
Community Co-Benefit4:	Improves Public Health

GHG Reduction Tech Appendix

Measure LUT 2: Alternative-Fuel Infrastructure

Policy Language: Expand the use of alternative fuels in vehicle travel.

Action Items:

1. As opportunities arise, include alternative-fuel use goals in franchise agreements for waste hauling and contracts with other vehicle fleets.
2. Support development of alternative-fuel vehicle infrastructure such as biofuel and electric vehicle (EV) charging stations and designated parking spots with chargers, including amending parking design and layout section (82-16-404) of the County Zoning Code to locate alternative fuel vehicle infrastructure in areas of high visibility and easy access.
3. Pursue grant funding opportunities to install public EV chargers or other alternative fuel charging stations.

Participation Assumptions:

	2020	2035
Number of public EV charging stations	20	50
EV ownership rate	3%	5%
Percent of trips made by an EV among EV-owning households	62%	60%

Performance Targets:

	2020	2035
Annual VMT per public charging station	4,700	4,070
VMT per EV	14,220	13,800
Electricity use per EV	4,830	4,690
Number of households with an EV	1,790	3,090

GHG Reduction Tech Appendix

D

Measure LUT 2 Continued

2020 GHG Reductions (MTCO ₂ e)	7,630
2035 GHG Reductions (MTCO ₂ e)	11,670
GHG Method:	Used CAAPA v. 1.5 and EMFAC to determine emissions savings from conversion to EV. Conservative behavioral estimates were used, including assuming no increase in EV capacity or efficiency and that EV owners are not more inclined to use their EV more than their other vehicle(s).
GHG Sources:	<p>California Air Resources Board. 2015. EMFAC Emissions Database. http://www.arb.ca.gov/emfac/</p> <p>Davies, J. 2014. "How Assumptions About Consumers Influence Estimates of Electric Vehicle Miles Traveled of Plug-in Hybrid Electric Vehicles." UC Davis Institute of Transportation Studies. http://www.its.ucdavis.edu/wp-content/themes/ucdavis/pubs/download_pdf.php?id=2036</p> <p>ICLEI – Local Governments for Sustainability. n.d. "Climate and Air Pollution Planning Assistant v 1.5."</p> <p>US Environmental Protection Agency. 2012. "Fuel Economy and Environment Labels – Electric Vehicles." http://www.epa.gov/carlabel/electriclabelreadmore.htm</p>
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development, Public Works, Additional departments depending on grant resources
Community Co-Benefit 1:	Improves Air Quality
Community Co-Benefit 2:	Conserves Resources
Community Co-Benefit 3:	Improves Public Health

GHG Reduction Tech Appendix

Measure LUT 3: Off-Road Vehicles and Equipment

Policy Language: Reduce emissions from off-road vehicles and equipment.

Action Items:

1. Work with the BAAQMD to incentivize the use of battery-powered lawn and garden equipment.
2. Provide support for the BAAQMD's voluntary exchange program for residential lawn mowers.
3. Work with the BAAQMD to increase the use of alternatively fueled equipment in agricultural operations through education, incentives, or revisions to existing regulations.
4. Consider an amendment to the County Building Code that would prohibit unnecessary idling of off-road and heavy equipment.

Participation Assumptions:

	2020	2035
Percent of lawn mowers traded in for electric models	5%	10%

Performance Targets:

	2020	2035
Number of lawn mowers traded in	50 (average reduction of 0.15 MTCO ₂ e and average increase of 60 kWh per lawn mower)	100 (average reduction of 0.15 MTCO ₂ e and average increase of 60 kWh per lawn mower)

GHG Reduction Tech Appendix

D

Measure LUT 3 Continued

2020 GHG Reductions (MTCO ₂ e)	10
2035 GHG Reductions (MTCO ₂ e)	10
GHG Method:	Estimated GHGs from lawn mowers reported by OFFROAD2007 for 2020, and applied assumed participation rates and kWh/electric mowers. 2035 lawn mowers were extrapolated from 2020 data.
GHG Sources:	California Air Resources Board. 2011. OFFROAD model. http://www.arb.ca.gov/msei/categories.htm Salem Electric. n.d. "Home Energy Use Guide". https://www.salemelectric.com/sites/default/files/downloads/HomeEnergyUseGuide_0.pdf US Environmental Protection Agency. 2009. Potential for Reducing Greenhouse Gas Emissions in the Construction Sector. http://www.epa.gov/sectors/pdf/construction-sector-report.pdf
Implementation Time Frame:	Near-Term (by 2018)
Responsible Agencies:	Agriculture, Conservation & Development
Community Co-Benefit 1:	Improves Air Quality
Community Co-Benefit 2:	Conserves Resources
Community Co-Benefit 3:	Improves Public Health

Measure LUT 4: Vehicle Miles Traveled Reduction

Policy Language: Reduce vehicle miles traveled.

Action Items:

1. Collaborate with BART and other transit providers to increase ridership in the county.
2. Partner with waste haulers and other fleets with regular routes to reduce the frequency of routes where possible.
3. Support and increase the use of carpooling services such as rideshare or casual carpool.
4. Continue to promote voluntary trip reduction programs such as school buses, Rideshare, Spare-the-Air Days, Bike to Work Day, employer shuttles, and alternative work schedules.
5. Work to increase densities within half a mile of BART and Amtrak stations, and within a quarter of a mile of stops for express bus routes.
6. Prioritize alternative mode access to BART and other transit stations.
7. Continue to explore funding transit with development applications and other alternative transportation finance methods.
8. Continue the County's policy of encouraging the establishment of Priority Economic Development Areas in residential communities.

Participation Assumptions:

	2020	2035
Increase in per capita bus ridership from 2005 levels	10%	20%
Increase in BART ridership from 2005 levels (independent of East Contra Costa Extension)	15%	30%
Number of new homes within 1/2 mile of a BART or Amtrak station, or within 1/4 mile of a bus stop	230	1,120
Estimated HOV lane cost per mile	\$0.22	\$0.22

Performance Targets:

	2020	2035
Number of BART extension trips taken by unincorporated county residents	54,400 (average of 40 miles per trip)	143,310 (average of 40 miles per trip)
Number of new bus ridership miles taken by unincorporated county residents	3,274,820	9,728,220
Number of new BART ridership miles taken by unincorporated county residents	1,202,980	4,112,830
Estimated decrease in VMT from HOV lanes	1,170,070	2,678,280

GHG Reduction Tech Appendix

D

Measure LUT 4 Continued

2020 GHG Reductions (MTCO ₂ e)	4,080
2035 GHG Reductions (MTCO ₂ e)	9,020
GHG Method:	VMT reductions are identified based on the County's single-occupancy vehicle mode share target. Countywide AC Transit and BART data was used to estimate increased ridership.
GHG Sources:	<p>Bay Area Rapid Transit District. 2008. East Contra Costa BART Extension Draft EIR, Summary. http://www.bart.gov/sites/default/files/docs/000_Summary.pdf</p> <p>California Air Pollution Control Officers Association. 2010. "Quantifying Greenhouse Gas Mitigation Measures."</p> <p>Federal Transit Administration. 2009. Public Transportation's Role in Responding to Climate Change. http://www.fta.dot.gov/documents/PublicTransportationsRoleInRespondingToClimateChange.pdf</p> <p>ICLEI - Local Governments for Sustainability USA. 2012. US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. http://icleiusa.org/publications/us-community-protocol/</p> <p>Metropolitan Transportation Commission. 2015. "Express Lanes." http://mtcexpresslanes.org/projects/express_lanes/</p> <p>National Transit Database. 2006. Alameda-Contra Costa Transit District. http://www.actransit.org/wp-content/uploads/2005.pdf</p> <p>US Census Bureau. 2010. US 2010 Census, Table DP-1 [data table].</p>
Implementation Time Frame:	Long-Term (by 2035)
Responsible Agencies:	Conservation & Development
Community Benefits 1:	Improves Public Health
Community Benefits 2:	Improves Air Quality
Community Benefits 3:	Improves Mobility
Community Benefits 4:	Provides Educational Opportunities
Community Benefits 5:	Improves Community Livability

Measure LUT 5: Agricultural Land Uses

Provide opportunities to grow, sell, and purchase local food.

Action Items:

1. Continue to support local farmers markets, local community gardens, school gardens, and other urban agricultural practices, including in areas with poor food access.
2. Amend the Zoning Code to allow urban agriculture in appropriate areas.
3. Amend the General Plan to add a policy that encourages community gardens in new residential developments as appropriate.
4. Encourage partnerships between local food growers and local food retailers.
5. Encourage partnerships between local food growers and local institutions such as schools, hospitals, colleges, and correctional facilities.
6. Continue to discourage schools being sited in agricultural areas.
7. Encourage retention of agricultural land to maintain the County's agricultural base and enable long-term carbon sequestration.

Participation Assumptions:

Supportive Measure

Performance Targets:

Supportive Measure

GHG Reduction Tech Appendix

D

Measure LUT 5 Continued

2020 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
2035 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
GHG Method:	Supportive, not quantified
GHG Sources:	Supportive, not quantified
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Agriculture, Conservation & Development, County Administrator's Office
Community Co-Benefit 1:	Supports Local Economy
Community Co-Benefit 2:	Provides Educational Opportunities
Community Co-Benefit 3:	Improves Community Livability
Community Co-Benefit 4:	Improves Public Health

Reduction Measure W 1: Waste Reduction and Recycling

Policy Language: Develop a waste reduction strategy to increase recycling and reuse of materials.

Action Items:

1. Achieve a local 75% waste diversion rate, in support of the 2020 state target diversion rate of 75%, as identified in AB 341.
 - Establish new and enhanced programs to collect organic material from businesses and residents in order to recover their material, energy, and nutrient values.
2. Increase public outreach to promote participation in existing waste diversion and prevention programs.
 - Continue promoting and supporting proper backyard composting, grass-cycling, and low-maintenance gardening programs, and greater participation in other recycling and composting programs. Consider outreach campaigns targeted to low-income or non-English-speaking residents.
 - Continue participating in the Bay Area Regional Outreach Campaign by serving on the steering committee and contributing funding.
 - Continue to offer and promote the Environmental Action Program for Schools as a way to achieve waste prevention reduction and recycling in K–12 schools.
3. Work with private owners and operators of solid waste transfer stations and landfills, as well as with publicly owned wastewater treatment plants, to establish anaerobic digesters to treat and recover energy from food waste and other organic waste.
4. Update the County's Source Reduction and Recycling Element, Household Hazardous Waste Element, and other relevant components of the Countywide Integrated Waste Management Plan to include an updated list of measures, actions, and programs supportive of this CAP.
5. Identify best practices and reduce the amount of wastewater treatment sludge (biosolids) that is disposed of in landfills.

Participation Assumptions:

	2020	2035
Target diversion rate	75%	85%

GHG Reduction Tech Appendix

D

Measure W 1 Continued

Performance Targets:

	2020	2035
Tons of waste reduced	90,850 (average of 0.42 tons of waste reduced per person)	133,180 (average of 0.59 tons of waste reduced per person)

2020 GHG Reductions (MTCO₂e)	25,780
2035 GHG Reductions (MTCO ₂ e)	37,780
GHG Method:	Waste stream diversion reductions were based on County-identified targets. Existing improvements to waste diversion rates in the county were incorporated to avoid double counting.
GHG Sources:	California Department of Resources Recycling and Recovery. 2015. Jurisdiction Diversion/Disposal Rate Summary. http://www.calrecycle.ca.gov/LGCentral/reports/diversionprogram/JurisdictionDiversion.aspx
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development
Community Co-Benefit 1:	Improves Air Quality
Community Co-Benefit 2:	Provides Educational Opportunities
Community Co-Benefit 3:	Conserves Resources

GHG Reduction Tech Appendix

Measure W 2: Landfill Management

Policy Language: Reduce fugitive methane emissions and other greenhouse gas emissions from solid waste landfills.

Action Items:

1. Annually verify compliance with the California Air Resource Board's (ARB) landfill methane control measures.
2. Request that landfill operators consider implementing additional reduction actions, including but not limited to:
 - Reducing landfilled materials with high methane-generation potential.
 - Reducing idling time for diesel equipment.
 - Encouraging adequate maintenance of rolling stock.
 - Establishing standards beyond those required by regulation for landfill gas collection system leak detection and prevention.
 - Excluding the use of green waste as a material for alternative daily cover (ADC), consistent with AB 1594.
3. Amend the General Plan and Zoning Code to allow renewable energy generation, such as solar and wind, on closed landfill areas. Market renewable energy on closed landfill areas to potential stakeholders (energy providers and landfill owners).

Participation Assumptions:

	2020	2035
Landfill methane capture rate	85%	85%

Performance Targets:

	2020	2035
Increase in captured landfilled gas (MTCO ₂ e)	29,500	41,650

GHG Reduction Tech Appendix

D

Measure W 2 Continued

2020 GHG Reductions (MTCO ₂ e)	29,500
2035 GHG Reductions (MTCO ₂ e)	41,650
GHG Method:	Fugitive emissions capture targets were identified and converted to GHG reductions.
GHG Sources:	California Air Resources Board. 2014. Landfill Gas Emissions Tool Version 1.3. http://www.arb.ca.gov/cc/landfills/landfills.htm
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development, Health Services
Community Co-Benefit 1:	Improves Air Quality
Community Co-Benefit 2:	Provides Educational Opportunities
Community Co-Benefit 3:	Conserves Resources
Community Co-Benefit 4:	Improves Public Health

Measure WE 1: Water Conservation

Policy Language: Reduce water demand.

1. Continue to reduce potable water use by at least 20% by 2020 through conservation efforts in new and existing development.
2. Continue to enforce water conservation requirements in new developments per the State Model Water Efficient Landscape Ordinance.

Participation Assumptions:

	2020	2035
Reduction from 2013 water use	20%	20%

2020 GHG Reductions (MTCO ₂ e)	1,210
2035 GHG Reductions (MTCO ₂ e)	940
GHG Method:	Applied the 20% reduction target to the 2013 actual MG water use in Contra Costa County.
GHG Sources:	California Department of Water Resources. 2015. The Water Conservation Act of 2009. http://www.water.ca.gov/wateruseefficiency/sb7/ ———. 2015. Water Efficient Landscape Ordinance. http://www.water.ca.gov/wateruseefficiency/landscapeordinance
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Reduces Water Use
Community Co-Benefit 3:	Provides Educational Opportunities
Community Co-Benefit 4:	Saves Money
Community Co-Benefit 5:	Conserves Resources

GHG Reduction Tech Appendix

D

Measure WE 2: Alternative Water Supplies

Policy Language: Provide alternative water resources for irrigation in residential and nonresidential areas.

1. Promote rainwater collection for irrigation purposes.
2. Update the Dual Water Systems Ordinance to allow the use of recycled water for irrigation in residential and nonresidential areas.

Participation Assumptions:

Supportive Measure

Performance Targets:

Supportive Measure

2020 GHG Reductions (MTCO ₂ e)	Supportive of Measure WE 1
2035 GHG Reductions (MTCO ₂ e)	Supportive of Measure WE 1
GHG Method:	Supportive, not quantified
GHG Sources:	Supportive, not quantified
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	Conservation & Development
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Reduces Water Use
Community Co-Benefit 3:	Saves Money
Community Co-Benefit 4:	Conserves Resources

GHG Reduction Tech Appendix

Measure GO 1: Government Operations – Public Lighting

Policy Language: Save energy used for public lighting.

Action Items:

1. Complete LED upgrade of traffic signals, street lighting, and other public lighting located in the unincorporated area of the County.

Participation Assumptions:

	2020	2035
Hours of Use Per Day	12	12

Performance Targets:

	2020	2035
Number of light bulbs replaced	7,210 (average of 100 watts per replaced bulb, or 450 kWh annually)	7,210 (average of 100 watts per replaced bulb, or 450 kWh annually)

2020 GHG Reductions (MTCO ₂ e)	580
2035 GHG Reductions (MTCO ₂ e)	450
GHG Method:	Expected wattage saving estimates were converted to kWh, allowing for annual kWh savings and MTCO ₂ e reductions to be calculated.
GHG Sources:	Balbas, Brian M. 2015. Deputy Public Works Director, County of Contra Costa. Personal correspondence to Chris Read, Michael Baker International senior planner.
Implementation Time Frame:	Near-Term (by 2018)
Responsible Agencies:	Public Works
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Saves Money

GHG Reduction Tech Appendix

D

Measure GO 2: Government Operations – Energy Efficiency

Policy Language: Promote energy-saving tools and practices.

Action Items:

1. Continue to conduct audits of existing and recently acquired facilities, prioritize improvements, and upgrade facilities to save energy.
2. Increase solar electricity use for County and agency operations.
3. Develop policies related to powering off lights and appliances after hours and after dark.
4. Site facilities that have more than 50 personnel in close proximity to infrastructure and services that support alternative commute modes.

Participation Assumptions:

Supportive Measure

Performance Targets:

Supportive Measure

2020 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
2035 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
GHG Method:	Supportive, not quantified
GHG Sources:	Supportive, not quantified
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	County Administrator's Office, Public Works
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Saves Money
Community Co-Benefit 3:	Improves Mobility

Measure GO 3: Government Operations – Water Conservation

Policy Language: Conserve water.

Action Items:

1. Continue to install water-efficient landscaping on County properties.
2. Where possible, remove turf from County-owned facilities.

Participation Assumptions:

Supportive Measure

Performance Targets:

Supportive Measure

2020 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
2035 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
GHG Method:	Supportive, not quantified
GHG Sources:	Supportive, not quantified
Implementation Time Frame:	Near-Term (by 2018)
Responsible Agencies:	Public Works
Community Co-Benefit 1:	Reduces Water Use
Community Co-Benefit 2:	Provides Educational Opportunities
Community Co-Benefit 3:	Saves Money

GHG Reduction Tech Appendix

D

Measure GO 4: Government Operations – Waste Reduction

Policy Language: Reduce waste.

Action Items:

1. Develop a recycling and composting program for County facilities.
2. Educate and train staff to recycle and compost appropriately.
3. Develop interim waste diversion/reduction goals.
4. Achieve zero-waste operations by 2035.

Participation Assumptions:

Supportive Measure

Performance Targets:

Supportive Measure

2020 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
2035 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
GHG Method:	Supportive, not quantified
GHG Sources:	Supportive, not quantified
Implementation Time Frame:	Long-Term (by 2035)
Responsible Agencies:	Public Works
Community Co-Benefit 1:	Provides Educational Opportunities
Community Co-Benefit 2:	Conserves Resources

Measure GO 5: Government Operations – CAP Implementation Support

Policy Language: Establish budgeting and administration practices to support the Climate Action Plan.

Action Items:

1. Ensure that the Environmental Purchasing Policy includes:
 - Green office supplies: Purchase energy-efficient appliances and recycled/recyclable and compostable supplies.
 - Green fleet and equipment: Evaluate progress of hybrid and CNG fleet measures in the 2007 Municipal Climate Action Plan. Create purchase orders for replacing less efficient vehicles with fuel-efficient vehicles (e.g., hybrids, electric vehicles, and biofuel vehicles) and old office machines with energy-efficient machines.
2. Reduce County fleet use of traditional fuels 25% by the year 2020.
3. Evaluate progress of Measure 13 from the 2007 Municipal Climate Action Plan (30% of employees telecommuting two days a week). If the target has not been achieved, establish policies to further support telecommuting and flexible work hours for employees. If the target has been achieved, consider increasing the target to 40% employee participation.
4. Develop a process for sharing information on government operations' energy and water use and efficiency and conservation measures with the public as an educational tool.
5. Advocate for regional, state, and federal activities that support GHG emissions in the county, including but not limited to the following:
 - Work with the BAAQMD to support reductions in process emissions from industrial entities.
 - Where appropriate, adopt language in the County's State and Federal legislative platforms that directs support and lobbying for local GHG reductions.
 - Advocate for additional transit funding sources concurrently with the development of priority development areas.

Participation Assumptions:

Supportive Measure

Performance Targets:

Supportive Measure

GHG Reduction Tech Appendix

D

Measure GO 5 Continued

2020 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
2035 GHG Reductions (MTCO ₂ e)	Supportive of Overall GHG Reductions
GHG Method:	Supportive, not quantified
GHG Sources:	Supportive, not quantified
Implementation Time Frame:	Mid-Term (by 2020)
Responsible Agencies:	County Administrator's Office, Public Works
Community Co-Benefit 1:	Conserves Energy
Community Co-Benefit 2:	Improves Air Quality
Community Co-Benefit 3:	Reduces Water Use
Community Co-Benefit 4:	Provides Educational Opportunities
Community Co-Benefit 5:	Improves Mobility

Appendix E: Development Checklist

E



The development checklist (**Table E.1**) was created to help both project applicants and County staff determine where a proposed new development project is consistent with Contra Costa County's Climate Action Plan (CAP). This checklist should be filled out for each new project subject to discretionary review. The County will work with applicants on a project-by-project basis to identify appropriate measures to integrate with the project through conditions of approval or project design, or other techniques as applicable. This approach allows the County to ensure that new projects are consistent with and do not compromise the County's ability to attain the greenhouse gas (GHG) reduction targets outlined in this CAP. To assist with implementation, the checklist provides descriptions and performance criteria that explain how individual projects can comply with requirements. The individual project criterion clarifies implementation of the CAP, providing additional information that is consistent with the assumptions identified in **Appendix D**.

Development Checklist

DEVELOPMENT CHECKLIST

Project Description Characteristics

Please identify the applicable land uses included in the proposed project and provide a brief description of the proposed project (or the project description to be used for the associated environmental document).

1) What is the size of the project (in acres)?:

2) Identify the applicable land uses:

- ☐ Residential
- ☐ Commercial
- ☐ Industrial
- ☐ Manufacturing
- ☐ Other

3) If there is a residential component to the project, how many units are being proposed?

SINGLE-FAMILY RESIDENCES:	
MULTI-FAMILY RESIDENCES:	

4) Please provide a brief project description:

5) Does the project require any amendments to the General Plan or specific plans?

☐ Yes ☐ No

If yes, please explain:

Development Checklist

E

6) Is the project located in a specific plan area?

☐ Yes ☐ No

If yes, which one?

7) Please complete the following table to identify project compliance with any applicable CAP measures.

Table E.1. Standards for CAP Consistency – New Development

Reduction Measure and Applicable Standard	Does the Project Comply?	Notes & Comments
EE 1 & EE 6. New residential development will install high-efficiency appliances and insulation to prepare for the statewide transition to zero net energy.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Additional Notes:
EE 1. New nonresidential development will install high-efficiency appliances and insulation.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Additional Notes:
RE 1. New residential and nonresidential development will meet the standards to be solar ready as defined by the California Building Standards Code.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	If yes, how many kW of solar will be installed? Additional Notes:
LUT 2. New single-family houses and multi-family units with private attached garages or carports will provide rewiring for EV charging stations inside the garage or carport.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	If yes, how many spaces are rewired? Additional Notes:
LUT 2. New multi-family (greater than five units) and nonresidential (greater than 10,000 square feet) developments will provide EV charging stations in designated parking spots.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	If yes, how many spaces are rewired? Additional Notes:
LUT 4. New residential and nonresidential development will be located within one half-mile of a BART or Amtrak station, or within one quarter-mile of bus station.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	If yes, what is the vehicle miles traveled reduction from the project? Additional Notes:



Los Vaqueros Reservoir, Contra Costa County