M E M O R A N D U M

To: Brian Foote, City Planner/Planning Manager, City of Redlands

From: Mayu Tanaka, Senior Associate, and Rajeev Bhatia, Principal

Re: Redlands CAP Update - Greenhouse Gas Inventory Methodology and Progress Report

Date: May 14, 2024

1 INTRODUCTION

In 2017, the City of Redlands adopted its first Climate Action Plan (CAP) concurrently with the 2035 General Plan Update. The CAP demonstrates how actions by the City of Redlands are consistent with statewide greenhouse gas (GHG) reduction targets, in accordance with State law. In addition to establishing GHG reduction strategies to support achievement of the City's GHG reduction targets, the CAP also helps with streamlining environmental review of projects under the California Environmental Quality Act (CEQA).

The City is now interested in evaluating its progress toward meeting targets established under the 2017 CAP and updating the plan to respond to new State goals and mandates. The 2017 CAP includes a 2015 baseline GHG emissions inventory and projections for the years 2030 and 2035. The City has not monitored progress since the 2017 CAP was prepared to ensure that it is on the path to attaining the GHG reduction targets for 2030 and 2035.

Additionally, the State has since passed laws that establish more aggressive long-term targets. The Governor's Executive Order (EO) B-55-18 outlines the State's objective to achieve carbon neutrality no later than 2045. This goal was codified in 2022 by Assembly Bill (AB) 1279, which further clarifies that statewide GHG emissions should be reduced to at least 85 percent below 1990 levels by 2045. These targets extend and expand previous targets set by EO B-30-15 and Senate Bill (SB) 32 as well as past goals established by AB 32 and EO S-3-05.

This memo outlines the methodology and data sources used in preparation of the GHG Inventory for the Redlands CAP Update and presents the results of the draft inventory. This memo identifies the major sources and the overall magnitude of GHG emissions in the City of Redlands for the year 2022, which is the most recent year for which there is complete data available (at the time the CAP Update was initiated). The inventory follows the standards developed by the International Council for Local Environmental Initiatives - Local Governments for Sustainability USA (ICLEI). The inventory methodology is described first, followed by the inputs, and results.

Section 2 will discuss the methodology, Section 3 discusses the baseline emission inventory, Section 4 discusses the business-as-usual forecast, Section 5 discusses the adjusted business-as-usual forecast, and Section 6 summarizes the findings.

2 METHODOLOGY

2.1 Framework and Included Emissions

The emissions inventory covers direct GHG emissions from sources within the boundaries of Redlands, including fuel combusted and solid waste generated within the city. Indirect emissions associated with the consumption of energy in Redlands that is generated outside the borders of the city (such as electricity, with no end point emissions) are also included. The emissions inventory is calculated for the year 2022.

While the methodology for the updated GHG inventory is broadly consistent with the approach used for the current CAP (adopted in 2017), the 10 emissions sectors (Residential, Commercial, Industrial, Transportation, Solid Waste, Water, Wastewater, Agriculture, Off-Road Equipment, and Public Lighting) have been consolidated to better align with available data, types of emissions sources or activities, and the anticipated framework for potential GHG reduction strategies. The resulting five sectors are: Built Environment (including electricity and natural gas usage from residential, commercial, industrial uses and public lighting), Transportation, Solid Waste, Potable Water, and Wastewater. (See Section 2.2 for more information about excluded emissions.)

ICLEI U.S. Community Protocol (version 1.2, July 2019) methods and assumptions were used to estimate emissions from electricity and natural gas usage, solid waste generation, potable water delivery, and wastewater treatment. Although the 2017 CAP used ICLEI's ClearPath model to estimate emissions from these sources, the updated inventory follows the quantification methods described in the U.S. Community Protocol appendices that correspond to each applicable sector because the model is no longer available for public use.[1]

The California Air Resources Board's (CARB's) Emissions Factor (EMFAC) 2021 model was used to calculate on-road transportation emissions, and the companion OFFROAD2021 model was used for the off-road equipment sector. Unlike the previous version used to prepare the GHG inventory for the 2017 CAP, EMFAC 2021 is offered as a web-based tool and includes a Scenario Analysis option that directly calculates emissions specific to the selected location and year for the input vehicle miles traveled (VMT). The result includes total emissions from on-road vehicles during start-up, running, and idling phases and is therefore more comprehensive than the on-road emissions estimated for the 2017 CAP, which only included running emissions. The methodology for off-road transportation is unchanged.

The basic approach to calculate emissions is based on activity data and emissions factors, using the following equation:

[Activity Data] x [Emissions Factor] = Emissions

Activity data refers to a measurement of energy use or another GHG-generation process, such as electricity consumption or decomposition of landfilled solid waste. Emissions factors are used to

[1] ClearPath is a web-based model developed by ICLEI in 2013 to inventory, forecast, and manage GHG emissions. Use of the ClearPath model was available for any U.S. city, county, or regional government for free between 2015 and 2018 due to grant funding by Bloomberg Philanthropies. Since 2019, ClearPath is only available through paid ICLEI membership.

convert activity data to emissions and are usually expressed as emissions per unit of activity data (e.g., metric tons of carbon dioxide equivalent [$MTCO_2e$] per kilowatt hour [kWh] of electricity). As an example, multiplying the total amount of electricity consumed (i.e., activity data, expressed in kWh) by the emissions factor (in $MTCO_2e$ per kWh) produces the GHG emissions from electricity consumption. Inputs for the emissions inventory based on activity data (or usage) for baseline year 2022 are described in the next section.

Although there are six internationally recognized GHGs that directly impact the climate—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)—the GHG inventory quantifies only the weighted sum of CO_2, CH_4, and N_2O as carbon dioxide equivalents (CO_2e) due to lack of reliable data about sources of HFCs, PFCs, and SF_6 (broadly referred to as fluorinated gases), which are typically emitted by leaking refrigerants and fire suppressants. Further, the City has little to no control over this emissions source, so these GHGs are excluded from the inventory, consistent with the significant influence reporting framework of the ICLEI U.S. Community Protocol. Where CO_2, CH_4, and N_2O emissions are calculated separately (e.g., when there is no CO_2e emission factor available), the 100-year Global Warming Potential (GWP) factors are used to convert CH_4 and N_2O emissions to CO_2e. According to the International Panel on Climate Change (IPCC), the GWP of CH_4 is 27, and the GWP of N_2O is 293.[2]

2.2 Excluded Emissions

Consistent with the current 2017 CAP, the updated baseline and forecasted community-wide GHG inventories are intended to encapsulate emissions generated by sources and activities within Redlands over which the City has significant influence to measure progress of existing local GHG reduction strategies, or revise/develop new strategies as necessary, that support short- and long-term climate objectives established by the State. The GHG inventories are as comprehensive as possible; however, some emissions are excluded because sufficient, accurate data was unavailable; there is no established method for quantification; or the scope or applicability to the City of Redlands was inappropriate or irrelevant. The following emissions were excluded from the GHG inventories:

2.2.1 Consumption-Based Emissions

Although emissions related to solid waste generated by residents and businesses in Redlands account for some of the goods consumed within the city, there is no widely accepted standard methodology for reporting consumption-based inventories or reliable database for tracking consumption (i.e., all the consumer goods of a household). ICLEI Community Protocol also notes that inclusion of consumption-based reporting frameworks may also increase potential for double-counting. As such, the prepared inventories are prepared at the community (citywide) level.

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2 Intergovernmental Panel on Climate Change, Climate Change 2021: The Physical Science Basis [Table 7.15], Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)] (Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press): 2021, https://doi.org/10.1017/9781009157896.

2.2.2 Emissions from Mountainview Generating Station

Consistent with the 2017 CAP, emissions related to the Southern California Edison (SCE) Mountainview Generating Station—including embodied or "upstream" emissions from energy generation, in addition to emissions associated with consumption of the electricity itself—were excluded from the community-wide GHG inventory because these emissions are included at the points where energy is consumed (some of which are in Redlands) rather than where it is simply produced. Exclusion of emissions from the Mountainview Generating Station therefore ensures that they would not be double counted within the data provided by SCE for the Built Environment (electricity) sector. Additionally, large stationary sources (which are considered part of the Built Environment sector by ICLEI) are generally regulated at the state level, and the City has little to no influence over the facility. Finally, emissions from this production source are excluded because they would otherwise inflate emissions from electricity consumption, which is already the second largest contributor to GHG (as discussed in **Section 3.6**), such that it would critically undermine local climate action planning.

2.2.3 Natural and Working Lands

Although the City of Redlands is located within a context of significant natural and agricultural resources, a majority of land within city limits is classified as urban and built-up (developed) land. CARB's 2022 update of the AB 32 Scoping Plan (2022 Scoping Plan) emphasize the importance of natural and working lands to achieving statewide carbon neutrality; however, sufficient data and tools are not available to quantify local levels of carbon sinks and sources in this sector.

2.2.4 Emissions from Agricultural Operations

Agricultural land located within city limits is relatively limited and does not include major commercial-scale livestock activity, which would generate substantial emissions. Existing General Plan policies and other regulations allow certain urban agriculture activities within Redlands, and many of the emissions from these activities are covered by other sectors included in the inventory, such as off-road equipment within the Transportation sector. It is noted that the 2017 CAP included an Agriculture sector, which included electricity consumption by agricultural users. However, this data was not available for 2022 due to data aggregation laws, and therefore, an accurate estimate of agricultural emissions could not be quantified. Given that emissions from agricultural operations makes up only 0.13 percent of the 2015 baseline inventory, as presented in the 2017 CAP, this amount is considered relatively negligible for the CAP Update.

2.2.5 High-Global Warming Potential Greenhouse Gases

High-GWP GHGs, including sulfur hexafluoride (SF_6), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), and other fluorinated gases, are most commonly generated in urban environments by refrigerant leakage and fire suppressant emissions. Although these GHGs contribute a significant effect to climate change, there is no reliably accurate data source for this information, and the City has limited control over the issue. For these reasons, high-GWP GHGs are generally excluded from local community inventories.

3 BASELINE EMISSIONS INVENTORY

3.1 Built Environment

Emissions from electricity consumption were calculated using information provided by Southern California Edison (SCE), including electricity usage for the residential, commercial, and industrial (RCI) sectors and for public lighting. The electricity emissions factor is from SCE's 2022 Sustainability Report.[3]

Emissions from natural gas consumption were calculated using information from the Southern California Gas Company (SoCalGas), including natural gas usage for the RCI sectors. The natural gas emissions factor for SoCalGas is based on the metric reported to the California Public Utilities Commission (CPUC) in correspondence on February 25, 2019.[4]

Consumption data and emission factors for electricity and natural gas are provided in **Table 1**, which includes electricity consumption in kWh and natural gas consumption in therms. Given that one therm is approximately 29.3 kWh, the fuel sources for energy consumed by Redlands are roughly comparable, with electricity representing a slightly larger share.

Table 1: Electricity and Natural Gas Activity Data and Emission Factors, 2022

Consumption Sector	*SCE Electricity (kWh)*	*SoCalGas Natural Gas (therms)*
Utility Emission Factor[1,2]	0.00020 $MTCO_2e$ per kWh	0.0005464 $MTCO_2e$ per therm
Total Consumption[3]	**479,469,550**	**15,250,617**
Residential	215,097,648	10,252,027
Commercial	200,275,449	4,900,806
Industrial	58,092,046	97,764
Public Lighting	3,004,407	n/a

1. SCE emission factor as reported in their 2022 Sustainability Report: https://download.edison.com/406/files/20237/eix-2022-sustainability-report.pdf.
2. SoCalGas emission factor as reported to the CPUC in correspondence on February 25, 2019 (Advice No. 5426) in Attachment C Table A: https://tariff.socalgas.com/regulatory/tariffs/tm2/pdf/submittals/GAS_5426.pdf.
3. Consumption data for the City of Redlands provided from SCE and SoCalGas for 2022.

Sources: Southern California Edison, 2024; Southern California Gas Company, 2024

3.2 Transportation

Transportation emissions from on-road vehicles are based on Redlands' share of on-road emissions within the southwestern portion of San Bernardino County under the authority of the South Coast

3 Edison International, 2022 Sustainability Report, 2023, https://download.edison.com/406/files/20237/eix-2022-sustainability-report.pdf.

4 Ronald van der Leeden, correspondence with California Public Utilities Commission: Rate Update to Include Costs for Greenhouse Gas Compliance and the 2018 California Climate Credit in Accordance with Decision (D.)15-10-032, D.18-03-017, and Resolution G-3547, Advice No. 5426 (U 904 G), Southern California Gas Company, February 25, 2019, https://tariff.socalgas.com/regulatory/tariffs/tm2/pdf/submittals/GAS_5426.pdf.

Air Quality Management District (SCAQMD) ("San Bernardino (SC) Sub-Area" in EMFAC 2021) estimated by CARB, calculated using the Scenario Analysis for total daily VMT attributed to Redlands (as described in the Methodology section) modeled by Fehr & Peers (see Attachment A). VMT estimates were modeled using the San Bernardino County Transportation Authority's (SBCTA's) San Bernardino Transportation Analysis Model Plus (SBTAM+), which was recently updated in preparation for the 2024 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS, also known as Connect SoCal) for the Southern California Association of Governments (SCAG) region. SBTAM+ estimated VMT generated by land uses in Redlands (available through 2050, consistent with growth projections in Connect SoCal).

Consistent with CARB's Regional Targets Advisory Committee (RTAC) accounting method established for SB 743 as well as ICLEI guidance, 100 percent of the length of trips beginning and ending in Redlands and 50 percent of the length of trips that either begin or end in Redlands are included in the VMT totals and therefore counted toward Redlands' transportation emissions; however, trips that just pass through Redlands are excluded, as their emissions would be reflected at their trip ends. Furthermore, although pass-through trips contribute a substantial amount to VMT totals, the City has limited ability to influence them.

The Scenario Analysis was run for annual (not seasonal) conditions in 2022 without SB 375 Analysis, which deactivates the State's Advanced Clean Cars and Pavley regulations to better characterize benefits from SB 375-related community strategies but only includes emissions and related activity for certain vehicle types (passenger cars, certain light duty trucks, and medium-duty trucks) and two fuel types (gasoline and diesel).

Off-road exhaust emissions in Redlands were modeled for all 19 equipment sectors—such as agricultural, construction, industrial, and lawn and garden equipment, among others—modeled using OFFROAD 2021. The CO_2 emissions were calculated for the entire San Bernardino County area in calendar year 2022, all equipment and fuels, and aggregate model year and horsepower bin. These emissions were then pro-rated by Redlands' share of the county population, according to Population and Housing Estimates for 2020-2023 (Table E-5) by the California Department of Finance, multiplied by 310 days (the operational period used for transportation modeling, consistent with California Department of Transportation and SCAG recommendations), and converted to metric tons.

VMT input and EMFAC 2021 Scenario Analysis results for on-road emissions, population, and off-road emissions results for 2022 are shown in **Table 2**.

Table 2: On-Road and Off-Road Transportation Inputs and EMFAC Results, 2022

Metric	*Value*	*Units*
Redlands total daily vehicle miles traveled (VMT)	2,447,632	VMT per day
Total Daily CO_2 Emissions		
Redlands on-road transportation[1]	1,133.69	tons per day
San Bernardino County off-road equipment[2]	1,713.17	tons per day
Population		
City of Redlands	72,259	people

Metric	*Value*	*Units*
San Bernardino County	2,180,777	people

1. Estimated for the San Bernardino (SC) Sub-Area using the EMFAC 2021 Scenario Analysis tool without SB 375 analysis, scaled to Redlands using total daily VMT as prepared by Fehr & Peers.
2. Estimated for the entire San Bernardino County, then prorated to Redlands based on Redlands' share of countywide population.

Sources: California Air Resources Board (EMFAC 2021), 2024; California Department of Finance, 2023; Fehr & Peers, 2024

3.3 Solid Waste

Fugitive methane emissions generated from decomposition of landfilled solid waste disposed of by Redlands and sent to California Street Landfill (for residential and commercial/industrial waste) and San Timoteo Landfill (for bulk waste) were calculated using data from the U.S. Environmental Protection Agency (EPA) GHG Reporting Program (pursuant to the Mandatory Reporting Rule, 40 CFR Part 98) Facility Level Information on Greenhouse gases Tool (FLIGHT) tool, scaled to the specific quantity of solid waste generated by Redlands in 2022 as provided by the City of Redlands Facilities and Community Services Department (FCS) and converted to $MTCO_2e$.

A large majority of Redlands' waste is sent to the City-owned and operated California Street Landfill facility, which is located within the city boundary. It is noted that San Timoteo Landfill is also located within the city boundary but is owned and operated by the County of San Bernardino. Bulk waste from the City of Redlands contributes a very small fraction of the total solid waste sent to the County landfill; emissions associated with waste generated outside of Redlands are not included in the inventory.

Process and collection/transport emissions related to solid waste are not quantified because specific information about energy consumption and transportation for operation of the landfill facilities is not available and are assumed to be included within the energy consumption data provided by SCE for the Built Environment sector as well as reflected in the VMT used to calculate emissions for the Transportation sector. This is consistent with ICLEI recommendations, especially for landfills that are located within a community boundary (i.e., California Street Landfill).

Solid waste disposal data and facility-level emissions used to estimate GHG emissions for Redlands are shown in **Table 3**.

Table 3: Solid Waste Activity Data and Facility-Level Emissions, 2022

Metric	*Value*	*Units*
California Street Landfill		
Total Redlands waste sent to California Street Landfill	48,291.80	tons
Residential solid waste	15,454.06	tons
Commercial/Industrial solid waste	32,837.74	tons
California Street Landfill total annual disposal quantity[1]	46,226	tons
California Street Landfill CH_4 emissions[2]	262.31	MT CH_4
San Timoteo Landfill		

Metric	Value	Units
Total Redlands waste sent to San Timoteo Landfill (Bulk waste)	158.95	tons
San Timoteo Landfill total annual disposal quantity[3]	369,577.09	tons
San Timoteo Landfill CH_4 emissions[2]	1,140.38	MT CH_4

1. As reported to EPA under the GHG Reporting Program, pursuant to the requirements of the Mandatory Reporting Rule (40 CFR Part 98). Total annual landfill solid waste does not match City data due to difference in accounting methods.
2. CH_4 emissions as calculated for the disposal quantity reported to EPA. GHG emissions, in metric tons of CO_2 equivalent, were calculated using the same GWP as other sectors and scaled to Redlands using the annual disposal data provided by the Facilities and Community Services Department.
3. Includes all waste at the County-owned facility, as reported to EPA under the GHG Reporting Program, pursuant to the requirements of the Mandatory Reporting Rule (40 CFR Part 98).

Sources: City of Redlands Facilities and Community Services Department, 2024; U.S. Environmental Protection Agency (FLIGHT), 2024.

3.4 Potable Water

Emissions from energy used to treat and deliver potable water were calculated based on the volume of potable water consumed in 2022 provided by the City of Redlands Municipal Utilities and Engineering Department (MUED). It is noted that this total volume of potable water is for the entire City of Redlands service area, which includes some land outside of city boundaries such as the unincorporated Mentone area. However, emissions corresponding to water consumption outside of Redlands are not excluded in this case because the City is the water provider and therefore has full control over the system. This is consistent with the “significant influence” framework recommended by ICLEI and therefore better characterizes the effect that City actions would have on GHG emissions in this sector. Consistent with the 2017 CAP, specific information about water supplied by the Western Heights Mutual Water Company to a small part in the southeastern portion of Redlands is not available and is small enough to be considered negligible for emissions accounting purposes.

Energy used to deliver potable water was calculated by multiplying this volume by the energy intensity factor of water delivery reported in the City’s 2020 Urban Water Management Plan (UWMP) (Part 2, Chapter 4 of the San Bernardino Valley Municipal Water District’s 2020 Integrated Regional Urban Water Management Plan). Energy used to treat surface water supply is a product of this volume and default energy intensity from ICLEI U.S. Protocol Appendix F. Energy consumed to treat and distribute potable water were then multiplied by SCE’s electricity emissions factor, consistent with the Built Environment sector. Emissions from electricity (locally supplied by SCE to the Hinckley and Tate water treatment plants) used to treat and deliver potable water were subtracted from commercial electricity in the Built Environment sector to avoid double counting.

Emissions from embodied energy used for extraction and conveyance processes were calculated separately using ICLEI U.S. Protocol Appendix F. According to data from MUED, groundwater sources account for about 69 percent of the City of Redlands’ water supply, and surface water contributes 31 percent. Although the City has purchased supplemental water from the State Water Project (SWP) from the Valley District when needed (i.e., when surface water is inadequate to meet demand, surface water supply is turbid and requires blending, or for other operational purposes), the City generally receives sufficient surface water from local sources, including the Mill Creek and Santa Ana watersheds. Inputs for 2022 are summarized in **Table 4**.

Although the local utility (i.e., SCE) electricity emissions factor was used to calculate emissions generated by energy used for surface water conveyance, as consistent with ICLEI methodology, this amount was not removed from the energy sector because it is not included in the data provided by SCE; therefore, there is no double counting.

Table 4: Potable Water Activity Data and Energy Intensity Factors, 2022

Metric	*Value*	*Units*
Total volume of water delivered[1]	**7,786.6**	**million gallons (MG)**
Groundwater supply	5,391.8	MG
Surface water supply	2,394.8	MG
Energy Intensity		
Groundwater extraction[2]	540	kWh per MG
Surface water conveyance (local) [2]	110	kWh per MG
Surface water treatment[2,3]	210	kWh per MG
Water delivery[4]	421.2	kWh per acre-foot

1. Total volume of water delivered is the volume for the entire water service area, which includes portions of land outside of city boundaries (i.e., unincorporated Mentone area).
2. Defaults from ICLEI U.S. Community Protocol Appendix F: Wastewater and Water Emission Activities and Sources.
3. Median value for a wastewater treatment plant with less than 20 MG per day, as calculated based on the total volume of water delivered (in MG per year) divided by 365.25 days per year.
4. As reported in the Redlands 2020 UWMP; converted to 1,292.62 kWh per MG using standard conversion factors and multiplied by the SCE electricity emission factor to calculate GHG emissions.

Sources: ICLEI U.S. Community Protocol Appendix F, 2013; City of Redlands Urban Water Management Plan, 2020; City of Redlands Municipal Utilities and Engineering Department, 2024.

3.5 Wastewater

Emissions from energy used to collect and treat wastewater were calculated using energy usage provided by MUED; these are combined because the City does not distinguish energy usage by process. The local utility energy emission factors were used to convert to $MTCO_2e$. Emissions from energy use (locally supplied by SCE and SoCalGas to the Redlands Wastewater Treatment Facility) for collection/treatment of wastewater were subtracted from the commercial energy categories of the Built Environment sector to avoid double counting.

MUED also provided information about the Redlands Wastewater Treatment Facility, which is a centralized system with lagoons, practices nitrification/denitrification without methanol for nitrogen removal, and produces digester gas (practices anaerobic digestion). As shown in **Table 5**, stationary emissions of CH_4 and N_2O from the treatment plant were calculated based on the volume, CH_4 content, and energy content of digester gas produced in 2022 from MUED and the ICLEI U.S. Protocol Appendix F default CH_4 emission factor, converted to $MTCO_2e$.

Process and fugitive emissions from treatment of wastewater were calculated based on the population served by the treatment plant (provided by MUED for 2022), using methods from the ICLEI U.S. Protocol Appendix F with significant inputs from industrial and commercial sources, and converted into $MTCO_2e$. It is noted that MUED provided an approximation for population served by the wastewater treatment plant, which may not necessarily be the same as the population served by the City's potable water system. However, it is assumed that this input is sufficiently accurate to represent N_2O generated from process and fugitive emissions in the absence of known nitrogen (N) content of the wastewater. Emissions and conversion factors are from ICLEI, except for the average total N load, which was updated using the latest protein consumption and fraction non-consumed protein entering water from the EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021.[5]

Activity data and factors used to calculate wastewater emissions for 2022 are summarized in **Table 5.**

Table 5: Wastewater Activity Data and Emission Factors, 2022

Metric	*Value*	*Units*
Population served by the wastewater treatment plant[1]	72,000	people
Volume of wastewater	70,024,444	gallons
Factor for high N loading of industrial/commercial discharge[2]	1.25	(no units)
Process N_2O emission factor for treatment with nitrification/denitrification[2]	7	(no units)
Fraction of N removed from the plant with nitrification/denitrification[2]	0.7	(no units)
Average total N load in wastewater[3]	0.01703	kg N per person per day
Digester Gas		
Volume of digester gas produced	1,400,146	standard cubic feet (scf) per day
CH_4 content in digester gas	55%	percent
Energy content of digester gas	500	British thermal units (BTU) per scf
Digester gas combustion CH_4 emission factor[2]	0.0032	kg CH_4 per million BTU
Digester gas combustion N_2O emission factor[2]	0.00063	kg N_2O per million BTU
Energy used for wastewater treatment		
Electricity	6,016,844	kWh
Natural gas	2,073,000	therms

[5] U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021 (EPA 430-R-23-002), April 13, 2023, https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Main-Text.pdf.

1. Population served by the wastewater treatment plant is an approximated value provided by the City MUED and is assumed to reflect nitrogen inputs to the entire wastewater system.
2. Defaults from ICLEI U.S. Community Protocol Appendix C: Built Environment Emission Activities and Sources (for digester gas emission factors) and Appendix F: Wastewater and Water Emission Activities and Sources (for all other defaults).
3. Updated factor based on information from EPA's Inventory of GHG Emissions and Sinks: 1990-2021 (EPA 430-R-23-002, April 13, 2023: https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Main-Text.pdf) Table 7-34 and calculated using the equation for total nitrogen load provided in footnote #34 in ICLEI U.S. Protocol Appendix F.

Sources: ICLEI U.S. Community Protocol Appendix F, 2013; City of Redlands Municipal Utilities and Engineering Department, 2024.

3.6 Total Emissions

The annual GHG emissions for baseline year 2022 total 556,310 MTCO_2e. **Table 6** details the emissions by sector, and **Figure 1** depicts the distribution of emissions by sector. The largest sector is Transportation (66 percent), followed by Built Environment (30 percent).

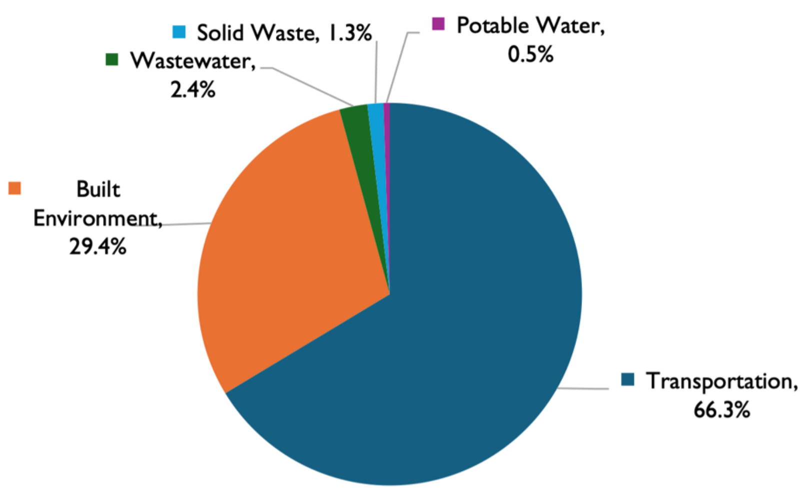
Table 6: 2022 Baseline Community-wide GHG Emissions Inventory by Sector

			MTCO_2e per year	
Sector	*Source/Activity*	*Details*	*Emissions*	*Subtotal*
Built Environment	Energy - Electricity	Residential	43,020	**91,750** (16.5%)
		Commercial	36,512	
		Industrial	11,618	
		Public Lighting	601	
	Energy - Natural Gas	Residential	56,017	**72,002** (12.9%)
		Commercial	15,451	
		Industrial[1]	534	
Transportation	Fugitive/Energy	On-Road	351,444	**369,041** (66.3%)
		Off-Road	17,597	
Solid Waste	Fugitive - Landfill	Residential	2,368	**7,412** (1.3%)
		Commercial/Industrial	5,031	
		Bulk Waste	13	
Potable Water	Energy - Supply	Extraction	582	**2,975** (0.5%)
		Conveyance	53	
	Energy – Treatment[2]		327	
	Energy – Distribution[2]		2,013	
Wastewater	Stationary - Treatment		38	**13,129** (2.4%)
	Process - Treatment		185	
	Fugitive - Treatment		376	
	Energy - Collection, Treatment[3]	Electricity	1,203	
		Natural Gas	11,327	

Grand Total	**556,310**
1. Industrial natural gas emissions may be underestimated due to unavailability of data from large facilities (customer confidentiality laws). 2. Emissions from electricity used to treat and distribute potable water are subtracted from the commercial category in the Built Environment sector to avoid double counting; emissions from water supply represent embodied energy and are not included in the SCE report for consumption by Redlands and therefore do not need to be subtracted. 3. Energy for wastewater collection and treatment is reported together and cannot be separated. Emissions are subtracted from the commercial electricity and natural gas categories in the Built Environment sector to avoid double counting.	

Dyett & Bhatia, 2024.

Figure 1: 2022 Baseline GHG Emissions by Sector



Dyett & Bhatia, 2024

In 2021, the San Bernardino County Transportation Authority (SBCTA) led preparation of the San Bernardino Regional Greenhouse Gas Reduction Plan, which includes GHG inventories and potential reduction measures to serve as a guide for more detailed community-level CAPs throughout the county. The Regional GHG Reduction Plan provides context for neighboring jurisdictions in the county; for example, the 2016 baseline was 203,924 $MTCO_2e$ for the City of Loma Linda, 218,940 $MTCO_2e$ for the City of Highland, and 1,440,525 $MTCO_2e$ for the City of San Bernardino.[6]

Likewise, neighboring cities in Riverside County have also prepared GHG inventories. According to their Economic Prosperity Action Plan and Climate Action Plan (2016), the 2020 forecasted business-as-usual GHG inventory for the City of Riverside was 1,045,427 $MTCO_2e$.[7] The City of

[6] San Bernardino County Transportation Authority/San Bernardino Council of Governments, San Bernardino County Regional Greenhouse Gas Reduction Plan, March 2021, https://www.gosbcta.com/wp-content/uploads/2019/09/San_Bernardino_Regional_GHG_Reduction_Plan_Main_Text_Mar_2021.pdf.

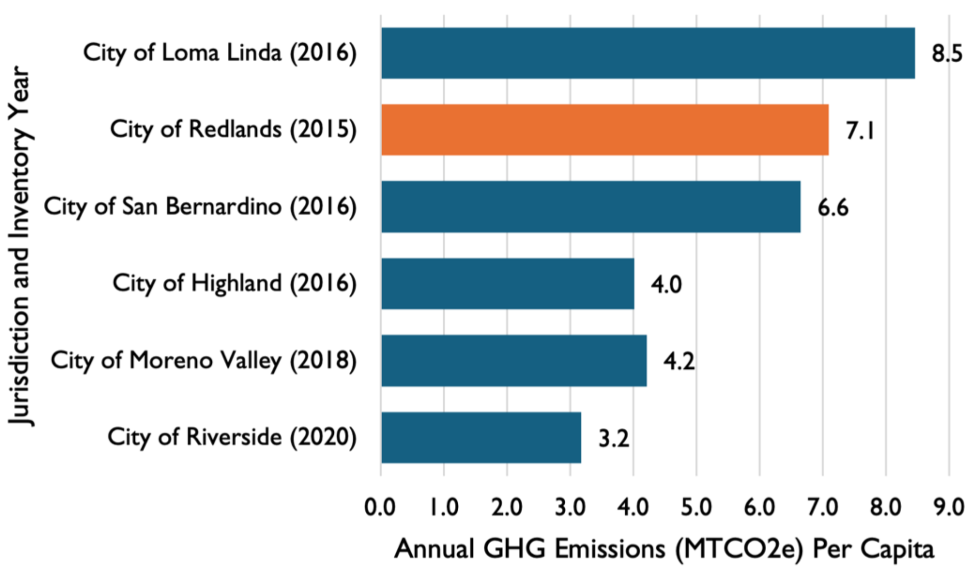
[7] City of Riverside, Economic Prosperity Action Plan and Climate Action Plan, January 2016, https://corweb.riversideca.gov/cedd/sites/riversideca.gov.cedd/files/pdf/planning/other-

Moreno Valley also adopted a CAP in 2021, which estimates a 2018 baseline inventory of 866,410 $MTCO_2e$.[8]

As reported in the 2017 CAP, the 2015 baseline inventory for Redlands was 419,417 $MTCO_2e$. However, as noted in the Methodology section, tools and data sources used to prepare the 2015 baseline have changed or are no longer available. In addition, the updated 2022 baseline inventory recategorizes the emissions sectors to better align with recent State recommendations for local government actions for GHG reductions that support State efforts to decarbonize the built environment, electrify transportation, and reduce VMT. To enable valid comparison between 2015 and 2022 and assess progress, the 2015 baseline inventory has been adjusted using the new methodology and based on inputs reported in the 2017 CAP; the resulting 2015 adjusted baseline inventory is 499,157 $MTCO_2e$.

Given its geographic and population size, the relatively moderate level of GHG emissions generated by Redlands is comparable to neighboring jurisdictions based on a comparison of per capita emissions, shown in **Figure 2**. However, the updated baseline GHG Inventory for 2022 shows an increase in community-generated GHG emissions since 2015 (discussed further in **Section 4.6**), and therefore GHG reduction is recommended.

Figure 2: Annual GHG Emissions Per Capita Comparison with Neighboring Jurisdictions



Sources: City of Riverside Economic Prosperity Action Plan and Climate Action Plan, 2016; City of Moreno Valley Climate Action Plan, 2021; SBCTA San Bernardino County Regional Greenhouse Gas Reduction Plan, 2021; California Department of Finance Table E-4; Dyett & Bhatia, 2024

plans/2016%20Riverside%20Restorative%20Growthprint%20Economic%20Proposerity%20Action%20Plan%20and%20Climate%20Action%20Plan.pdf.

[8] City of Moreno Valley, City of Moreno Valley Climate Action Plan, Adopted June 15, 2021, https://moval.gov/city_hall/general-plan2040/MV-CAP.pdf.

4 BUSINESS-AS-USUAL FORECAST

As was done for the baseline inventory (see **Section 3**), the forecasted GHG inventories project all direct emissions from sources within Redlands city limits, including fuel combusted in the city, as well as indirect emissions associated with the consumption of energy that is generated outside the borders of the city. Included and excluded GHGs are as described in **Section 2**. The emissions inventories tally emissions from the same five sectors as the baseline inventory.

The emissions projected in the forecast use the activity data (or usage) from the 2022 baseline inventory as an initial value, then predicted growth in each sector is projected to scale with various Redlands characteristics, such as population and housing growth and increase in non-residential development in 2030 and 2050, unless specific growth projections (e.g., water use or energy demand) are otherwise provided.

The business-as-usual forecast estimates emissions through the years 2030 and 2050, assuming the land use and circulation system incorporated into the SBTAM+ regional transportation model, which is consistent with regional growth projections under the 2024 update to Connect SoCal that is currently underway. The growth assumptions, as shown in **Table 7**, include the housing and employment inputs for SBTAM+ provided by Fehr & Peers, as well as population estimates and projections from the California Department of Finance. This approach was used to model growth assumptions in absence of specific buildout projections that align with the target years 2030 and 2050. This methodology differs from the 2017 CAP, which used the 2035 General Plan buildout. Where possible, 2022 values were validated against or supplemented by the most recent estimates from the California Department of Finance.

As described in Attachment A, SBTAM+ models existing conditions under the base year 2019 and future conditions projected under the 2024 Connect SoCal RTP for 2050. VMT estimates for 2022 and 2030 were interpolated between 2019 and 2050, and as such, reflect the general trajectory between the base and future years, rather than exact estimates of a single point in time. For example, the housing units for 2030 shown in **Table 7** do not necessarily match the amount of housing development anticipated by Redlands' 2021-2029 Housing Element. However, the SBTAM+ socioeconomic data inputs assumptions are used because (1) buildout projections for Redlands in 2030 and 2050 are unavailable; (2) these inputs are consistent with the most recent regional (SCAG) and subregional (SBCOG/SBCTA) projections; and (3) growth assumptions would be consistent across all emissions sectors (e.g., VMT estimates used to calculate Transportation sector emissions are appropriately scaled with energy demand in the Built Environment sector, and so on).

It is also important to note that the non-retail category for employment includes all occupation sectors (agriculture and mining, construction, manufacturing, wholesale trade, transportation/warehousing/utility, information, financial activity, professional and business services, education and health, art/entertainment, other service, and public administration) other than retail trade. Retail trade employment is scaled using a local input determined by the San Bernardino Council of Governments (SBCOG) and SBCTA, while non-retail employment is estimated by the ratio of non-retail jobs from SCAG's Connect SoCal projections.[9] The decrease in

[9] San Bernardino County Transportation Authority, San Bernardino County Transportation Analysis Model – SBTAM: Model Development and Validation Report and User's Guide, December 2019, https://www.gosbcta.com/wp-content/uploads/2019/10/SBTAM-Documentation-and-User%E2%80%99s-Guide.pdf.

retail jobs shown in **Table 7** therefore are likely a reflection of transferred growth in all other occupational sectors.

Table 7: Population, Housing, and Employment Growth Assumptions, 2022-2050

	2022	*2030*		*2050*	
Metric	*Estimate*	*Projection*	*Growth, 2022-2030*	*Projection*	*Growth, 2030-2050*
Population[1]					
City of Redlands	72,259	75,243	4.1%	82,228	9.3%
San Bernardino County	2,180,777	2,368,002	8.6%	2,681,796	13.3%
Redlands Housing Units[2]	**27,580**	**28,321**	**2.7%**	**32,849**	**16.0%**
Single-family	17,766	18,024	1.5%	18,903	4.9%
Multifamily	9,814	10,297	4.9%	13,947	35.4%
Redlands Employment[3]	**50,400**	**52,803**	**4.8%**	**60,103**	**13.8%**
Retail jobs	9,474	9,232	-2.6%	8,499	-7.9%
Non-retail jobs	40,926	43,571	6.5%	51,604	18.4%

1. Population estimates for 2022 from California Department of Finance Table E-5 (May 2023 release), and 2030 and 2050 County population projections from Table P-2B. City of Redlands population projections for 2030 and 2050 as used in regional modeling and as provided by Fehr & Peers.
2. Housing for 2030 and 2050 calculated based on the number of households provided by Fehr & Peers and maintaining Redlands' vacancy rate in 2022 (5.14%) as estimated by California Department of Finance Table E-5 (May 2023 release).
3. Employment estimates and projections are provided by Fehr & Peers, consistent with inputs to the SBTAM+ used to calculate VMT. SBTAM+ is consistent with regional projections (by SCAG) under the 2024 Connect SoCal RTP/SCS but are locally scaled by SBCOG/SBCTA. Employment is categorized into retail (including retail trade) and non-retail (including all occupational sectors other than retail trade); the decrease in retail jobs is likely a result of both growth projections as well as the categorization method.

Sources: California Department of Finance, 2023; Fehr & Peers, 2024; Dyett & Bhatia, 2024

In addition, the business-as-usual scenario includes the effects of key climate regulations at the federal and State levels, primarily affecting the Built Environment and Transportation sectors. These effects are incorporated into the energy demand forecasts prepared by the California Energy Commission (CEC) and used to project growth in electricity and natural gas consumption, as well as EMFAC 2021 (and the corresponding OFFROAD 2021 model) used to model future transportation emissions. For example, both sources account for the impact of Executive Order (EO) N-79-20, which calls for 100 percent of passenger vehicle sales to be zero-emission by 2035 and all on-road trucks to be zero-emission where feasible by 2045, in addition to Advanced Clean Cars, Advanced Clean Fleets, and related Pavley regulations. A full description of the regulations incorporated into the CEC's energy demand forecast are described in the 2023 Integrated Energy

Policy Report (IEPR)[10], and regulatory assumptions for EMFAC 2021 are as described in the EMFAC 2021 Volume III Technical Document[11].

State actions that do not underlie growth assumptions were quantified separately and are reflected in the adjusted business-as-usual forecast (described in **Section 5**). These include Renewables Portfolio Standards (RPS) under SB 100 and SB 1020, 2022 Title 24 Building Energy Efficiency Standards, and Renewable Gas Standards (RGS) under SB 1440. Local actions that would be implemented by the City, such as increasing solid waste diversion in line with the statewide goal under AB 341, are not included but would instead be credited as a GHG reduction measure (to be developed) in the updated CAP.

The following sections describe how assumed growth was applied to each sector to calculate business-as-usual forecast emissions.

4.1 Built Environment

Built Environment emissions are from energy consumption and are proportional to the electricity and natural gas demand forecasted by CEC for the SCE and SoCalGas planning areas as part of the 2023 IEPR. This demand forecast has a 2023 baseline and is projected out to 2040, which includes year 2030; however, energy demand in 2050 was linearly extrapolated based on the change between 2030 and 2040.

Future residential electricity consumption was calculated based on the household consumption rate for the SCE area, multiplied by the number of households projected for Redlands. Electricity consumption for the commercial, industrial, and public lighting categories were assumed to grow in proportion with electricity consumption in those sectors, according to the electricity demand forecast for the SCE area. Future residential, commercial, and industrial natural gas consumption were likewise assumed to grow in proportion with the natural gas demand in the SoCalGas area forecasted by CEC for those categories.

As described above, the business-as-usual scenario (without adjustments) does not include changes to SCE's electricity emission factor (which would be affected by RPS, SB 100, and SB 1020) or SoCalGas' natural gas emission factor (which would change according to the SoCalGas 2021 Climate Commitment). Business-as-usual built environment sector emissions were calculated using the inputs shown in **Table 8**.

[10] California Energy Commission, Adopted 2023 Integrated Energy Policy Report with Errata, February 14, 2024, https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2023-integrated-energy-policy-report.

[11] California Air Resources Board, EMFAC2021 Volume III Technical Document (Version 1.0.1), April 2021, https://ww2.arb.ca.gov/sites/default/files/2021-08/emfac2021_technical_documentation_april2021.pdf.

Table 8: Business-As-Usual Electricity and Natural Gas Activity Data, 2030-2050

	SCE Electricity (kWh)		*SoCalGas Natural Gas (therms)*	
Consumption Sector	*2030*	*2050*	*2030*	*2050*
Utility Emission Factor[1]	0.00020 $MTCO_2e$ per kWh		0.0005464 $MTCO_2e$ per therm	
Total Consumption[2]	**534,973,435**	**740,460,494**	**15,792,936**	**19,657,823**
Residential	236,630,473	317,001,286	10,263,164	13,648,861
Commercial	237,503,986	362,465,137	5,431,192	5,909,408
Industrial	58,119,940	58,749,240	98,580	99,555
Public Lighting	2,719,037	2,244,832	n/a	n/a

1. Consistent with 2022 emission factors.
2. Residential electricity consumption based on household consumption rate as calculated from the CEC's electricity demand forecast for the SCE planning area and projected number of households provided by Fehr & Peers (consistent with SBTAM+). All other energy consumption assumed to grow from the 2022 baseline in proportion with CEC energy demand forecasts.

Sources: Dyett & Bhatia, 2024

4.2 Transportation

Transportation emissions are based on the emissions associated with VMT. As discussed above and consistent with the baseline inventory, VMT estimates were provided by Fehr & Peers using the SBTAM+ regional model, which is aligned with Connect SoCal (2024 update, currently underway). As was conducted for the baseline, EMFAC 2021 Scenario Analysis and OFFROAD 2021 were used to quantify on-road and off-road total daily CO_2 emissions for Redlands using updated VMT and population inputs, as shown in **Table 9**.

As noted above, EMFAC 2021 includes the effect of transportation regulations and programs that would increase the share of electric vehicles through 2050 and would therefore decrease CO_2 emissions despite an increase in VMT. These changes would decrease on-road emissions but are not as evident for off-road equipment.

Table 9: Business-As-Usual On-Road and Off-Road Transportation Inputs and EMFAC Results, 2030-2050

Metric	*2030*	*2050*
Redlands total daily vehicle miles traveled (VMT)	2,551,867	2,812,455
Total Daily CO_2 Emissions (tons per day)		
Redlands on-road transportation[1]	995.07	952.23
San Bernardino County off-road equipment[2]	1,826.86	2,158.89
Population		
City of Redlands	75,243	82,228
San Bernardino County	2,368,002	2,681,796

1. Estimated for the San Bernardino (SC) Sub-Area using the EMFAC 2021 Scenario Analysis tool without SB 375 analysis, scaled to Redlands using total daily VMT as prepared by Fehr & Peers.
2. Estimated for the entire San Bernardino County, then prorated to Redlands based on Redlands' share of countywide population.

Sources: California Air Resources Board (EMFAC 2021), 2024; California Department of Finance, 2023; Fehr & Peers, 2024

4.3 Solid Waste

Emissions from decomposition of landfilled solid waste generated in Redlands was assumed to scale with population growth, calculated based on a consistent per capita disposal rate (tons of waste divided by population). Like the baseline inventory, the facility-level CH_4 emissions from California Street and San Timoteo landfills were scaled to the disposal quantity specific to Redlands. The proportion of residential versus commercial/industrial solid waste sent to California Street Landfill and the ratio of bulk waste sent to San Timoteo Landfill relative to waste sent to California Street Landfill were assumed to stay the same as for 2022. Inputs for 2030 and 2050 are summarized in **Table 10**.

Table 10: Business-As-Usual Solid Waste Activity Data and Facility-Level Emissions, 2030-2050

Metric	*2030*	*2050*
California Street Landfill		
Total Redlands waste sent to California Street Landfill[1] (tons)	50,286	54,954
Residential solid waste (tons)	16,092	17,586
Commercial/Industrial solid waste (tons)	34,194	37,368
California Street Landfill total annual disposal quantity[2] (tons)	48,135	52,603
California Street Landfill CH_4 emissions[3] (MT CH_4)	273.14	298.50
San Timoteo Landfill		
Total Redlands waste sent to San Timoteo Landfill[4] (tons)	166	181
San Timoteo Landfill total annual disposal quantity[2] (tons)	384,839	420,565
San Timoteo Landfill CH_4 emissions[3] (MT CH_4)	1,187.47	1,297.71

1. Corresponds to solid waste disposal quantity provided by the City FCS Department, scaled to population growth; distribution between residential and commercial/industrial is the same as provided for 2022.
2. Corresponds to the facility-level total disposal quantity from EPA's GHG Reporting Program, per requirements of the Mandatory Reporting Rule (40 CFR Part 98), scaled to population growth.
3. CH_4 emissions relative to the facility-level disposal quantity.
4. Corresponds to bulk waste disposal quantity provided by the City FCS Department, assumed to be the same proportion of waste sent to California Street Landfill in 2022.

Sources: Dyett & Bhatia, 2024

4.4 Potable Water

The increased demand for electricity usage for supplying, treating, and distributing potable water was assumed to be proportional to the water demand projections according to the Redlands 2020 UWMP, excluding water losses and converted from acre-feet (AF) to million gallons (MG).

Projected water demand for 2050 was linearly interpolated based on the growth rate between 2040 and 2045. The proportion of groundwater and surface water supply is based on the 10-year average reported in the 2020 UWMP. Energy intensities and the corresponding electricity emission factor were assumed to remain the same as was used for the baseline.

Table 11: Business-As-Usual Potable Water Activity Data, 2030-2050

Metric	*2030*	*2050*
Total volume of water delivered[1] (MG)	**7,956.6**	**9,091.1**
Groundwater supply	4,933.1	5,636.5
Surface water supply	3,023.5	3,454.6

1. Total water demand as projected in the Redlands 2020 UWMP, excluding water losses, and interpolated for 2050. Groundwater and surface water volume based on the 10-year average distribution reported in 2020 UWMP.

Sources: City of Redlands Urban Water Management Plan, 2020; Dyett & Bhatia, 2024

4.5 Wastewater

Forecasted emissions from wastewater treatment reflect increases in the volume of wastewater, corresponding volume of digester gas and effluent discharge, and energy required to collect and treat wastewater. Process and fugitive N_2O emissions are a product of the population served by the wastewater treatment plant and are consistent with the growth assumptions shown in **Table 7**. As shown in **Table 12**, digester gas was calculated to scale with this population growth, while electricity and natural gas used for collection and treatment of wastewater was assumed to change according to CEC energy demand forecast for the SCE/SoCalGas area in the Agriculture and Water Pumping (AGWP) sector. Consistent with the Built Environment sector, these energy demand forecasts were linearly interpolated for 2050 based on the growth rate between 2030 and 2040. All other inputs, including the electricity and natural gas emission factors, are the same as the baseline.

Table 12: Business-As-Usual Wastewater Activity Data, 2030-2050

Metric	*2030*	*2050*
Volume of digester gas produced (scf per day)	1,463,211	1,599,045
Energy used for wastewater treatment[1]		
Electricity (kWh)	5,850,648	6,382,510
Natural gas (therms)	2,106,226	3,206,583

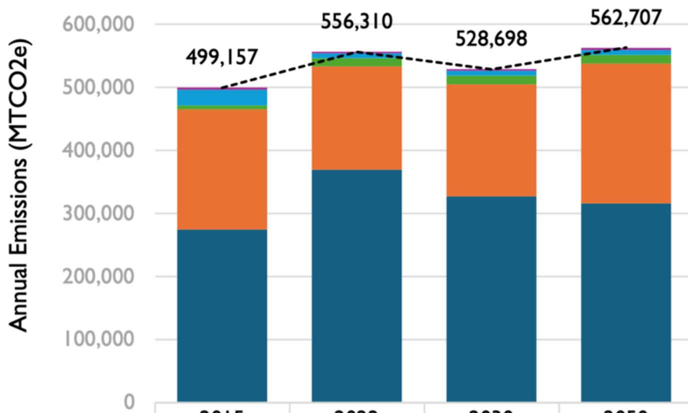
1. Assumed to change in proportion with the CEC's electricity demand forecast for the SCE area and natural gas demand forecast for the SoCalGas area in the Agriculture and Water Pumping (AGWP) sector.

Sources: Fehr & Peers, 2024; Dyett & Bhatia, 2024

4.6 Total Emissions

Table 13 compares the GHG emissions inventories by sector for the adjusted 2015 baseline, 2022 baseline, and 2030 and 2050 business-as-usual forecasts without reductions from State actions. As shown in **Figure 3**, annual GHG emissions in Redlands is estimated to continue increasing since 2015, except for a slight fluctuation in 2030, when the decrease in transportation emissions outweighs growth-induced increases in emissions from other sectors. In absolute terms, total annual emissions in the business-as-usual scenario are projected to increase from 499,157 $MTCO_2e$ in 2015 to 562,707 $MTCO_2e$ in 2050 (an increase of 13 percent).

Figure 3: Change in Total Annual Business-As-Usual GHG Emissions, 2015-2050



	2015	2022	2030	2050
Potable Water	3,189	2,975	2,990	3,417
Solid Waste	24,933	7,412	7,718	8,435
Wastewater	6,088	13,129	13,329	13,530
Built Environment	190,861	163,753	178,193	221,613
Transportation	274,086	369,041	326,467	315,712
------- Total	499,157	556,310	528,698	562,707

Dyett & Bhatia, 2024

Table 13: Baseline and Business-As-Usual Detailed Community-wide GHG Emissions Inventories by Sector, 2015-2050

Source/Activity	*Details*	*Annual Emissions ($MTCO_2e$)* 2015[1] Baseline	2022 Baseline	2030 BAU Forecast	2050 BAU Forecast
Built Environment					
Energy - Electricity	Residential	46,892	43,020	47,326	63,400
	Commercial	50,240	36,512	43,9678	68,187
	Industrial	19,306	11,618	11,624	11,750
	Public Lighting	747	601	544	449
Energy - Natural Gas	Residential	49,983	56,017	56,078	56,266
	Commercial	23,362	15,451	18,404	21,017
	Industrial[2]	331	534	539	544
Subtotal		190,861	163,753	178,193	221,613
Transportation					
Fugitive/Energy	On-Road	259,239	351,444	308,472	295,192
	Off-Road	14,847	17,597	17,995	20,520

Source/Activity	Details	Annual Emissions ($MTCO_2e$) 2015[1] Baseline	2022 Baseline	2030 BAU Forecast	2050 BAU Forecast
Subtotal		274,086	369,041	326,467	315,712
Solid Waste					
Fugitive - Landfill	Residential	14,741	2,368	2,466	2,694
	Commercial/ Industrial	10,184	5,031	5,239	5,725
	Bulk Waste	8	13	14	15
Subtotal		24,933	7,412	7,718	8,435
Potable Water					
Energy - Supply	Extraction	621	582	533	609
	Conveyance	77	53	67	76
Energy – Treatment[3]		—[4]	327	334	382
Energy – Distribution[3]		2,490	2,013	2,057	2,350
Subtotal		3,189	2,975	2,990	3,417
Wastewater					
Stationary - Treatment		1	38	40	44
Process - Treatment		180	185	193	211
Fugitive - Treatment		402	376	393	430
Energy - Collection, Treatment[5]	Electricity	1,345	1,203	1,431	1,574
	Natural Gas	4,161	11,327	11,272	11,272
Subtotal		6,088	13,129	13,329	13,530
Grand Total		**499,157**	**556,310**	**528,698**	**562,707**
Percent Change from 2015		-	+11%	+6%	+13%
Per capita emissions		7.1	7.7	7.0	6.8

Source/Activity	Details	Annual Emissions ($MTCO_2e$)			
		2015[1] Baseline	2022 Baseline	2030 BAU Forecast	2050 BAU Forecast

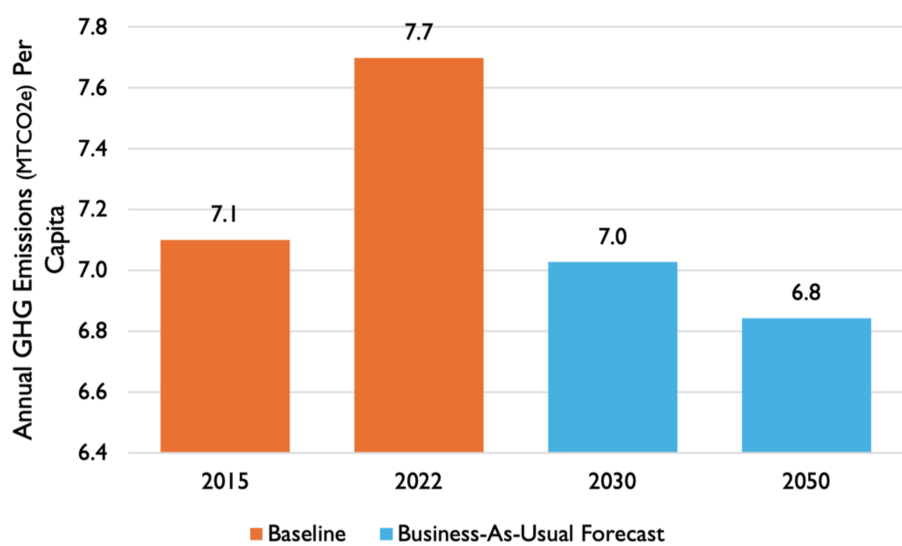
BAU = Business-As-Usual

1. Emissions for 2015 are adjusted from the 2015 GHG Inventory included in the 2017 CAP using the same methodology as the 2022 baseline inventory to allow for valid comparison. Emissions from the Residential, Commercial, Industrial, Agricultural, and Public Lighting sectors of the 2015 GHG Inventory were combined into the Built Environment sector; 2015 commercial electricity includes agriculture electricity, which is not available for other years.
2. Industrial natural gas emissions may be underestimated due to unavailability of data from large facilities (customer confidentiality laws).
3. Emissions from electricity used to treat and distribute potable water are subtracted from the commercial category in the Built Environment sector to avoid double counting; emissions from water supply represent embodied energy and are not included in the SCE report for consumption by Redlands and therefore do not need to be subtracted.
4. Energy (electricity) used for treatment and distribution of potable water were reported together for the 2015 GHG Inventory and are shown combined under distribution.
5. Energy for wastewater collection and treatment is reported together and cannot be separated. Emissions are subtracted from the commercial electricity and natural gas categories in the Built Environment sector to avoid double counting.

Dyett & Bhatia, 2024

When evaluated based on an efficiency metric, business-as-usual forecast emissions are expected to improve compared to the 2022 baseline emissions level, which is substantially higher than in 2015 (as adjusted for valid comparison). As shown in **Figure 4**, the total annual emissions of 528,698 $MTCO_2e$ in 2030 would correspond to 7.0 $MTCO_2e$ per capita, decreasing from 7.7 $MTCO_2e$ per capita in 2022 as well as decreasing from 7.1 $MTCO_2e$ per capita in 2015. The efficiency metric for 2050 would also continue this downward trend to 6.8 $MTCO_2e$ per capita.

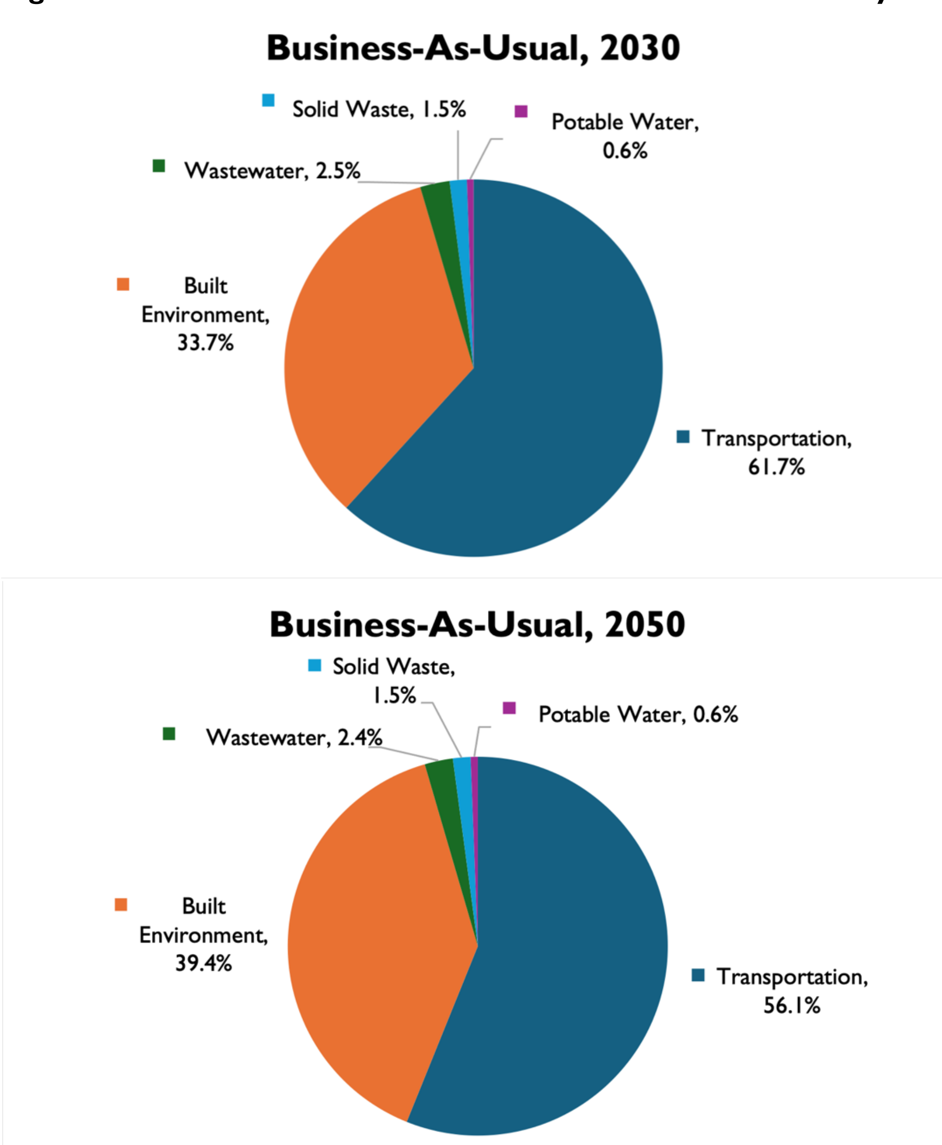
Figure 4: Business-As-Usual GHG Emissions Per Capita, 2015-2050



Dyett & Bhatia, 2024

As shown in **Figure 5**, the transportation sector continues to represent the greatest source of community-wide emissions, accounting for 61.7 percent of emissions in 2030 and 56.1 percent in 2050. Built environment emissions remain as the second largest sector, making up 33.7 percent of emissions in 2030 and 39.4 percent in 2050.

Figure 5: 2030 and 2050 Business-As-Usual GHG Emissions by Sector



Dyett & Bhatia, 2024

5 ADJUSTED BUSINESS-AS-USUAL FORECAST

Reductions from State actions that could be quantified independently from growth assumptions are reflected in the adjusted business-as-usual forecast, as described in the following sections. Local actions that would be implemented by the City, such as increasing solid waste diversion in line with AB 341 or establishing a local food recovery goal as outlined by SB 1383, are not included but would instead be credited as a GHG reduction measure in the CAP.

5.1 Electricity Emissions Reductions from Renewables Portfolio Standards

Renewables Portfolio Standards (RPS), established in 2002 by SB 1078 with the initial requirement that 20 percent of electricity retail sales (such as by investor-owned utilities like SCE) must be served by renewable resources by 2017. RPS requirements were accelerated in 2015 with SB 350 to 50 percent by 2030, then again in 2018 with SB 100, which increased the 2030 target to 60 percent and requires all of the state's electricity to come from carbon-free resources by 2045. In 2022, SB 1020 clarified interim RPS targets: 90 percent by 2035, 95 percent by 2040, and 100 percent by 2045. Quantified reductions in the adjusted business-as-usual forecast reflect the latest RPS consistent with SB 100 and SB 1020.

5.2 Natural Gas Emissions Reductions from Renewable Gas Standards

CPUC Decision 22-02-025[12] requires California's four largest investor-owned utilities providing natural gas (one of which is SoCalGas) to meet collective biomethane procurement targets for 2025 and 2030 to implement SB 1440 (2022) and support California's organic waste diversion goal under SB 1383 (2016). Under this decision, SoCalGas is responsible for procuring its proportionate share of Cap-and-Trade allowances (49.26 percent) of the collective renewable natural gas procurement target of 17.6 billion cubic feet (Bcf) annually by 2025, as well as contributing its proportionate share of 2020 annual bundled core natural gas demand forecasted in the 2020 California Gas Report[13] of the collective 72.8 Bcf annually by 2030. The latter target is referred to as the "Renewable Gas Standard" (RGS) and applies to 2030 and beyond, but CPUC will re-evaluate and revise, as necessary, this standard for the longer term in 2025.

SoCalGas' Aspire 2045 Sustainability Strategy establishes a goal of delivering 20 percent renewable natural gas to core customers by 2030,[14] in line with these regulations. According to the Aspire 2045 Factsheet, SoCalGas is currently (as of August 2023) providing five percent renewable gas.[15] Given this direction, quantified reductions in the adjusted business-as-usual forecast reflect SoCalGas' goal for 2030 and assume this goal would be maintained thereafter (through 2050). Although SoCalGas is the locally specific utility for Redlands, SoCalGas' compliance with RGS is included as

[12] California Public Utilities Commission, Decision 22-02-025: Decision Implementing Senate Bill 1440 Biomethane Procurement Program (Rulemaking 13-02-008), February 24, 2022, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M454/K335/454335009.PDF

[13] California Gas and Electric Utilities, 2020 California Gas Report, October 2020, https://www.socalgas.com/sites/default/files/2020-10/2020_California_Gas_Report_Joint_Utility_Biennial_Comprehensive_Filing.pdf.

[14] Southern California Gas Company, Aspire 2045: SoCalGas Sustainability Strategy, February 2022, https://www.socalgas.com/sites/default/files/2022-02/SoCalGas_Sustainability_Strategy_final.pdf.

[15] Southern California Gas Company, Aspire 2045 Factsheet, August 2023, https://www.socalgas.com/sites/default/files/2023-08/ASPRIE_2045_Factsheet.pdf.

a state-level (rather than local) action because it is directly tied to SB 1440 and the City has no influence over this action.

5.3 Built Environment Reductions from Title 24

The Title 24 Building Energy Efficiency Standards (Part 6, Energy Code) are updated every three years and set increasingly stringent standards to reduce wasteful, uneconomical, and unnecessary uses of energy in residential and non-residential buildings. The 2022 standards are effective as of January 1, 2023. The CEC estimated annual savings over the previous (2019) standards in the 2022 Energy Code Impact Analysis.[16] Quantified reductions in the adjusted business-as-usual forecast reflect these estimates for climate zone 10 (Riverside County), applied to electricity and natural gas consumption of residential and non-residential new construction and alterations, using the same assumptions as the CEC. Savings from Title 24 due to avoided electricity and natural gas consumption are in addition to reductions from RPS and RGS.

Table 14 summarizes the estimated reductions from RPS, RGS, and Title 24 by sector.

Table 14: Reductions from State Actions included in Adjusted Business-As-Usual Scenario, 2030-2050

	Annual Emissions Reductions ($MTCO_2e$)					
Year	*2030*			*2050*		
Sector/Action	*RPS*	*RGS*	*Title 24*	*RPS*	*RGS*	*Title 24*
Built Environment	**29,032**	**13,625**	**253**	**147,643**	**14,068**	**71**
Electricity	29,032	-	220	147,643	-	-
Natural Gas	-	13,625	33		14,068	71
Potable Water	**816**	**-**	**-**	**3,417**	**-**	**-**
Electricity	816	-	-	3,417	-	-
Wastewater	**390**	**1,780**		**1,574**	**1,780**	**-**
Electricity	390	-	-	1,574	-	-
Natural Gas	-	1,780	-	-	1,780	-
Total Reductions	**30,238**	**15,405**	**253**	**152,634**	**18,740**	**71**

1. Reductions from Title 24 are beyond (distinct from) reductions from RPS and RGS.

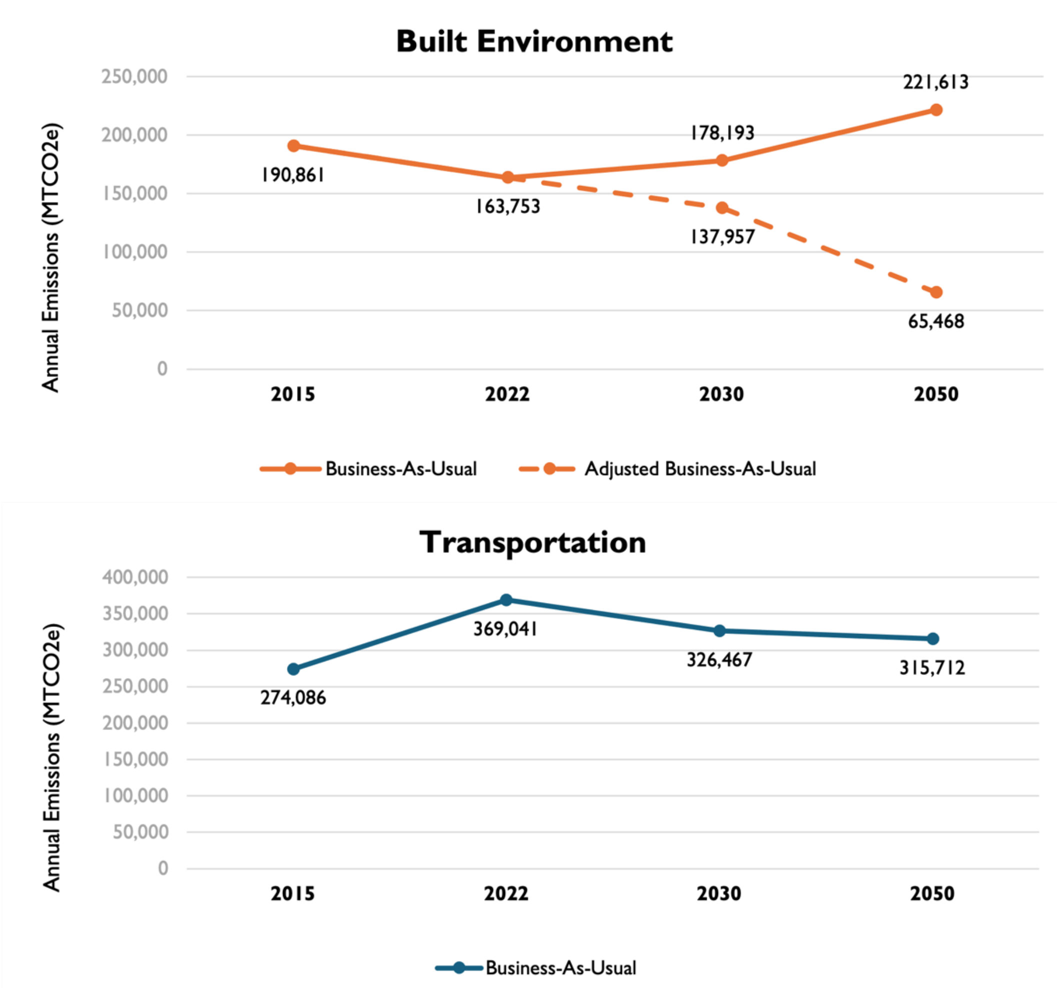
Sources: Dyett & Bhatia, 2024

Figure 6 summarizes the changes in GHG emissions for each sector over time under the business-as-usual scenario, with and without adjustments from State actions. Decarbonization of electricity through RPS would be the main contributor to emissions reductions, particularly in the Built Environment sector. As described in **Section 4**, reductions from regulations affecting the transportation sector are already included in the business-as-usual scenario due to their inclusion

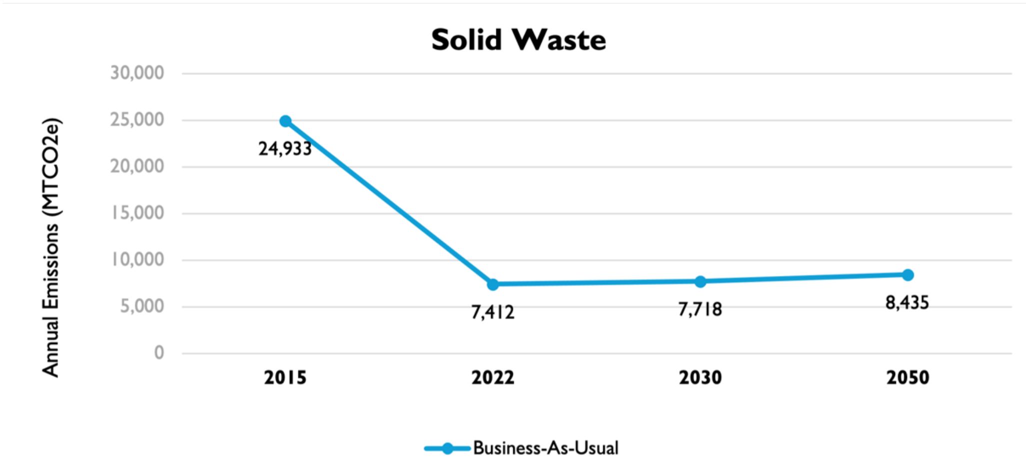
[16] California Energy Commission, 2022 Energy Code Impact Analysis, June 30, 2023, https://www.energy.ca.gov/publications/2023/impact-analysis-2022-update-california-energy-code.

in EMFAC 2021 and are not quantified in the adjustments. Additionally, reductions in the solid waste sector are not quantified in the adjustments because these would be credited as a GHG reduction measure (to be developed) in the City's updated CAP. Therefore, both of these sectors do not have dashed lines for adjusted business-as-usual trajectories in **Figure 6**.

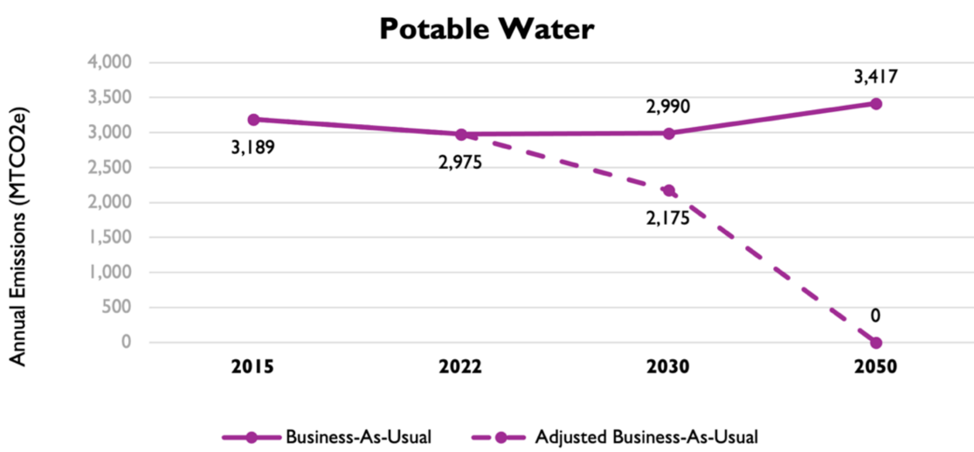
Figure 6: Changes in Business-As-Usual and Adjusted Business-As-Usual GHG Emissions by Sector, 2015-2050

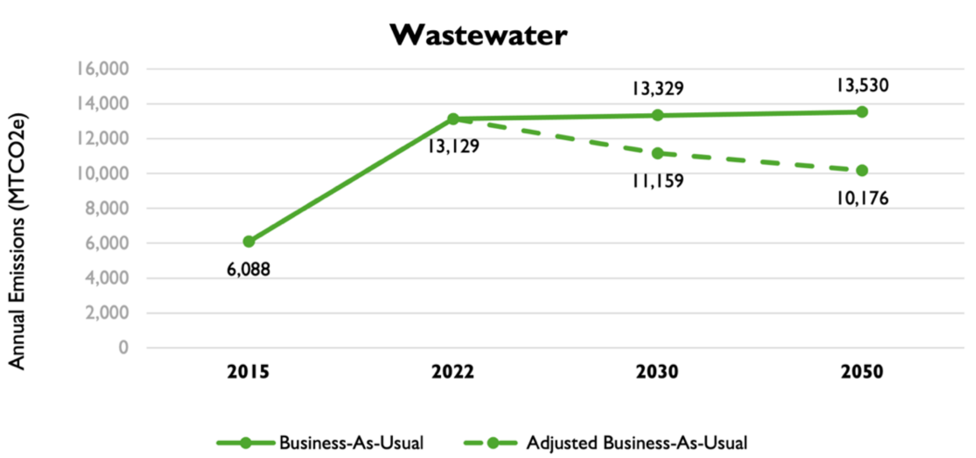


Note: Reductions from State actions in the Transportation sector are already included in the Business-As-Usual scenario due to their inclusion in CARB's EMFAC 2021 and therefore cannot be quantified separately in the adjustments (shown in dashed line).



Note: Reductions due to local actions affecting the Solid Waste sector are not quantified as adjustments (shown in dashed line) because they would be credited as a GHG reduction measure (to be developed) in the City's updated CAP.





Dyett & Bhatia, 2024

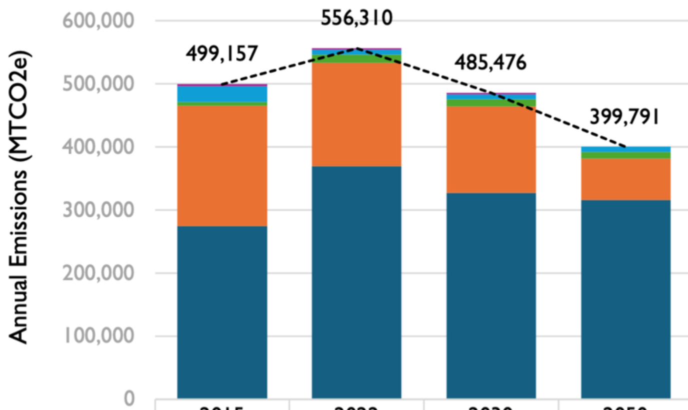
6 SUMMARY

As shown in **Figure 7**, annual community-wide GHG emissions in Redlands have increased since 2015, rising about 11 percent from 499,157 $MTCO_2e$ in 2015 (adjusted using the methodology described in this report using inputs from the 2017 CAP for valid comparison) to 556,310 $MTCO_2e$ in 2022. Without State actions to decarbonize electricity and natural gas GHG emissions generated by Redlands would continue to increase to 562,707$MTCO_2e$ in 2050 under the business-as-usual scenario, representing a 13-percent rise above 2015 levels.

However, annual community-wide GHG emissions are estimated to decrease under the adjusted business-as-usual scenario to 399,791 $MTCO_2e$ in 2050, representing a 20-percent reduction from 2015 levels. These significant reductions, particularly in the Built Environment and Potable Water sectors, reflect the achievement of 100-percent carbon-free electricity from SCE by 2045 (supporting RPS) and 20-percent renewable gas delivered by SoCalGas by 2030 and beyond (supporting RGS). In fact, emissions in the Potable Water sector would virtually be reduced to zero, based on the carbon-free energy used to supply, treat, and deliver potable water. In addition, Transportation sector emissions are expected to decrease slightly due to State efforts such as the Advanced Clean Cars Program and EO N-79-20, despite an absolute increase in VMT within Redlands.

Meanwhile, emissions from the Solid Waste sector would continue to increase in proportion with increasing solid waste disposed by the growing population of Redlands. However, emissions quantified in this report do not include the impact of increasing solid waste diversion in line with the statewide target under AB 341 or establishing a local food recovery goal under SB 1383, which would be implemented as a City action and credited under the updated CAP. Inclusion of these GHG reduction measures, to be developed as part of the updated CAP's GHG Reduction Strategy, is recommended to offset increasing emissions in this sector.

Figure 7: Change in Total Annual Adjusted Business-As-Usual GHG Emissions, 2015-2050



	2015	2022	2030	2050
Potable Water	3,189	2,975	2,175	0
Solid Waste	24,933	7,412	7,718	8,435
Wastewater	6,088	13,129	11,159	10,176
Built Environment	190,861	163,753	137,957	65,468
Transportation	274,086	369,041	326,467	315,712
------- Total	499,157	556,310	485,476	399,791

Dyett & Bhatia, 2024

Despite the increase between 2015 and 2022 baseline conditions, future per capita emissions under the adjusted business-as-usual scenario would also decrease to about 6.5 $MTCO_2e$ per capita in 2030 and 4.9 $MTCO_2e$ in 2050, as shown in **Table 15**. Based on this efficiency metric, the City would not meet its adopted target for 2030 of 6.0 $MTCO_2e$ per capita contained in the adopted 2017 CAP, and additional reductions would be required, especially in the Transportation and Built Environment sectors. Prioritization of GHG reduction measures will be developed with the GHG Reduction Strategy.

Table 15: Summary of Adjusted Business-As-Usual Community-wide GHG Emissions Inventory, 2015-2050

Metric	*2015 Baseline*	*2022 Baseline*	*2030 Adj. BAU*	*2050 Adj. BAU*
Total Annual GHG Emissions ($MTCO_2e$)	**499,157**	**556,310**	**485,476**	**399,791**
Percent change from 2015 levels	-	+11%	-3%	-20%
Per capita emissions[1]	7.1	7.7	6.5	4.9

Adj. BAU = Adjusted Business-As-Usual (includes reductions from State actions, including RPS, RGS, and Title 24)

1. Per capita emissions calculated based on population shown in Table 7.

Sources: Dyett & Bhatia, 2024

ATTACHMENT A: Fehr & Peers Memorandum - Vehicle Miles Traveled Inventory for City of Redlands Climate Action Plan, March 27, 2024.

ATTACHMENT A

FEHR PEERS

Memorandum

Date: March 27, 2024

To: Rajeev Bhatia, Dyett & Bhattia
Mayu Tanaka, Dyett & Bhattia

From: Paul Herrmann, P.E.
Marsha Phillips
Raymond Poss

Subject: Vehicle Miles Traveled Inventory for City of Redlands Climate Action Plan

OC24-1042

Fehr & Peers has completed Vehicle Miles Traveled (VMT) inventory for the City of Redlands Climate Action Plan (CAP). This memorandum summarizes the methodology of VMT preparation and key findings.

Methodology

Travel Demand Model

Fehr & Peers utilized the latest version of the San Bernardino Transportation Analysis Model (SBTAM+) to estimate VMT for the City of Redlands. SBTAM+ is the most appropriate travel demand model for forecasting traffic volumes and VMT in San Bernadino County and reflects the most recent Southern California Association of Governments (SCAG) Regional Transportation Plan (RTP) and associated Sustainable Communities Strategy (SCS) from 2024. The travel demand model produces weekday VMT for a typical Tuesday through Thursday, therefore Fehr & Peers annualized the VMT data in the inventory for use in the GHG assessment.

VMT Methodology

Fehr & Peers utilized the Regional Transportation Advisory Committee (RTAC) VMT calculation methodology, also referred to as the half-accounting method, to prepare VMT forecasts. Using this methodology, 100% of the VMT with two trip ends within a jurisdiction is attributed to that agency, 50% of the VMT with only one trip end is allocated to the jurisdiction (the other 50% is allocated to the jurisdiction where the other trip end is located), and no VMT for trips that simply pass-through the City is included in the accounting methodology. This method is considered state-of-the-practice for use in CAPs as it allocates the VMT that specific agencies can control to that specific agency as part of the inventory.

As noted, the SBTAM+ model was used to assist in this accounting to track trips and allocation. This was completed for both the model base year (2019) and model future year (2050). Additionally, 2022 and 2030 years were interpolated to align with the CAP scenarios.

VMT Results

Table 1 shows the socioeconomic data inputs assumptions in SBTAM+. **Table 2** shows the daily VMT by vehicle class for year 2022, 2030, and 2050 in City of Redlands. The daily VMT by speed bin is provided in **Tables 3, 4, and 5** for years 2022, 2030, and 2050, respectively.

Please note that, if you are using the VMT by speed bin information, the speed bins are representative of typical weekday conditions – if you are using the annualized speed bin information, it would be assuming similar congestion profiles for all days of the week and all periods of the year are the same as a typical Tuesday through Thursday.

Table 1: Redlands Socioeconomic Data Summary

Category	2019[1]	2022[2]	2030[2]	2050[1]
Population	71,948	72,943	75,243	82,228
Households	25,644	26,186	27,439	31,244
Single-Family Units	16,749	16,868	17,143	17,979
Multi-Family Units	8,895	9,318	10,296	13,265
Retail Employment	9,578	9,474	9,232	8,499
Non-retail Employment	39,782	40,926	43,571	51,604
Total Employment	49,360	50,400	52,803	60,103

Notes:
1. 2019 and 2050 data are consistent with the 2020 SCAG RTP/SCS base year and future year land use assumptions in SBTAM+.
2. Interim years were interpolated between base and future.

Source: SBTAM+, 2024

Table 2: Redlands Daily VMT by Vehicle Class (RTAC Methodology)

Year		Auto[1]		LHDT[2]		MHDT[3]		HHDT[4]		Total VMT		RTAC VMT 100% ii +50% ix & xi	Annual RTAC VMT
		i	x	i	x	i	x	i	x	i	x		
2022	i	277,485	1,976,456	1,878	28,842	1,723	25,645	1,055	121,788	282,140	2,152,731	2,447,632	758,765,921
	x	2,001,753	-	28,920	-	25,689	-	121,891	-	2,178,252	-		
2030	i	281,731	2,067,410	1,819	30,143	1,653	26,654	1,070	126,272	286,272	2,250,479	2,551,867	791,078,754
	x	2,097,331	-	30,240	-	26,706	-	126,432	-	2,280,710	-		
2050	i	292,346	2,294,797	1,671	33,394	1,478	29,176	1,108	137,483	296,603	2,494,850	2,812,455	871,861,080
	x	2,336,278	-	33,540	-	29,251	-	137,785		2,536,854	-		

Note:

1. Auto = passenger cars.
2. LHDT = Light heavy-duty trucks.
3. MHDT = Might heavy-duty trucks.
4. HHDT = Heavy heavy-duty trucks.

Source: SBTAM+, 2024

Table 3: 2022 Daily VMT by Speed Bin (RTAC Methodology)

Speed		Total VMT i	Total VMT x	RTAC VMT 100% ii +50% ix & xi	Annual RTAC VMT
0-5 MPH	i x	0 116	0	58	17,970
5-10 MPH	i x	0 0	0	0	0
10-15 MPH	i x	0 2,028	179	1,104	342,136
15-20 MPH	i x	1,415 2,877	59	2,883	893,829
20-25 MPH	i x	10,941 11,517	2,584	17,992	5,577,571
25-30 MPH	i x	111,762 71,067	41,063	167,827	52,026,397
30-35 MPH	i x	116,111 259,133	217,172	354,264	109,821,717
35-40 MPH	i x	27,193 328,598	309,908	346,446	107,398,378
40-45 MPH	i x	11,144 320,539	440,926	391,877	121,481,773
45-50 MPH	i x	3,438 410,534	506,214	461,812	143,161,699
50-55 MPH	i x	135 486,636	404,517	445,712	138,170,650
55-60 MPH	i x	0 240,278	195,091	217,684	67,482,140
60-65 MPH	i x	0 44,929	35,017	39,973	12,391,660
65-70 MPH	i x	0 0	0	0	0
70-75 MPH	i x	0 0	0	0	0
75-80 MPH	i x	0 0	0	0	0
Total VMT	**i** **x**	**282,140** **2,178,253**	**2,152,731** **-**	**2,447,632**	**758,765,921**

Source: SBTAM+, 2024

Table 4: 2030 Daily VMT by Speed Bin (RTAC Methodology)

Speed		Total VMT i	Total VMT x	RTAC VMT 100% ii +50% ix & xi	Annual RTAC VMT
0-5 MPH	i	0	0	213	65,874
	x	425			
5-10 MPH	i	0	0	0	0
	x	0			
10-15 MPH	i	0	657	4,047	1,254,383
	x	7,436			
15-20 MPH	i	1,011	101	6,260	1,940,646
	x	10,397			
20-25 MPH	i	9,215	3,554	24,130	7,480,448
	x	26,276			
25-30 MPH	i	109,942	57,555	186,536	57,826,031
	x	95,632			
30-35 MPH	i	125,146	277,340	413,096	128,059,812
	x	298,560			
35-40 MPH	i	26,924	392,935	397,544	123,238,583
	x	348,305			
40-45 MPH	i	10,535	458,855	428,607	132,867,964
	x	377,288			
45-50 MPH	i	3,362	481,656	452,555	140,291,825
	x	416,729			
50-55 MPH	i	137	373,330	416,763	129,196,396
	x	459,921			
55-60 MPH	i	0	168,473	183,454	56,870,686
	x	198,435			
60-65 MPH	i	0	36,023	38,665	11,986,105
	x	41,307			
65-70 MPH	i	0	0	0	0
	x	0			
70-75 MPH	i	0	0	0	0
	x	0			
75-80 MPH	i	0	0	0	0
	x	0			
Total VMT	**i**	**286,272**	**2,250,479**	**2,551,867**	**791,078,754**
	x	**2,280,710**	**-**		

Source: SBTAM+, 2024

Table 5: 2050 Daily VMT by Speed Bin (RTAC Methodology)

Speed		Total VMT i	 x	RTAC VMT 100% ii +50% ix & xi	Annual RTAC VMT
0-5 MPH	i x	0 1,197	0	598	185,465
5-10 MPH	i x	0 0	0	0	0
10-15 MPH	i x	0 20,955	1,852	11,404	3,535,183
15-20 MPH	i x	1 29,197	206	14,702	4,557,767
20-25 MPH	i x	4,900 63,174	5,977	39,476	12,237,490
25-30 MPH	i x	105,393 157,045	98,784	233,308	72,325,364
30-35 MPH	i x	147,734 397,128	427,758	560,177	173,654,735
35-40 MPH	i x	26,251 397,572	600,501	525,287	162,839,060
40-45 MPH	i x	9,012 519,160	503,680	520,431	161,333,745
45-50 MPH	i x	3,172 432,215	420,262	429,410	133,117,148
50-55 MPH	i x	141 393,134	295,363	344,389	106,760,623
55-60 MPH	i x	0 93,828	101,929	97,878	30,342,260
60-65 MPH	i x	0 32,251	38,538	35,394	10,972,241
65-70 MPH	i x	0 0	0	0	0
70-75 MPH	i x	0 0	0	0	0
75-80 MPH	i x	0 0	0	0	0
Total VMT	**i** **x**	**296,603** **2,536,854**	**2,494,850** **-**	**2,812,455**	**871,861,080**

Source: SBTAM+, 2024