3.7 Greenhouse Gas Emissions

This section of the Draft EIR evaluates potential impacts to greenhouse gas (GHG) emissions associated with implementation of the proposed Golden State Natural Resources Forest Resiliency Demonstration Project (project or proposed project). This section describes the existing GHG emissions and climate change setting, and evaluates the potential for project-related GHG emissions impacts related to activities at feedstock source locations (Sustainable Forest Management Projects), proposed pellet processing facility sites in Northern California (Lassen Facility) and the Central Sierra Nevada foothills (Tuolumne Facility), and the export terminal at the Port of Stockton.

Scoping comments were received regarding GHGs in response to the Notice of Preparation (NOP) (see Appendix A). The GHG related comments included concerns associated with the construction and operational lifecycle (i.e., from harvesting, processing, feedstock transport and storage, pellet production, rail transport, port operations, overseas transport, and combustion of the pellets to make electricity) of the proposed project. Concerns related to GHGs generated during construction and operation are addressed in the Estimated GHG Emissions subsection within Section 3.7.4.2. Concerns were also related to forest carbon loss and transfer of carbon from terrestrial stocks to the atmosphere, which are addressed in Section the Forest Carbon Change subsection within Section 3.7.4.2. Finally, concerns pertaining to the proposed project's potential to conflict with California's climate goals and policies were received, which are addressed in the CARB 2022 Scoping Plan, California Forest Carbon Plan, AB 1757 California's Nature-Based Solutions, and Local GHG Reduction Plans subsections within Section 3.7.4.2.

3.7.1 Environmental Setting

Due to the nature of GHG emission and climate change, the following environmental setting does not provide a description of existing conditions at each site or project activity (e.g., sustainable forest management projects, Northern California [Lassen Facility], Central Sierra Nevada [Tuolumne Facility], or Port of Stockton), but rather provides a summary of climate change, GHGs, global warming potential (GWP), sources of GHG emissions, and potential effects of climate change.

3.7.1.1 Climate Change Overview

Climate change refers to any significant change in measures of climate, such as temperature, precipitation, or wind patterns, lasting for an extended period (i.e., decades or longer). The Earth's temperature depends on the balance between energy entering and leaving the planet's system. Many factors, both natural and human, can cause changes in Earth's energy balance, including variations in the sun's energy reaching Earth, changes in the reflectivity of Earth's atmosphere and surface, and changes in the greenhouse effect, which affects the amount of heat retained by Earth's atmosphere (EPA 2024a).

The greenhouse effect is the trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. The greenhouse effect traps heat in the troposphere through a threefold process as follows: Short-wave radiation emitted by the Sun is absorbed by the Earth, the Earth emits a portion of this energy in the form of long-wave radiation, and GHGs in the upper atmosphere absorb this long-wave radiation and emit it into space and toward the Earth. The greenhouse effect is a natural process that contributes to regulating the Earth's temperature and creates a pleasant, livable environment on the Earth. Human activities that emit additional GHGs to the atmosphere increase the amount of infrared radiation that gets absorbed before escaping into space, thus enhancing the greenhouse effect and causing the Earth's surface temperature to rise.

The scientific record of the Earth's climate shows that the climate system varies naturally over a wide range of time scales and that, in general, climate changes prior to the Industrial Revolution in the 1700s can be explained by natural causes such as changes in solar energy, volcanic eruptions, and natural changes in GHG concentrations. Recent climate changes, in particular the warming observed over the past century, however, cannot be explained by natural causes alone. Rather, it is extremely likely that human activities have been the dominant cause of that warming since the mid-twentieth century and is the most significant driver of observed climate change (IPCC 2013; EPA 2024a). Human influence on the climate system is evident from the increasing GHG concentrations in the atmosphere, positive radiative forcing, observed warming, and improved understanding of the climate system (IPCC 2013). The atmospheric concentrations of GHGs have increased to levels unprecedented in the last 800,000 years, primarily from fossil fuel emissions and secondarily from emissions associated with land use changes (IPCC 2013). Continued emissions of GHGs will cause further warming and changes in all components of the climate system, which is discussed further in Section 3.7.1.6, Potential Effects of Climate Change.

3.7.1.2 Greenhouse Gases

A GHG is any gas that absorbs infrared radiation in the atmosphere; in other words, GHGs trap heat in the atmosphere. As defined in California Health and Safety Code, Section 38505(g), for purposes of administering many of the State's primary GHG emissions reduction programs, GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). (See also CEQA Guidelines, Section 15364.5.) Some GHGs, such as CO_2, CH_4, and N_2O, occur naturally and are emitted into the atmosphere through natural processes and human activities. Of these gases, CO_2 and CH_4 are emitted in the greatest quantities from human activities. Manufactured GHGs, which have a much greater heat-absorption potential than CO_2, include fluorinated gases, such as HFCs, PFCs, and SF_6, which are associated with certain industrial products and processes. The following paragraphs provide a summary of the most common GHGs and their sources.[1]

Carbon Dioxide. CO_2 is a naturally occurring gas and a by-product of human activities and is the principal anthropogenic GHG that affects the Earth's radiative balance. Natural sources of CO_2 include respiration of bacteria, plants, animals, and fungus; evaporation from oceans; volcanic out-gassing; and decomposition of dead organic matter. Human activities that generate CO_2 are from the combustion of fuels such as coal, oil, natural gas, and wood and changes in land use.

Methane. CH_4 is produced through both natural and human activities. CH_4 is a flammable gas and is the main component of natural gas. Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, flooded rice fields, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

Nitrous Oxide. N_2O is produced through natural and human activities, mainly through agricultural activities and natural biological processes, although fuel burning and other processes also create N_2O. Sources of N_2O include soil cultivation practices (microbial processes in soil and water), especially the use of commercial and organic fertilizers, manure management, industrial processes (such as in nitric acid production, nylon production, and fossil-fuel-fired power plants), vehicle emissions, and using N_2O as a propellant (e.g., rockets, racecars, and aerosol sprays).

1 The descriptions of GHGs are summarized from the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (1995), IPCC Fourth Assessment Report (2007), CARB's "GHG Inventory Glossary" (CARB 2024a), and EPA's "Overview of Greenhouse Gases" (EPA 2024b).

Fluorinated Gases. Fluorinated gases (also referred to as F-gases) are synthetic powerful GHGs emitted from many industrial processes. Fluorinated gases are commonly used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons [CFCs], hydrochlorofluorocarbons [HCFCs], and halons). The most prevalent fluorinated gases include the following:

- *Hydrofluorocarbons:* HFCs are compounds containing only hydrogen, fluorine, and carbon atoms. HFCs are synthetic chemicals used as alternatives to ozone-depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are used in manufacturing.
- *Perfluorocarbons:* PFCs are a group of human-made chemicals composed of carbon and fluorine only. These chemicals were introduced as alternatives, with HFCs, to the ozone depleting substances. The two main sources of PFCs are primary aluminum production and semiconductor manufacturing. Since PFCs have stable molecular structures and do not break down through the chemical processes in the lower atmosphere, these chemicals have long lifetimes, ranging between 10,000 and 50,000 years.
- *Sulfur Hexafluoride:* SF_6 is a colorless gas soluble in alcohol and ether and slightly soluble in water. SF_6 is used for insulation in electric power transmission and distribution equipment, semiconductor manufacturing, the magnesium industry, and as a tracer gas for leak detection.
- *Nitrogen Trifluoride:* NF_3 is used in the manufacture of a variety of electronics, including semiconductors and flat panel displays.

Chlorofluorocarbons. CFCs are synthetic chemicals that have been used as cleaning solvents, refrigerants, and aerosol propellants. CFCs are chemically unreactive in the lower atmosphere (troposphere) and the production of CFCs was prohibited in 1987 due to the chemical destruction of stratospheric O_3.

Hydrochlorofluorocarbons. HCFCs are a large group of compounds, whose structure is very close to that of CFCs—containing hydrogen, fluorine, chlorine, and carbon atoms—but including one or more hydrogen atoms. Like HFCs, HCFCs are used in refrigerants and propellants. HCFCs were also used in place of CFCs for some applications; however, their use in general is being phased out.

Black Carbon. Black carbon is a component of fine particulate matter, which has been identified as a leading environmental risk factor for premature death. It is produced from the incomplete combustion of fossil fuels and biomass burning, particularly from older diesel engines and forest fires. Black carbon warms the atmosphere by absorbing solar radiation, influences cloud formation, and darkens the surface of snow and ice, which accelerates heat absorption and melting. Black carbon is a short-lived species that varies spatially, which makes it difficult to quantify the global warming potential. Diesel particulate matter emissions are a major source of black carbon and are TACs that have been regulated and controlled in California for several decades to protect public health. In relation to declining diesel particulate matter from the CARB's regulations pertaining to diesel engines, diesel fuels, and burning activities, CARB estimates that annual black carbon emissions in California have reduced by 70% between 1990 and 2010, with 95% control expected by 2020 (CARB 2014).

Water Vapor. The primary source of water vapor is evaporation from the ocean, with additional vapor generated by sublimation (change from solid to gas) from ice and snow, evaporation from other water bodies, and transpiration from plant leaves. Water vapor is the most important, abundant, and variable GHG in the atmosphere and maintains a climate necessary for life.

Ozone. Tropospheric O_3, which is created by photochemical reactions involving gases from both natural sources and human activities, acts as a GHG. Stratospheric O_3, which is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2), plays a decisive role in the stratospheric radiative balance. Depletion of stratospheric O_3, due to chemical reactions that may be enhanced by climate change, results in an increased ground-level flux of ultraviolet-B radiation.

Aerosols. Aerosols are suspensions of particulate matter in a gas emitted into the air through burning biomass (plant material) and fossil fuels. Aerosols can warm the atmosphere by absorbing and emitting heat and can cool the atmosphere by reflecting light.

3.7.1.3 Global Warming Potential

Gases in the atmosphere can contribute to climate change both directly and indirectly. Direct effects occur when the gas itself absorbs radiation. Indirect radiative forcing occurs when chemical transformations of the substance produce other GHGs, when a gas influences the atmospheric lifetimes of other gases, and/or when a gas affects atmospheric processes that alter the radiative balance of the Earth (e.g., affect cloud formation or albedo) (EPA 2024c). The Intergovernmental Panel on Climate Change (IPCC) developed the GWP concept to compare the ability of each GHG to trap heat in the atmosphere relative to another gas. The GWP of a GHG is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kilogram of a trace substance relative to that of 1 kilogram of a reference gas (IPCC 2014). The reference gas used is CO_2; therefore, GWP-weighted emissions are measured in metric tons of CO_2 equivalent (MT CO_2e).

The current version of CalEEMod (version 2022.1.1.25) assumes that the GWP for CH_4 is 25 (so emissions of 1 MT of CH_4 are equivalent to emissions of 25 MT of CO_2), and the GWP for N_2O is 298, based on the IPCC Fourth Assessment Report (IPCC 2007). The GWP values identified in CalEEMod were applied to the Project.

3.7.1.4 Forest Carbon Storage and Sequestration

Stored Carbon

Compared with other terrestrial ecosystems, forests store some of the largest quantities of carbon per surface area of land (Poeplau et al. 2011). Stored carbon in forests refers to the amount of carbon that is stored within the trees, soil, and other biomass in a forest ecosystem. Forests play a crucial role in mitigating climate change by acting as carbon sinks, capturing, and storing carbon through the process of photosynthesis. Forest carbon storage in live vegetation is directly influenced by forest biomass. Forest biomass refers to the total amount of living and dead organic matter (biomass) present in a forest ecosystem. It includes all plant material, such as trees, shrubs, grasses, and other vegetation, as well as organic matter in the soil, such as roots, leaves, branches, and fallen trees. Forest biomass can be categorized into several components:

1. **Aboveground Biomass:** This includes the living components of the forest canopy, such as trees, shrubs, and vines, as well as dead material such as fallen branches and leaves. Aboveground biomass is often measured using methods such as tree inventories, satellite imagery, or aerial surveys.
2. **Belowground Biomass:** This comprises the roots of trees and other plants, as well as soil organic matter. Belowground biomass is an important but often underestimated component of forest ecosystems, as it plays a crucial role in nutrient cycling, soil structure, and carbon storage.
3. **Standing Dead Biomass and Deadwood:** Standing dead biomass refers to dead trees or standing snags that are still standing upright. Deadwood consists of fallen trees, branches, and logs that are lying on the forest floor. Unlike live trees, dead biomass releases carbon and other gases such as methane into the

atmosphere through decomposition. Worldwide, dead and decaying wood releases roughly 10.9 gigatons of carbon every year. This is roughly 115% of annual fossil fuel emissions (Seibold et al. 2021).

4. **Litter:** This includes freshly fallen leaves, branches, and other organic material on the forest floor. Litter plays a vital role in nutrient cycling, soil moisture retention, and providing habitat for soil organisms.
5. **Deadwood:** This consists of fallen trees, branches, and logs that are lying on the forest floor.

Forest biomass is an essential component of forest ecosystems and plays a crucial role in regulating the Earth's climate by storing CO_2 through the process of photosynthesis. Forests also provides habitat for biodiversity, supports soil fertility and structure, regulates water cycles, and offers numerous ecosystem services essential for human well-being. Understanding and managing forest biomass is therefore essential for sustainable forest management and conservation efforts.

Carbon Storage in Forest Soils

Forest soils play a crucial role in the global carbon cycle by storing significant amounts of carbon. This carbon is primarily stored in two forms: organic carbon and inorganic carbon. Organic carbon is derived from decomposed plant and animal material, as well as microbial activity. Forest litter, dead wood, roots, and soil organic matter are major reservoirs of organic carbon in forest soils. These materials accumulate over time and contribute to soil fertility and structure. Inorganic carbon in forest soils is mainly present in the form of carbonate minerals, such as calcite and dolomite. These minerals are formed from the weathering of rocks and contribute to soil pH regulation and nutrient availability.

Overall, the specific effects of forest fuels treatments on soil carbon will depend on factors such as treatment intensity, frequency, and site characteristics. In a study of forest harvest impacts on soil organic carbon, conventional harvests were found to not result in substantial changes to soil organic carbon, whereas intensive harvests led to soil organic carbon losses in all layers of forest soils (Achat et al. 2015). Fuel treatments can positively impact carbon storage if they prevent soil loss to erosion after a high-severity fire (Campbell et al. 2012). In a study of the effects of various fuels treatment techniques on soil carbon, it was concluded that there were no significant differences in soil carbon in thinned versus untreated stands (Moghaddas and Stephens 2007).

Carbon Sequestration

Where forest carbon storage describes the level of carbon present within a forest, carbon sequestration is the capture, removal, and storage of atmospheric CO_2. Generally, carbon sequestration is a key component of forest health, with forests that actively sequester large amounts of atmospheric carbon being considered healthier than those that sequester carbon at slower rates. There are three types of carbon sequestration: biological, geological, and technological. Biological carbon sequestration is the storage of atmospheric carbon in vegetation such as forests, crops, and grasslands, as well as in soils and oceans. Management practices can affect the amount of CO_2 stored, or “sequestered”; some management practices will increase the amount of carbon stored in vegetation and soil, while others will lead to decreases in the amount of carbon storage.

Carbon sequestration analyses provide an estimate of total sequestered carbon for a given location over a given period (e.g., annually). As opposed to carbon storage inventories that estimate total carbon for a given location for a particular point in time, sequestration analyses quantify the amount of CO_2 that is being removed from the atmosphere and stored within vegetation with a given action.

As forest vegetation grows, CO_2 is removed from the atmosphere and stored within plants, predominantly in the form of woody biomass. In forest ecosystems specifically, healthy large and mature trees remove carbon from the atmosphere at significantly greater rates compared to young, small trees (Stephenson et al. 2014). Within a single year, a fully grown living tree has the capacity to sequester over 48 pounds of CO_2, which becomes permanently housed within its fibers until external forces, such as fire or decomposition, trigger its release into the atmosphere (Stancil 2015). In most cases, tree growth rates have been found to increase with age. Therefore, forest management activities aimed at increasing forest carbon sequestration rates should facilitate conditions conducive to producing large diameter trees (Stephenson et al. 2014, Ontl et al. 2020). Maintaining mature and old forests that already store large amounts of carbon is a mitigation option, as suggested by the IPCC (2007).

Forest Density, Severe Wildfire, and Carbon Sequestration

Many argue that current forest conditions are not conducive to high rates of carbon sequestration (Liang et al. 2017, Hurteau et al. 2008). In addition, present forest conditions increase the likelihood of massive carbon loss events through severe wildfires.

Wildfire is a critical component for ecosystems present within the project area. The project area's Mediterranean climate involves warm and dry summers where fuels are highly receptive to fire (Miller et al. 2012). These climatic conditions have facilitated fire adaptation with historically short fire frequency intervals. Historic frequent low intensity fire, either natural or from indigenous burning, reduced forest fuel loads and fostered moderate density, healthy forest stands. While wildfire's presence within the project area landscape was previously maintained through natural events and indigenous burning practices, California's wildfire regime been altered severely in the past century. A long history of successful fire suppression, the absence of indigenous burning, and certain forest management practices have limited the ability for wildfire to perform essential ecosystem services (Syphard et al. 2007).

Instead, a substantial increase in the size and severity of wildfire events has and is expected to occur given current and projected forest and climate conditions (Westerling et al. 2011). Fifteen of the twenty largest wildfires in California's history have occurred since 2000, and six of the twenty largest fires in state history occurred in 2020 (Kane 2019). The past few years alone have experienced unprecedented wildfire behavior. The Dixie fire occurred within the project area and burned 963,310 acres, an area larger than the entire state of Rhode Island, in the summer of 2021, burning the majority of the structures in the town of Greenville, California (Weber and Berger 2020).

Although fire suppression has resulted in increased stem density, it has resulted in fewer very large trees, reducing total live-tree carbon stocks and shifting a greater proportion of these stocks into small-diameter, fire-sensitive trees (North et al. 2009). While overstocked forests may contain more trees per unit area compared lower density stands, the rate at which these overstocked forests remove CO_2 from the atmosphere is lower due to smaller tree size and reduced tree growth rates as a result of tree-to-tree competition.

The current state of forests in the project area is overstocked as presented below in Table 3.7-1. It can be argued that the current high density forest conditions within the project area's forest land is unsustainable as it does not promote long term carbon sequestration and storage. The current state of many areas within the Project area leaves forests susceptible to large carbon loss events such as severe wildfire and mortality.

Stand Density Index (SDI) is a measure used in forestry to quantify the density or crowding of trees within a stand. SDI is calculated based on the number of trees per unit area and the average diameter of those trees. Stand density measurements assist managers in identifying the degree of competition among trees and the utilization of the site, aiding in the determination of appropriate management strategies to achieve specific objectives. Forest types have a maximum SDI which sets the upper limit for forest stocking. Negative consequences from overstocking such as competition caused mortality, high susceptibility to pests and diseases, and the potential for high severity wildfire, begin to occur as forest stands encroach higher near their maximum SDI. Research suggests that forests begin to experience density-related mortality at 55% of the maximum SDI, with peak mortality occurring at 85% of maximum SDI (Sherlock 2007, Long and Shaw 2012). As presented below in Table 3.7-1, roughly 27% of the Project area's forests are considered overcrowded.

Table 3.7-1. Project Area Stand Density Index

	55%-85% of Maximum SDI	Greater than 85% of Maximum SDI	Total Overcrowded
Percent of Project Area	20%	7%	27%

Notes: SDI = stand density index.
Tree density related mortality has been found to begin at 55% of maximum SDI, with peak mortality occurring at 85% of maximum (Sherlock 2007).
Analysis only includes dominant forest types (California Mixed Conifer, Ponderosa Pine, White Fir) which comprise roughly 80% of the project area.

With wildfire severity rising in most of the project area's forests, implementing management actions to enhance fire resistance is justified for long-term carbon sequestration (Stephens et al. 2009). Fuel treatments that prioritize reducing surface and ladder fuels and actively thinning the majority of small trees have been found to help decrease emissions from potential future wildfires and promote the development of large, fire-resistant trees that can better stabilize carbon stocks (Hurteau and Innes 2009). The project's fuel treatments align with these characteristics and promote long term carbon sustainability.

Type Conversion and Its Effect on Carbon Sequestration

Forest type conversion refers to the process where one type of forest ecosystem is transformed into a different type of ecosystem, often permanently. In conifer forest systems, high severity wildfire may cause type conversion to shrublands or grasslands (Steel et al. 2018, Chambers et al. 2016, Stevens-Rumann and Morgan 2019, Haffey 2014). The project area has been subject to an increase in stand clearing wildfire, or wildfires which result in large continuous patches of substantial mortality (ex. 2021 Dixie Fire, 2021 Caldor Fire, 2020 Creek Fire). Many conifer species rely on the presence of mature trees to produce seeds for regeneration. When a high-severity fire leads to extensive tree mortality, the local seed source is often eliminated or greatly reduced. This makes it difficult for conifer seedlings to establish and grow in the burned area. These impacts are expected to be exacerbated due to climate change. Researchers predict that the high rate of increasing average temperatures limits the ability of conifers to adapt their range and leaves them highly vulnerable to type conversion following high severity wildfires (Hill et al. 2023).

Type conversion of forest ecosystems results in substantial losses in carbon storage and sequestration. Forests in the Western United States store significantly more carbon compared to shrub and grasslands. Shifts from forestlands to shrublands or grasslands can result in large reductions in carbon storage (Kodero et al. 2024). In addition, the loss of existing carbon stored in forest biomass, the establishment of a new plant community composed of grasses and shrubs can alter the fire regime of the area. These species often burn more frequently and with higher intensity than conifer forests. This creates a feedback loop where recurrent high-severity fires perpetuate the new vegetation type and prevent the re-establishment of conifer forests (Haffey 2014). Therefore, ecosystems that have historically resembled atmospheric carbon sinks may become significant contributors to atmospheric carbon. Fuel treatments can positively impact carbon storage if they prevent changes to a site's carbon storage ability (e.g., prevent soil loss to erosion after a high-severity fire, or prevent type conversion to a vegetation type that stores less carbon) (Campbell et al. 2012).

3.7.1.5 Sources of Greenhouse Gas Emissions

Global Inventory

Anthropogenic GHG emissions worldwide in 2020 (the most recent year for which data is available) totaled approximately 49,800 million metric tons (MMT) of CO_2e, excluding land use change and forestry (PBL 2022). The top six GHG emitters include China (28.7%), the United States (11.3%), the European Union (6.9%), India (7.1%), the Russian Federation (4.4%), and Japan (2.3%), which accounted for approximately 60% of the total global emissions, or approximately 30,270 MMT CO_2e (PBL 2022). Table 3.7-2 presents the top GHG-emissions-producing countries.

Table 3.7-2. Six Top GHG Producer Countries

Emitting Countries	2020 GHG Emissions (MMT CO_2e)[a,b]
China	14,300
United States	5,640
European Union	3,440
India	3,520
Russian Federation	2,210
Japan	1,160
Total	**30,270**

Source: PBL 2022.
Notes: MMT CO_2e = million metric tons of carbon dioxide equivalent.
a Column may not add due to rounding.
b GHG emissions do not include land use change and forestry-related GHG emissions.

National Inventory

Per the EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022, total United States GHG emissions were approximately 6,343 MMT CO2e in 2022 (EPA 2024d). Total U.S. emissions have decreased by 3.1 percent from 1990 to 2022, down from a high of 15.2 percent above 1990 levels in 2007. Emissions increased from 2021 to 2022 by 0.2 percent (14.4 MMT CO_2e). Net emissions (i.e., including sinks) were 5,489.3 MMT CO_2e in 2022. Overall, net emissions increased 1.3 percent from 2021 to 2022 and decreased 16.7 percent from 2005 levels. Between 2021 and 2022, the increase in total GHG emissions was driven largely by an increase in CO_2 emissions from fossil fuel combustion across most end-use sectors due in part to increased energy use from the continued rebound of economic activity after the height of the COVID-19 pandemic. The CO_2 emissions from fossil fuel combustion increased by 1.0 percent from 2021 to 2022 and were 1.1 percent below emissions in 1990. Carbon dioxide emissions from natural gas use increased by 5.2 percent (84.80 MMT CO_2e) from 2021, while CO_2 emissions from coal consumption decreased by 6.1 percent (58.6 MMT CO_2e.) from 2021 to 2022 (EPA 2024d).

State Inventory

According to California's 2000–2021 GHG emissions inventory (2023 edition), California emitted 381.3 MMT CO2e in 2021, including emissions resulting from out-of-state electrical generation (CARB 2023a). The sources of GHG emissions in California include transportation, industrial uses, electric power production from both in-state and out-of-state sources, commercial and residential uses, agriculture, high-GWP substances, and recycling and waste. The California GHG emission source categories and their relative contributions in 2021 are presented in Table 3.7-3.

Table 3.7-3. Greenhouse Gas Emissions Sources in California

Source Category	Annual GHG Emissions ($MMT\ CO_2e$)	Percent of Total
Transportation	145.66	38.2%
Industrial uses	73.97	19.4%
Electricity generation[a]	62.53	16.4%
Residential and commercial uses	38.89	10.2%
Agriculture and Forestry	30.89	8.1%
High GWP substances	21.35	5.6%
Recycling and waste	8.39	2.2%
Totals	**381.3**	**100%**

Source: CARB 2023a.
Notes: GHG = greenhouse gas; GWP = global warming potential; MMT CO_2e = million metric tons of carbon dioxide equivalent.
Emissions reflect 2021 California GHG inventory.
Totals may not sum due to rounding.
[a] Includes emissions associated with imported electricity, which account for 18.46 MMT CO_2e.

Per capita GHG emissions in California have dropped from a 2001 peak of 13.8 MT per person to 9.7 MT per person in 2021, a 30% decrease. In 2014, statewide GHG emissions dropped below the 2020 GHG Limit of 431 MMT CO_2e and have remained below the Limit since that time (CARB 2023a).

3.7.1.6 Potential Effects of Climate Change

Globally, climate change has the potential to affect numerous environmental resources through uncertain impacts related to future air temperatures and precipitation patterns. The 2014 IPCC Synthesis Report (IPCC 2014) indicated that warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. Signs that global climate change has occurred include warming of the atmosphere and ocean, diminished amounts of snow and ice, rising sea levels, and ocean acidification (IPCC 2014).

In California, climate change impacts have the potential to affect sea-level rise, agriculture, snowpack and water supply, forestry, wildfire risk, public health, frequency of severe weather events, and electricity demand and supply. The primary effect of global climate change has been a rise in average global tropospheric temperature. Global surface temperature in the first two decades of the twenty-first century (2001–2020) was 0.99 [0.84 to 1.10]°C higher than 1850–1900 (IPCC 2023). Global surface temperature has increased faster since 1970 than in any other 50-year period over at least the last 2000 years (IPCC 2023). Scientific modeling predicts that continued emissions of GHGs at or above current rates would induce more extreme climate changes during the twenty-first century than were observed during the twentieth century. Human activities, principally through emissions of GHGs, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020 (IPCC 2023).

Although climate change is driven by global atmospheric conditions, climate change impacts are felt locally. A scientific consensus confirms that climate change is already affecting California. OEHHA identified various indicators of climate change in California, which are scientifically based measurements that track trends in various aspects of climate change. Many indicators reveal discernible evidence that climate change is occurring in

California and is having significant, measurable impacts in the state. Changes in the state's climate have been observed including an increase in annual average air temperature, more frequent extreme heat events, more extreme drought, a decline in winter chill, an increase in cooling degree days and a decrease in heating degree days, and an increase in variability of statewide precipitation (OEHHA 2022).

Warming temperatures and changing precipitation patterns have altered California's physical systems—the ocean, lakes, rivers and snowpack—upon which the state depends. Winter snowpack and spring snowmelt runoff from the Sierra Nevada and southern Cascade Mountains provide approximately one-third of the state's annual water supply. Impacts of climate on physical systems have been observed such as high variability of snow-water content (i.e., amount of water stored in snowpack), decrease in spring snowmelt runoff, glacier change (loss in area), rise in sea levels, increase in average lake water temperature and coastal ocean temperature, and a decrease in dissolved oxygen in coastal waters (OEHHA 2022).

Impacts of climate change on biological systems, including humans, wildlife, and vegetation, have also been observed including climate change impacts on terrestrial, marine, and freshwater ecosystems. As with global observations, species responses include those consistent with warming: elevational or latitudinal shifts in range, changes in the timing of key plant and animal life cycle events, and changes in the abundance of species and in community composition. Humans are better able to adapt to a changing climate than plants and animals in natural ecosystems. Nevertheless, climate change poses a threat to public health as warming temperatures and changes in precipitation can affect vector-borne pathogen transmission and disease patterns in California as well as the variability of heat-related deaths and illnesses. In addition, since 1950, the area burned by wildfires each year has been increasing.

The California Natural Resources Agency (CNRA) has released four California Climate Change Assessments (in 2006, 2009, 2012, and 2018), which have addressed the following: acceleration of warming across the state, more intense and frequent heat waves, greater riverine flows, accelerating sea level rise, more intense and frequent drought, more severe and frequent wildfires, more severe storms and extreme weather events, shrinking snowpack and less overall precipitation, and ocean acidification, hypoxia, and warming. Key projected changes for the statewide climate include the following (CNRA 2018):

- By 2100, the average annual maximum daily temperature is projected to increase by 5.6°F to 8.8°F depending on GHG emissions reductions. The greatest increase is seen with business-as-usual emissions levels.
- By 2100, water supply from snowpack is projected to decline by two-thirds. Water management practices in California face growing challenges from continued climate change and extreme weather. Promising technical adaptation options to reduce these negative water supply impacts include the use of probabilistic hydrological forecasts, groundwater storage, and better measurements of the snowpack.
- By 2050, under certain precipitation conditions, a study estimates California's agricultural production could face climate-related water shortages of up to 16% in certain regions. Hotter conditions due to climate change could lead to loss of soil moisture. Models show that increasing soil organic matter increases the soil water holding capacity, demonstrating one adaptation option.
- By 2100, if GHG emissions continue to rise, one study found that the frequency of extreme wildfires would increase, and the average area burned statewide would increase by 77%. In the areas that have the highest fire risk, wildfire insurance is estimated to see costs rise by 18% by 2055. A Fourth Assessment review of forest health literature provides further scientific backing to the State's Forest Carbon Plan to increase forest restoration and treatment, such as prescribed fire, to an average of 35,000 acres a year by 2020.

Climate change has led to the exacerbation of wildfire conditions in two major ways: earlier spring snowmelt and reduced winter precipitation has resulted in a longer wildfire season, and cycles of heavy precipitation followed by drought conditions increase fuel loading in wet years and reduce moisture-content during droughts. One study estimates that the western U.S. has experienced a doubling of area burned by wildfire due to anthropogenic climate change (Abatzoglou and Williams 2016). These conditions have resulted in the largest, most destructive, and deadliest wildfires on record in California history. Nine of the state's 10 deadliest wildfires have occurred since 2003. The project would substantially increase the pace and scale of vegetation treatments in response to increased wildfire risk.

Existing Emissions and Effects of Wildfires

In recent years, the increasing area burned by wildfires has coincided with increasing air temperatures (OEHHA 2018). Climate change has led to the exacerbation of wildfire conditions by creating warmer and drier conditions that lead to longer and more active fire seasons, as well as reduced snowpack causing decreased water availability during hot summer conditions (EPA 2024e). Furthermore, forests store large amounts of carbon, and when they burn, they release carbon dioxide and black carbon into the atmosphere, which in turn contributes to climate change. These conditions have resulted in the largest, most destructive, and deadliest wildfires on record in California history within the last decade. The project would increase the pace and scale of vegetation treatments in response to increased wildfire risk.

According to the CARB inventory, California's natural and working lands lost approximately 140 MMT of carbon between 2001 and 2014. This is equivalent to a loss of 510 MMT of CO_2 that was previously sequestered in California's lands as part of the terrestrial carbon cycle. The carbon dioxide emissions from wildfires were not counted against California's emissions targets because they are not considered by CARB to be an anthropogenic source. But if they were, the wildfires would be setting California back in meeting its climate goals, with the carbon emissions from California's 2020 fire season alone also making up 49% of the state's 2030 emissions target. California's wildfire carbon dioxide emissions from 2020 were approximately two times higher than California's total greenhouse gas emission reductions since 2003 (Jerrett, Jina, & Marlier 2022). In addition, wildfires were the second most important source of emissions in 2020 behind the transportation sector.

As California seeks to address changing wildfire regimes, the severity of carbon losses from wildfires will have implications for ecosystems, biodiversity, the economy, public health, and more (CARB 2024b).

As shown in Table 3.7-4, annual CO_2e emissions are correlated with acres burned from wildfire. In 2020, wildfires in California contributed approximately 107 MMT of CO_2e.

Table 3.7-4. Annual GHG Emissions and Acres Burned from Wildfire, 2000-2022

Year	MMT CO_2e	Acres Burned (million)*
2000	5.4	0.2
2001	6.7	0.2
2002	13.5	0.5
2003	19.7	1.0
2004	5.7	0.3
2005	2.6	0.2
2006	13.5	0.7
2007	20	1.0

Table 3.7-4. Annual GHG Emissions and Acres Burned from Wildfire, 2000-2022

Year	MMT CO_2e	Acres Burned (million)*
2008	42.8	1.4
2009	9.2	0.4
2010	1.9	0.1
2011	3.1	0.2
2012	11.4	0.7
2013	14.7	0.6
2014	17.2	0.5
2015	19.2	0.8
2016	10.5	0.5
2017	31.3	1.3
2018	39.1	1.6
2019	4.8	0.3
2020	106.7	4.1
2021	85.1	2.4
2022	8.9	0.3

Source: CARB 2023b.
Notes: MMT CO_2e = million metric tons of carbon dioxide equivalent
* These acreages do not include areas where wildland vegetation data for model inputs are not available, e.g., developed areas and croplands

3.7.2 Regulatory Setting

3.7.2.1 International

In 1988, the United Nations and the World Meteorological Organization established the IPCC to assess the scientific, technical, and socioeconomic information relevant to understanding the scientific basis for human-induced climate change, its potential impacts, and options for adaptation and mitigation. The most recent reports of the IPCC have emphasized the scientific consensus that real and measurable changes to the climate are occurring, that they are caused by human activity, and that significant adverse impacts on the environment, the economy, and human health and welfare are unavoidable.

On March 21, 1994, the United States joined a number of countries around the world in signing the United Nations Framework Convention on Climate Change. Under the Convention, governments agreed to gather and share information on GHG emissions, national policies, and best practices; launch national strategies for addressing GHG emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and cooperate in preparing for adaptation to the impacts of global climate change.

3.7.2.2 Federal

U.S. Forest Service

The United States Forest Service (USFS), established in 1905, operates as a federal agency within the U.S. Department of Agriculture. Its primary responsibility lies in managing national forests and grasslands across the country. The USFS plays a critical role in the stewardship of natural resources, particularly forested lands that significantly contribute to carbon sequestration and GHG mitigation. The agency's multifaceted mission encompasses maintaining ecosystem health, promoting sustainable land use practices, and carefully balancing various forest uses, including recreation, timber production, and wildlife habitat conservation. Title 16 U.S. Code Chapter 36 covers a wide range of law governing how the Forest Service and other agencies manage public lands.

In 2020, California Governor Gavin Newsom and the U.S. Forest Service signed a Joint Agreement for Shared Stewardship of California's Forests and Rangelands. The agreement is grounded in science-driven management and includes commitments to maintain and restore healthy forests and rangelands that reduce public safety risks, protect natural and built infrastructure, and enhance ecological habitat and biological diversity. Specifically, through this agreement, California and the U.S. Forest Service commit to execute the following activities together: treat one million acres per year; develop a joint plan; use sustainable vegetation treatments, expand forest management and associated infrastructure; promote ecological co-benefits; develop markets for wood products and recycle forest byproducts (including biomass energy); and fire-adapted communities.

Massachusetts v. U.S. Environmental Protection Agency

In *Massachusetts v. EPA* (April 2007), the U.S. Supreme Court ruled that CO_2 was a pollutant and directed the EPA administrator to determine whether GHG emissions from new motor vehicles cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In making these decisions, the EPA administrator is required to follow the language of Section 202(a) of the Clean Air Act. On December 7, 2009, the administrator signed a final rule with two distinct findings regarding GHGs under Section 202(a) of the Clean Air Act:

- **Endangerment Finding:** The elevated concentrations of GHGs—CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations. This is referred to as the "endangerment finding."
- **Cause or Contribute Finding**: The combined emissions of GHGs—CO_2, CH_4, N_2O, and hydrofluorocarbons—from new motor vehicles and new motor vehicle engines contribute to the GHG air pollution that endangers public health and welfare. This is referred to as the "cause or contribute finding."

These two findings were necessary to establish the foundation for regulation of GHGs from new motor vehicles as air pollutants under the Clean Air Act.

Energy Independence and Security Act

The Energy Independence and Security Act of 2007 (Public Law 110-140), among other key measures, would do the following in aiding the reduction of national GHG emissions:

- Increase the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard requiring fuel producers to use at least 36 billion gallons of biofuel in 2022.
- Set a target of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020, and direct National Highway Traffic Safety Administration (NHTSA) to establish a fuel economy program for medium- and heavy-duty trucks and create a separate fuel economy standard for work trucks.
- Prescribe or revise standards affecting regional efficiency for heating and cooling products and procedures for new or amended standards, energy conservation, energy-efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances.

Federal Vehicle Standards

In 2007, in response to the *Massachusetts v. EPA* decision, the Bush Administration issued Executive Order (EO) 13432 directing the EPA, the Department of Transportation, and the Department of Energy to establish regulations that reduce GHG emissions from motor vehicles, non-road vehicles, and non-road engines by 2008. In 2009, the NHTSA issued a final rule regulating fuel efficiency and GHG emissions from cars and light-duty trucks for model year 2011; and, in 2010, the EPA and the NHTSA issued a final rule regulating cars and light-duty trucks for model years 2012 through 2016 (75 FR 25324–25728).

In 2010, President Obama issued a memorandum directing the Department of Transportation, the Department of Energy, the EPA, and the NHTSA to establish additional standards regarding fuel efficiency and GHG reduction, clean fuels, and advanced vehicle infrastructure. In response to this directive, the EPA and the NHTSA proposed stringent, coordinated federal GHG and fuel economy standards for model years 2017 through 2025 light-duty vehicles. The proposed standards projected to achieve 163 grams per mile of CO_2 in model year 2025, on an average industry fleet-wide basis, which is equivalent to 54.5 miles per gallon if this level were achieved solely through fuel efficiency. The final rule was adopted in 2012 for model years 2017 through 2021 (77 FR 62624–63200). On January 12, 2017, the EPA finalized its decision to maintain the current GHG emissions standards for model years 2022–2025 cars and light trucks.

In 2011, in addition to the regulations applicable to cars and light-duty trucks described above, the EPA and the NHTSA announced fuel economy and GHG standards for medium- and heavy-duty trucks for model years 2014 through 2018. The standards for CO_2 emissions and fuel consumption are tailored to three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. According to the EPA, this regulatory program will reduce GHG emissions and fuel consumption for the affected vehicles by 6% to 23% over the 2010 baselines (76 FR 57106–57513).

In August 2016, the EPA and the NHTSA announced the adoption of the phase two program related to the fuel economy and GHG standards for medium- and heavy-duty trucks. The phase two program will apply to vehicles with model year 2018 through 2027 for certain trailers, and model years 2021 through 2027 for semi-trucks, large pickup trucks, vans, and all sizes of buses and work trucks. The final standards are expected to lower CO_2 emissions by approximately 1.1 billion MT and reduce oil consumption by up to 2 billion barrels over the lifetime of the vehicles sold under the program (EPA and NHTSA 2016).

On April 2, 2018, the EPA, under administrator Scott Pruitt, reconsidered the final determination for light-duty vehicles and withdrew its previous 2017 determination, stating that the current standards may be too stringent and therefore should be revised as appropriate (83 FR 16077–16087).

In August 2018, the EPA and the NHTSA proposed to amend certain fuel economy and GHG standards for passenger cars and light trucks and to establish new standards for model years 2021 through 2026. Compared to maintaining the post-2020 standards then in place, the 2018 proposal would increase U.S. fuel consumption by about half a million barrels per day (2% to 3% of total daily consumption, according to the Energy Information Administration) and impact the global climate by 3/1000th of 1°C by 2100 (EPA and NHTSA 2018).

In 2019, the EPA and the NHTSA published the Safer Affordable Fuel-Efficient Vehicles Rule Part One: One National Program (SAFE-1) (84 FR 51310), which revoked California's authority to set its own GHG emissions standards and set zero-emission vehicle (ZEV) mandates in California. In March 2020, Part Two was issued, which set CO_2

emissions standards and CAFE standards for passenger vehicles and light-duty trucks for model years 2021 through 2026.

In response to Executive Order 13990, on December 21, 2021, the NHTSA finalized the CAFE Preemption rule to withdraw its portions of the Part One Rule. The final rule concluded that the Part One Rule overstepped the agency's legal authority and established overly broad prohibitions that did not account for a variety of important state and local interests.

In March 2022, the NHTSA established new fuel economy standards that would require an industry-wide fleet average of approximately 49 miles per gallon for passenger cars and light trucks in model year 2026, by increasing fuel efficiency by 8% annually for model years 2024 and 2025, and 10% annually for model year 2026.

The Inflation Reduction Act of 2022

The Inflation Reduction Act was signed into law by President Biden in August 2022. The Act includes specific investment in energy and climate reform and is projected to reduce GHG emissions within the United States by 40% as compared to 2005 levels by 2030. The Act allocates funds to boost renewable energy infrastructure (e.g., solar panels and wind turbines), includes tax credits for the purchase of electric vehicles, and includes measures that will make homes more energy efficient.

The Inflation Reduction Act authorized the EPA to implement the Greenhouse Gas Reduction Fund (GGRF) program, which is a historic, $27 billion investment to mobilize financing and private capital to combat the climate crisis and ensure American economic competitiveness. The GGRF will be designed to achieve the following program objectives: reduce GHG emissions and other air pollutants; deliver the benefits of GHG- and air-pollution-reducing projects to American communities, particularly low-income and disadvantaged communities; and mobilize financing and private capital to stimulate additional deployment of GHG and air pollution reducing projects (EPA 2024f).

The Inflation Reduction Act confirms that reduction of GHGs is a core goal of the Clean Air Act and that the funding provided should allow the EPA to increase the scope of its Clean Air Act rulemakings. The Act also confirms applicability of the Inflation Reduction Act to GHGs in three specific areas: (1) California's ability to regulate GHG emissions from vehicles; (2) the EPA's authority to regulate methane emissions from oil and gas facilities; and (3) the EPA's authority to regulate GHG emissions from power plants.

3.7.2.3 State

The Statewide GHG emissions regulatory framework is summarized in this subsection by category: State climate change targets, building energy, renewable energy and energy procurement, mobile sources, water, solid waste, and other state actions. The following text describes Executive Orders (EOs), Assembly Bills (ABs), Senate Bills (SBs), and other plans and policies that would directly or indirectly reduce GHG emissions and/or address climate change issues.

State Climate Change Targets

The State has taken a number of actions to address climate change. These actions are summarized below, and include EOs, legislation, and CARB plans and requirements.

Executive Order S-3-05

Executive Order S-3-05 (June 2005) identified GHG emissions-reduction targets and laid out responsibilities among the State agencies for implementing the EO and for reporting on progress toward the targets. This EO identified the following targets:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80% below 1990 levels.

EO S-3-05 also directed the California Environmental Protection Agency to report biannually on progress made toward meeting the GHG targets and the impacts to California due to global warming, including impacts to water supply, public health, agriculture, the coastline, and forestry.

Assembly Bill 32

In furtherance of the goals identified in EO S-3-05, the Legislature enacted AB 32, the California Global Warming Solutions Act of 2006 (California Health and Safety Code Sections 38500–38599). AB 32 provided initial direction on creating a comprehensive multiyear program to limit California's GHG emissions at 1990 levels by 2020, and initiate the transformations required to achieve the State's long-range climate objectives.

Executive Order B-30-15

EO B-30-15 (April 2015) identified an interim GHG-reduction target in support of targets previously identified under S-3-05 and AB 32. EO B-30-15 set an interim target goal of reducing GHG emissions to 40% below 1990 levels by 2030 to keep California on its trajectory toward meeting or exceeding the long-term goal of reducing GHG emissions to 80% below 1990 levels by 2050, as set forth in S-3-05. To facilitate achieving this goal, EO B3015 called for CARB to update the Climate Change Scoping Plan (Scoping Plan) to express the 2030 target in terms of millions of metric tons (MMT) CO_2e. The EO also called for state agencies to continue to develop and implement GHG emission-reduction programs in support of the reduction targets.

Senate Bill 32 and Assembly Bill 197

SB 32 and AB 197 (enacted in 2016) are companion bills. SB 32 codified the 2030 emissions-reduction goal of EO B-30-15 by requiring CARB to ensure that statewide GHG emissions are reduced to 40% below 1990 levels by 2030. AB 197 established the Joint Legislative Committee on Climate Change Policies, consisting of at least three members of the Senate and three members of the Assembly, to provide ongoing oversight over implementation of the state's climate policies. AB 197 also added two members of the Legislature to the Board as nonvoting members; requires CARB to make available and update (at least annually via its website) emissions data for GHGs, criteria air pollutants, and TACs from reporting facilities; and requires CARB to identify specific information for GHG emissions-reduction measures when updating the Scoping Plan.

Executive Order B-55-18

EO B-55-18 (September 2018) identified a policy for the state to achieve carbon neutrality as soon as possible (no later than 2045) and achieve and maintain net negative emissions thereafter. The goal is in addition to the existing statewide targets of reducing the state's GHG emissions. CARB will work with relevant state agencies to ensure that future Scoping Plans identify and recommend measures to achieve the carbon neutrality goal.

Assembly Bill 1279

The Legislature enacted AB 1279, the California Climate Crisis Act, in September 2022. The bill declares the policy of the state to achieve net zero GHG emissions as soon as possible, but no later than 2045, and achieve and maintain net negative GHG emissions thereafter. Additionally, the bill requires that by 2045, statewide anthropogenic GHG emissions be reduced to at least 85% below 1990 levels.

California Air Resources Board's Climate Change Scoping Plan

One specific requirement of AB 32 is for CARB to prepare a scoping plan to help achieve the maximum technologically feasible and cost-effective GHG emission reductions by 2020 (California Health and Safety Code Section 38561[a]), and to update the plan at least once every 5 years. In 2008, CARB approved the first scoping plan: The Climate Change Proposed Scoping Plan: A Framework for Change (Scoping Plan). The Scoping Plan included a mix of recommended strategies that combined direct regulations, market-based approaches, voluntary measures, policies, and other emission-reduction programs calculated to meet the 2020 statewide GHG emission limit and initiate the transformations needed to achieve the state's long-range climate objectives.

In 2014, CARB approved the first update to the Scoping Plan. The First Update to the Climate Change Scoping Plan: Building on the Framework (2014 Scoping Plan Update) defined the state's GHG emission reduction priorities for the next 5 years and laid the groundwork to start the transition to the post-2020 goals set forth in EO S-3-05 and EO B-16-2012 (CARB 2014). The 2014 Scoping Plan Update concluded that California was on track to meet the 2020 target, but recommended that a 2030 mid-term GHG reduction target be established to ensure a continuum of action to reduce emissions. The 2014 Scoping Plan Update recommended a mix of technologies in key economic sectors to reduce emissions through 2050 including energy demand reduction through efficiency and activity changes; large-scale electrification of on-road vehicles, buildings, and industrial machinery; decarbonizing electricity and fuel supplies; and the rapid market penetration of efficient and clean energy technologies.

In December 2017, CARB released the 2017 Climate Change Scoping Plan Update (2017 Scoping Plan Update) for public review and comment (CARB 2017a). The 2017 Scoping Plan Update builds on the successful framework established in the initial Scoping Plan and 2014 Scoping Plan Update, while identifying new technologically feasible and cost-effective strategies that will serve as the framework to achieve the 2030 GHG target and define the state's climate change priorities to 2030 and beyond. The strategies' known commitments include implementing renewable energy and energy efficiency (including the mandates of SB 350), increased stringency of the Low Carbon Fuel Standard, measures identified in the Mobile Source and Freight Strategies, measures identified in the proposed Short-Lived Climate Pollutant (SLCP) Plan, and increased stringency of SB 375 targets. To fill the gap in additional reductions needed to achieve the 2030 target, the 2017 Scoping Plan Update recommends continuing the Cap-and-Trade Program and a measure to reduce GHGs from refineries by 20%.

CARB adopted the 2022 Scoping Plan Update in December 2022. The 2022 CARB Scoping Plan Update outlines the state's plan to reach carbon neutrality by 2045 or earlier, while also assessing the progress the state is making toward achieving GHG reduction goals by 2030. Per the Legislative Analyst's Office, the 2022 CARB Scoping Plan identifies a more aggressive 2030 GHG goal. As it relates to the 2030 goal, perhaps the most significant change in the 2022 plan (as compared to previous Scoping Plans) is that it identifies a new GHG target of 48% below the 1990 level, compared to the current statutory goal of 40% below. Current law requires the state to reduce GHG emissions by at least 40% below the 1990 level by 2030 but does not specify an alternative goal. According to CARB, a focus on the lower target is needed to put the state on a path to meeting the newly established 2045 goal, consistent with the overall path to 2045 carbon neutrality. The carbon neutrality goal requires CARB to expand proposed actions from only the reduction of anthropogenic sources of GHG emissions to also include those that capture and store carbon (e.g., through natural and working lands, or mechanical technologies). The carbon reduction programs build on and accelerate those currently in place, including moving to zero-emission transportation; phasing out use of fossil gas use for heating homes and buildings; reducing chemical and refrigerants with high GWP; providing communities with sustainable options for walking, biking, and public transit; displacement of fossil-fuel fired electrical generation through use of renewable energy alternatives (e.g., solar arrays and wind turbines); and scaling up new options such as green hydrogen (CARB 2022).

The 2022 CARB Scoping Plan Update also emphasizes that there is no realistic path to carbon neutrality without carbon removal and sequestration, and to achieve the state's carbon neutrality goal, carbon reduction programs must be supplemented by strategies to remove and sequester carbon. Strategies for carbon removal and sequestration include carbon capture and storage from anthropogenic point sources, where CO_2 is captured as it leaves a facility's smokestack and is injected into geologic formations or used in industrial materials (e.g., concrete); and carbon dioxide removal from ambient air, through mechanical (e.g., direct air capture with sequestration) or nature-based (e.g., management of natural and working lands) applications.

The 2022 CARB Scoping Plan Update details "Local Actions" in Appendix D. The Appendix D Local Actions include recommendations to build momentum for local government actions that align with the State's climate goals, with a focus on local GHG reduction strategies (commonly referred to as climate action planning) and approval of new land use development projects, including through environmental review under CEQA. The recommendations provided in Appendix D are non-binding (*i.e.*, not regulatory) and should not be interpreted as a directive to local governments, but rather as evidence-based analytical tools to assist local governments with their role as essential partners in achieving California's climate goals.

Importantly, the 2022 Update emphasizes that there is no realistic path to reaching the 2045 goal of carbon neutrality without removing and sequestering carbon from the atmosphere. So, in addition to programs that aim to reduce GHG emissions, the Draft Plan proposes strategies to capture and store carbon, highlighting the importance of nature-based solutions through preservation and climate smart management of the state's natural and working lands (NWLs)[2]. Modeling conducted for the 2022 Scoping Plan shows that California's NWLs are projected to be a net source of emissions (i.e., releasing more CO_2 emissions than they store) through 2045, which is historically due to human activities, such as land use change, and natural disturbances, such as wildfire. Therefore, the ability of the state's NWLs to act as a net sink (i.e., sequester and store more atmospheric CO_2 than they release) to help support the state's carbon neutrality goals is dependent on climate smart land management.

2 It is important to note that the Third Update emphasizes that reliance on carbon sequestration in the state's NWLs will not be sufficient to address residual GHG emissions, and achieving carbon neutrality will require research, development, and deployment of additional methods to capture atmospheric GHG emissions (e.g., mechanical direct air capture).

Executive Order B-18-12

EO B-18-12 (April 2012) directed state agencies, departments, and other entities under the Governor's executive authority to take action to reduce entity-wide GHG emissions by at least 10% by 2015 and 20% by 2020, as measured against a 2010 baseline. EO B-18-12 also identified goals for existing state buildings for reducing grid-based energy purchases and water use.

Senate Bill 605 and Senate Bill 1383

SB 605 (2014) requires CARB to complete a comprehensive strategy to reduce emissions of SLCPs in the state (California Health and Safety Code Section 39730) and SB 1383 (2016) requires CARB to approve and implement that strategy by January 1, 2018 (California Public Resources Code Sections 42652–43654). SB 1383 also establishes specific targets for the reduction of SLCPs (40% below 2013 levels by 2030 for CH_4 and HFCs, and 50% below 2013 levels by 2030 for anthropogenic black carbon) and provides direction for reductions from dairy and livestock operations and landfills. Accordingly, and as mentioned above, CARB adopted its SLCP Reduction Strategy in March 2017 (CARB 2017b). The SLCP Reduction Strategy establishes a framework for the statewide reduction of emissions of black carbon, methane, and fluorinated gases (CARB 2017b).

Executive Order N-82-20

EO N-82-20 (October 2020) directs state agencies to deploy nature-based strategies to remove carbon from the atmosphere and store it in the state's natural and working lands. The order sets a goal to conserve 30% of the state's land and coastal waters by 2030. To implement EO N-82-20, the CNRA developed the *Natural and Working Lands Climate Smart Strategy*, which defines the natural and working landscapes, and identifies land management actions that will help achieve carbon neutrality in alignment with EO B-55-18 and the *Draft 2022 Scoping Plan* (CNRA 2022).

Assembly Bill 1757

AB 1757 (September 2022) requires the CNRA to determine a range of targets for natural carbon sequestration, and for nature-based climate solutions that reduce GHG emissions for future years 2030, 2038, and 2045. These targets are to be determined by no later than January 1, 2024, and are established to support the state's goals to achieve carbon neutrality and foster climate adaptation and resilience.

Building Energy

California Code of Regulations, Title 24, Part 6

The California Building Standards Code was established in 1978 and serves to enhance and regulate California's building standards. While not initially promulgated to reduce GHG emissions, Part 6 of Title 24 specifically established Building Energy Efficiency Standards that are designed to ensure that new and existing buildings in California achieve energy efficiency and preserve outdoor and indoor environmental quality. These energy efficiency standards are reviewed every 3 years by the Building Standards Commission and the California Energy Commission (CEC) and revised if necessary (California Public Resources Code Section 25402[b][1]). The regulations receive input from members of industry, as well as the public, to "reduce the wasteful, uneconomic, inefficient, or unnecessary consumption of energy" (California Public Resources Code Section 25402). These regulations are carefully scrutinized and analyzed for technological and economic feasibility (California Public Resources Code

Section 25402[d]) and cost effectiveness (California Public Resources Code Section 25402[b][2–3]). As a result, these standards save energy, increase electricity supply reliability, increase indoor comfort, avoid the need to construct new power plants, and help preserve the environment.

The current Title 24, Part 6 standards, referred to as the 2022 Title 24 Building Energy Efficiency Standards, became effective on January 1, 2023. The 2022 Energy Code focuses on four key areas in newly constructed homes and businesses quality (CEC 2021):

- Encouraging electric heat pump technology for space and water heating, which consumes less energy and produces fewer emissions than gas-powered units.
- Establishing electric-ready requirements for single-family homes to position owners to use cleaner electric heating, cooking, and electric vehicle (EV) charging options whenever they choose to adopt those technologies.
- Expanding solar photovoltaic (PV) system and battery storage standards to make clean energy available on site and complement the state's progress toward a 100% clean electricity grid.
- Strengthening ventilation standards to improve indoor air quality.

California Code of Regulations, Title 24, Part 11

In addition to CEC's efforts, in 2008, the California Building Standards Commission adopted the nation's first green building standards. The California Green Building Standards Code (Part 11 of Title 24), which is commonly referred to as California's Green Building Standards (CALGreen), establishes minimum mandatory standards and voluntary standards pertaining to the planning and design of sustainable site development, energy efficiency (in excess of the California Energy Code requirements), water conservation, material conservation, and interior air quality. The CALGreen standards took effect in January 2011 and instituted mandatory minimum environmental performance standards for all ground-up new construction of commercial, low-rise residential and state-owned buildings and schools and hospitals. The 2022 CALGreen standards are the current applicable standards. For nonresidential projects, some of the key mandatory CALGreen 2022 standards involve requirements related to bicycle parking, designated parking for clean air vehicles, EV charging stations for passenger vehicles, medium heavy duty and heavy duty trucks , shade trees, water conserving plumbing fixtures and fittings, outdoor potable water use in landscaped areas, recycled water supply systems, construction waste management, excavated soil and land clearing debris, and commissioning (24 CCR, Part 11).

California Code of Regulations, Title 20

Title 20 of the California Code of Regulations requires manufacturers of appliances to meet state and federal standards for energy and water efficiency (20 CCR 1401–1410). CEC certifies an appliance based on a manufacturer's demonstration that the appliance meets the standards. New appliances regulated under Title 20 include refrigerators, refrigerator-freezers, and freezers; room air conditioners and room air-conditioning heat pumps; central air conditioners; spot air conditioners; vented gas space heaters; gas pool heaters; plumbing fittings and plumbing fixtures; fluorescent lamp ballasts; lamps; emergency lighting; traffic signal modules; dishwaters; clothes washers and dryers; cooking products; electric motors; low voltage dry-type distribution transformers; power supplies; televisions and consumer audio and video equipment; and battery charger systems. Title 20 presents protocols for testing each type of appliance covered under the regulations and appliances must meet the standards for energy performance, energy design, water performance, and water design. Title 20 contains three types of standards for appliances: federal and state standards for federally regulated appliances, state standards for federally regulated appliances, and state standards for non-federally regulated appliances.

Senate Bill 1

SB 1 (2006) established a $3 billion rebate program to support the goal of the state to install rooftop solar energy systems with a generation capacity of 3,000 megawatts through 2016. SB 1 added sections to the California Public Resources Code, including Chapter 8.8 (California Solar Initiative), that require building projects applying for ratepayer-funded incentives for photovoltaic systems to meet minimum energy-efficiency levels and performance requirements (California Public Resources Code Sections 25780–25784). Section 25780 established that it is a goal of the state to establish a self-sufficient solar industry. The goals included establishing solar energy systems as a viable mainstream option for both homes and businesses within 10 years of adoption and placing solar energy systems on 50% of new homes within 13 years of adoption. SB 1, also termed “Go Solar California,” was previously titled “Million Solar Roofs.”

Assembly Bill 1470

This bill established the Solar Water Heating and Efficiency Act of 2007 (California Public Utilities Code Sections 2851–2869). The bill makes findings and declarations of the Legislature relating to the promotion of solar water heating systems and other technologies that reduce natural gas demand.

Assembly Bill 1109

Enacted in 2007, AB 1109 required CEC to adopt minimum energy efficiency standards for general-purpose lighting to reduce electricity consumption by 50% for indoor residential lighting and by 25% for indoor commercial lighting (California Public Resources Code Section 25402.5.4).

Renewable Energy and Energy Procurement

Senate Bill 1078, Senate Bill 1368, Executive Order S-14-08, Executive Order S-21-09 and Senate Bill X1-2, and Senate Bill 1020

SB 1078 (2002) (California Public Utilities Code Section 399.11 et seq.) established the Renewables Portfolio Standard (RPS) program, which required an annual increase in renewable generation by the utilities equivalent to at least 1% of sales, with an aggregate goal of 20% by 2017. This goal was subsequently accelerated, requiring utilities to obtain 20% of their power from renewable sources by 2010 (see SB 107, EO S-14-08, and EO S-21-09).

SB 1368 (2006), required CEC to develop and adopt regulations for GHG emission performance standards for the long-term procurement of electricity by local publicly owned utilities (California Public Utilities Code Section 8340–8341). These standards must be consistent with the standards adopted by the California Public Utilities Commission (CPUC).

EO S-14-08 (2008) focused on the contribution of renewable energy sources to meet the electrical needs of California while reducing the GHG emissions from the electrical sector. This EO required that all retail suppliers of electricity in California serve 33% of their load with renewable energy by 2020. Furthermore, the EO directed state agencies to take appropriate actions to facilitate reaching this target. CNRA, in collaboration with CEC and the California Department of Fish and Wildlife, was directed to lead this effort.

EO S-21-09 (2009) directed CARB to adopt a regulation consistent with the goal of EO S-14-08 by July 31, 2010. CARB was further directed to work with CPUC and CEC to ensure that the regulation builds upon the RPS program and was applicable to investor-owned utilities, publicly owned utilities, direct access providers, and community choice providers. Under this order, CARB was to give the highest priority to those renewable resources that provide the greatest environmental benefits with the least environmental costs and impacts on public health, and those that can be developed the most quickly in support of reliable, efficient, cost-effective electricity system operations. On September 23, 2010, CARB initially approved regulations to implement a Renewable Electricity Standard; however, this regulation was not finalized because of subsequent legislation (SB X1-2) signed by Governor Brown in April 2011.

SB X1-2 (April 2011) expanded RPS by establishing a renewable energy target of 20% of the total electricity sold to retail customers in California per year by December 31, 2013, and 33% by December 31, 2020, and in subsequent years. Under the bill, a renewable electrical generation facility is one that uses biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation (30 megawatts or less), digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current, and that meets other specified requirements with respect to its location. SB X1-2 applies to all electricity retailers in the state, including publicly owned utilities, investor-owned utilities, electricity service providers, and community choice aggregators. All these entities must meet the renewable energy goals listed above.

SB 350 (2015) further expanded the RPS program by establishing a goal of 50% of the total electricity sold to retail customers in California per year by December 31, 2030. In addition, SB 350 included the goal to double the energy efficiency savings in electricity and natural gas final end uses (such as heating, cooling, lighting, or class of energy uses on which an energy-efficiency program is focused) of retail customers through energy conservation and efficiency. The bill also requires CPUC, in consultation with CEC, to establish efficiency targets for electrical and gas corporations consistent with this goal.

SB 100 (2018) increased the standards set forth in SB 350, establishing that 44% of the total electricity sold to retail customers in California per year by December 31, 2024; 52% by December 31, 2027; and 60% by December 31, 2030, be secured from qualifying renewable energy sources. SB 100 states that it is the policy of the state that eligible renewable energy resources and zero-carbon resources supply 100% of the retail sales of electricity to California. This bill requires that the achievement of 100% zero-carbon electricity resources do not increase the carbon emissions elsewhere in the western grid and that the achievement not be achieved through resource shuffling.

SB 1020 (September 2022) revises the standards from SB 100, requiring the following percentage of retail sales of electricity to California end-use customers to come from eligible renewable energy resources and zero-carbon resources: 90% by December 31, 2035; 95% by December 31, 2040; and 100% by December 31, 2045.

Mobile Sources

State Vehicle Standards (Assembly Bill 1493 and Executive Order B-16-12)

AB 1493 (July 2002) was enacted in response to the transportation sector accounting for a large share of California's CO_2 emissions. AB 1493 required CARB to set GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined by CARB to be vehicles that are primarily used for noncommercial personal transportation in the state. The bill required that CARB set GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. CARB adopted the standards in September 2004. EO B-16-12 (March 2012) required that state entities under the governor's direction and control support and facilitate the rapid commercialization of ZEVs. It ordered CARB, CEC, CPUC, and other relevant agencies to work with the Plug-In Electric Vehicle Collaborative and the California Fuel Cell Partnership to establish benchmarks to help achieve benchmark goals by 2015, 2020, and 2025. On a statewide basis, EO B-16-12 identified a target reduction of GHG emissions from the transportation sector equaling 80% less than 1990 levels by 2050. This directive did not apply to vehicles that have special performance requirements necessary for the protection of the public safety and welfare. As explained under the "Federal Vehicle Standards" description above, EPA and NHTSA approved the SAFE Vehicles Rule Part One and Two, which revoked California's authority to set its own GHG emissions standards and set ZEV mandates in California.

As also explained under Federal Regulations above, in March 2022, EPA reinstated California's authority under the Clean Air Act to implement its own GHG emission standards and ZEV sales mandate. EPA's action concludes its reconsideration of the 2019 SAFE-1 rule by finding that the actions taken under the previous administration as a part of SAFE-1 were decided in error and are now entirely rescinded.

Heavy-Duty Diesel

CARB adopted the final Heavy-Duty Truck and Bus Regulation on December 31, 2014, to reduce DPM, a major source of black carbon, and NO_x emissions from heavy-duty diesel vehicles (13 CCR, Part 2025). The rule requires that DPM filters be applied to newer heavier trucks and buses by January 1, 2012, with older vehicles required to comply by January 1, 2015. The rule will require nearly all diesel trucks and buses to be compliant with the 2010 model year engine requirement by January 1, 2023. CARB also adopted an Airborne Toxics Control Measure to limit idling of diesel-fueled commercial vehicles on December 12, 2013. This rule requires diesel-fueled vehicles with gross vehicle weights greater than 10,000 pounds to idle no more than 5 minutes at any location (13 CCR, Part 2485).

Executive Order S-1-07

EO S-1-07 (January 2007, implementing regulation adopted in April 2009) sets a declining Low Carbon Fuel Standard for GHG emissions measured in CO_2e grams per unit of fuel energy sold in California. The target of the Low Carbon Fuel Standard is to reduce the carbon intensity of California passenger vehicle fuels by at least 10% by 2020 (17 CCR 95480 et seq.). The carbon intensity measures the amount of GHG emissions in the lifecycle of a fuel—including extraction/feedstock production, processing, transportation, and final consumption—per unit of energy delivered.

Senate Bill 375

SB 375 (California Government Code Section 65080) addresses GHG emissions associated with the transportation sector through regional transportation and sustainability plans. SB 375 requires CARB to adopt regional GHG-reduction targets for the automobile and light-truck sector for 2020 and 2035, and to update those targets every 8 years. SB 375 requires the state's 18 regional metropolitan planning organizations (MPOs) to prepare a sustainable communities strategy (SCS) as part of their Regional Transportation Plan that will achieve the GHG-reduction targets set by CARB. If an MPO is unable to devise an SCS to achieve the GHG-reduction target, the MPO must prepare an alternative planning strategy demonstrating how the GHG-reduction target would be achieved through alternative development patterns, infrastructure, or additional transportation measures or policies.

An SCS does not (1) regulate the use of land; (2) supersede the land use authority of cities and counties; or (3) require that a city's or county's land use policies and regulations, including those in a general plan, be consistent with it (California Government Code Section 65080[b][2][K]). Nonetheless, SB 375 makes regional and local planning agencies responsible for developing those strategies as part of the federally required metropolitan transportation planning process and the state-mandated housing element process. Unlike AB 32, the California Global Warming Solutions Act of 2006, with its market mechanisms that generate cap-and-trade auction proceeds to the State for reinvestment, SB 375 does not provide any new financial resources to make the production and preservation of affordable homes near transit feasible (California Housing Partnership Corporation and TransForm 2014)

Advanced Clean Cars Program and Zero-Emissions Vehicle Program

The Advanced Clean Cars (ACC) I program (January 2012) is an emissions-control program for model years 2015 through 2025. The program combines the control of smog- and soot-causing pollutants and GHG emissions into a single coordinated package of regulations: the Low-Emission Vehicle (LEV) regulation for criteria air pollutant and GHG emissions and a technology forcing regulation for ZEVs that contributes to both types of emission reductions (CARB 2024c). The package includes elements to reduce smog-forming pollution, reduce GHG emissions, promote clean cars, and provide the fuels for clean cars. To improve air quality, CARB has implemented new emission standards to reduce smog-forming emissions beginning with 2015 model year vehicles. It is estimated that in 2025 cars will emit 75% less smog-forming pollution than the average new car sold in 2015. The ZEV program will act as the focused technology of the ACC I program by requiring manufacturers to produce increasing numbers of ZEVs and plug-in hybrid EVs in the 2018 to 2025 model years.

The ACC II program, which was adopted in August 2022, established the next set of LEV and ZEV requirements for model years after 2025 to contribute to meeting federal ambient air quality ozone standards and California’s carbon neutrality standards (CARB 2024c). The main objectives of ACC II are as follows:

- Maximize criteria and GHG emission reductions through increased stringency and real-world reductions.
- Accelerate the transition to ZEVs through both increased stringency of requirements and associated actions to support wide-scale adoption and use.

The ACC II rulemaking package also considers technological feasibility, environmental impacts, equity, economic impacts, and consumer impacts.

Executive Order N-79-20

EO N-79-20 (September 2020) requires CARB to develop regulations as follows: (1) Passenger vehicle and truck regulations requiring increasing volumes of new ZEVs sold in the state towards the target of 100% of in-state sales by 2035; (2) medium- and heavy-duty vehicle regulations requiring increasing volumes of new zero-emission trucks and buses sold and operated in the state towards the target of 100% of the fleet transitioning to ZEVs by 2045 everywhere feasible and for all drayage trucks to be zero emission by 2035; and (3) strategies, in coordination with other state agencies, the EPA, and local air districts, to achieve 100% zero emissions from off-road vehicles and equipment operations in the state by 2035. EO N-79-20 called for the development of a ZEV Market Development Strategy, which was released February 2021, to be updated every 3 years, that ensures coordination and implementation of the EO and outlines actions to support new and used ZEV markets. In addition, the EO specifies identification of near-term actions, and investment strategies, to improve clean transportation, sustainable freight, and transit options; and calls for development of strategies, recommendations, and actions by July 15, 2021, to manage and expedite the responsible closure and remediation of former oil extraction sites as the state transitions to a carbon-neutral economy.

Advanced Clean Trucks Regulation

The Advanced Clean Trucks (ACT) Regulation was also approved by CARB in 2020. The purpose of the ACT Regulation is to accelerate the market for ZEVs in the medium- and heavy-duty truck sector and to reduce air pollutant emissions generated from on-road mobile sources (CARB 2024d). The regulation has two components, (1) a manufacturer sales requirement and (2) a reporting requirement:

- **Zero-emission truck sales:** Manufacturers who certify Class 2b–8 chassis or complete vehicles with combustion engines will be required to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2035. By 2035, zero-emission truck/chassis sales would need to be 55% of Class 2b–3 truck sales, 75% of Class 4–8 straight truck sales, and 40% of truck tractor sales.
- **Company and fleet reporting:** Large employers including retailers, manufacturers, brokers, and others will be required to report information about shipments and shuttle services. Fleet owners with 50 or more trucks will be required to report about their existing fleet operations. This information will help identify future strategies to ensure that fleets purchase available zero-emission trucks and place them in service where suitable to meet their needs.

Commercial Harbor Craft Regulation

CARB adopted a Commercial Harbor Craft (CHC) Regulation in 2008 to reduce GHG emissions from vessels like tugboats and barges. These regulations required older engines to be replaced with cleaner ones. The 2022 amendments expanded the scope to more vessel types and mandated even cleaner technologies, aiming to improve public health by reducing harmful emissions. These changes began taking effect in early 2023, with ongoing assessments of low-emission technologies by a Technical Working Group until 2032.

Mobile Cargo Handling Equipment Regulation

CARB adopted a Mobile Cargo Handling Equipment (CHE) Regulation in 2005 to reduce GHG emissions at California’s ports and intermodal railyards. The regulation was fully implemented in 2017 and targets any motorized vehicle used to handle or perform activities at these ports and yards. Currently, CARB is in the process of implementing further regulation to reduce emissions with the implementation of zero-emission technologies.

Ocean-Going Vessel Fuel Regulation

CARB approved the Ocean-Going Vessel At-Berth Regulation in 2007 to reduce GHG emissions from container ships, passenger ships, and refrigerated-cargo ships at six California ports. CARB is also committed to develop new regulations to further reduce emissions and reduce the exposure to nearby port communities.

Water

Senate Bill X7-7

SB X7-7, or the Water Conservation Act of 2009, required that all water suppliers increase their water use efficiency with an overall goal of reducing per capita urban water use by 20% by December 31, 2020. Each urban water supplier was required to develop water use targets to meet this goal.

Executive Order B-29-15

In response to the ongoing drought in California, EO B-29-15 (April 2015) set a goal of achieving a statewide reduction in potable urban water usage of 25% relative to water use in 2013. The term of the EO extended through February 28, 2016, although many of the directives have become permanent water-efficiency standards and requirements. The EO includes specific directives that set strict limits on water usage in the state. In response to EO B-29-15, the California Department of Water Resources has modified and adopted a revised version of the Model Water Efficient Landscape Ordinance that, among other changes, significantly increases the requirements for landscape water use efficiency and broadens its applicability to include new development projects with smaller landscape areas.

Executive Order N-10-21

In response to a state of emergency due to severe drought conditions, EO N-10-21 (July 2021) called on all Californians to voluntarily reduce their water use by 15% from their 2020 levels. Actions suggested in EO N-10-21 include reducing landscape irrigation, running dishwashers and washing machines only when full, finding and fixing leaks, installing water-efficient showerheads, taking shorter showers, using a shut-off nozzle on hoses, and taking cars to commercial car washes that use recycled water.

Solid Waste

Assembly Bill 939, Assembly Bill 341, Assembly Bill 1826, and Senate Bill 1383

In 1989, AB 939, known as the Integrated Waste Management Act (California Public Resources Code Section 40000 et seq.), was passed because of the increase in waste stream and the decrease in landfill capacity. The statute established the California Integrated Waste Management Board (replaced in 2010 by the California Department of Resources Recycling and Recovery, or CalRecycle), which oversees a disposal reporting system. AB 939 mandated a reduction of waste being disposed where jurisdictions were required to meet diversion goals of all solid waste through source reduction, recycling, and composting activities of 25% by 1995 and 50% by the year 2000.

AB 341 (2011) amended the California Integrated Waste Management Act of 1989 to include a provision declaring that it is the policy goal of the state that not less than 75% of solid waste generated be source-reduced, recycled, or composted by the year 2020, and annually thereafter. In addition, AB 341 required CalRecycle to develop strategies to achieve the state's policy goal. CalRecycle has conducted multiple workshops and published documents that identify priority strategies that it believes would assist the state in reaching the 75% goal by 2020.

AB 1826 (Chapter 727, Statutes of 2014, effective 2016) requires businesses to recycle their organic waste (i.e., food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed in with food waste) depending on the amount of waste they generate per week. This law also requires local jurisdictions across the state to implement an organic waste recycling program to divert organic waste generated by businesses, including multifamily residential dwellings that consist of five or more units. The minimum threshold of organic waste generation by businesses decreases over time, which means an increasingly greater proportion of the commercial sector will be required to comply.

SB 1383 (2016) requires a 50% reduction in organic waste disposal from 2014 levels by 2020 and a 75% reduction by 2025—essentially requiring the diversion of up to 27 million tons of organic waste—to reduce GHG emissions.

SB 1383 also requires that not less than 20% of edible food that is currently disposed be recovered for human consumption by 2025.

Other State Actions

Senate Bill 97

SB 97 (2007) directed the Governor's Office of Planning and Research and CNRA to develop guidelines under CEQA for the mitigation of GHG emissions. CNRA adopted the CEQA Guidelines amendments in December 2009, which became effective in March 2010.

Under the amended CEQA Guidelines, a lead agency has the discretion to determine whether to use a quantitative or qualitative analysis or apply performance standards to determine the significance of GHG emissions resulting from a particular project (14 CCR 15064.4[a]). The CEQA Guidelines require a lead agency to consider the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions (14 CCR 15064.4[b]). The CEQA Guidelines also allow a lead agency to consider feasible means of mitigating the significant effects of GHG emissions, including reductions in emissions through the implementation of project features or off-site measures (14 CCR 15126.4[c]). The adopted amendments do not establish a GHG emission threshold, instead allowing a lead agency to develop, adopt, and apply its own thresholds of significance or those developed by other agencies or experts. CNRA also acknowledged that a lead agency could consider compliance with regulations or requirements implementing AB 32 in determining the significance of a project's GHG emissions (CNRA 2009).

With respect to GHG emissions, CEQA Guidelines Section 15064.4(a), as subsequently amended in 2018, states that lead agencies "shall make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate" GHG emissions. The CEQA Guidelines now note that an agency "shall have discretion to determine, in the context of a particular project, whether to: (1) Quantify greenhouse gas emissions resulting from a project; and/or (2) Rely on a qualitative analysis or performance-based standards" (14 CCR 15064.4[a]). Section 15064.4(b) states that the lead agency should consider the following when assessing the significance of impacts from GHG emissions on the environment: (1) the extent to which a project may increase or reduce GHG emissions as compared to the existing environmental setting; (2) whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project; and (3) the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions (14 CCR 15064.4[b]).

Executive Order S-13-08

EO S-13-08 (November 2008) is intended to hasten California's response to the impacts of global climate change, particularly sea-level rise. Therefore, the EO directs state agencies to take specified actions to assess and plan for such impacts. The final 2009 California Climate Adaptation Strategy report was issued in December 2009, and an update, Safeguarding California: Reducing Climate Risk, followed in July 2014. To assess the state's vulnerability, the report summarizes key climate change impacts to the state for the following areas: agriculture, biodiversity and habitat, emergency management, energy, forestry, ocean and coastal ecosystems and resources, public health, transportation, and water. Issuance of Safeguarding California: Implementation Action Plans followed in March 2016. In January 2018, CNRA released the Safeguarding California Plan: 2018 Update*,* which communicates current and needed actions that state government should take to build climate change resiliency.

Other State Plans and Targets

Draft 2030 Natural and Working Lands Implementation Plan

In a joint, interagency effort, the California Environmental Protection Agency (CalEPA), California Department of Food and Agriculture (CDFA), CNRA, CARB, and California Strategic Growth Council (SGC) released the *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan* in January 2019. The draft plan focuses on the natural and working lands sector, which includes farmland, rangeland, forests, grasslands, wetlands, riparian areas, seagrass, and urban green space. The draft plan addresses the carbon cycle from this sector, encompassing the constantly shifting dynamics of GHG emissions and carbon sequestration associated with natural and working lands management. It is estimated that California's natural and working lands lost approximately 170 MMT (million metric tons) of carbon between 2001 and 2014. Most of these losses were due to wildfire. This loss of carbon is equivalent to cumulative emissions of 630 $MMTCO_2e$ of previously sequestered carbon removed from the land over the same period (CalEPA et al. 2019). The draft plan strives to create an interdisciplinary approach to conserve and maintain a resilient natural and working lands sector that will gradually shift the natural and working lands sector from being a net carbon emitter to being a net carbon sink, while also producing benefits for air quality, water quality, wildlife habitat, recreation, and providing other benefits. The State will, at the least, strive to increase the rate of state-funded soil conservation practices fivefold, double the rate of state-funded forest management or restoration efforts, triple the rate of state-funded oak woodland and riparian restoration, and double the rate of state-funded wetland and seagrass restoration through 2030 (CalEPA et al. 2019). The measures included in the draft plan are projected to result in cumulative emissions of 21.6 to 56.8 $MMTCO_2e$ by 2030 and cumulative emissions reduction of -36.6 to -11.7 $MMTCO_2e$ by 2045. The benefits of the actions implemented are expected to grow substantially over time, through 2100 and beyond (CalEPA et al. 2019).

The draft plan indicates that these GHG reductions will be met through a variety of practices under four broad pathways: conservation, forestry, restoration, and agriculture. The "Improved forest health and reduced wildfire severity" suite of practices within the Forestry pathway includes prescribed fire, mechanical thinning, and understory treatment. It aims to restore health and resilience to overstocked forests and prevent carbon losses from severe wildfire, disease, pests, and water stress.

The implementation goals for this practice includes 59,000–73,000 acres of thinning per year and 23,500–25,300 acres of understory treatment per year (CalEPA et al. 2019). The draft plan notes that, although fuel reduction treatments involve near-term carbon costs, they result in long-term net carbon benefits in California. Fuel reduction activities, such as mechanical thinning and prescribed fire, reduce stand densities and fuel loads, restore the structure and composition of forest ecosystems, and lower the potential for damaging, high-severity fire, which is currently the primary cause of GHG emissions and carbon loss from the land sector. In the long-term, these activities are expected to result in climate benefits and healthier, more stable, and more resilient forests (CalEPA et al. 2019).

California Forest Carbon Plan

In May 2018, CAL FIRE, in coordination with CNRA and CalEPA, released the *California Forest Carbon Plan*, which is the detailed implementation plan for the forest carbon goals embodied in the *2017 CARB Scoping Plan.* Today, many forests are unhealthy, with unnaturally dense stands that lack resilience, making them more susceptible to drought, disease, insect pests, and uncharacteristically large, severe wildfires. The Plan seeks to reverse these trends and firmly establish California's forests as a more resilient and reliable long-term carbon sink, rather than a GHG and black carbon emission source. This Plan describes forest conditions across California today; provides a projection of future conditions given the ongoing and expected impacts of climate change; and describes goals and related specific actions that can be taken to improve overall forest health, including resilient carbon storage, and principles and policies to guide and support those actions (CalFIRE et al. 2018). Specifically, the plan identifies the following targets for forest restoration and treatment activities on non-federal forest lands:

- By 2030, increase forest restoration and fuels treatments, including mechanical thinning and prescribed burning, from the current rate of approximately 17,500 acres per year to 60,000 acres per year. This target is based on CALFIRE's determination of an operationally feasible increase in activity through its Vegetation Treatment Program;
- Through CAL FIRE's Forest Practice Program and the Timber Regulation and Forest Restoration Program, ensure that timber operations conducted under the Forest Practice Act and Rules contribute to the achievement of healthy and resilient forests that are net sinks of carbon, with due consideration given to all forest carbon pools;
- Promote increasing the acreage of forest carbon projects and remove barriers to their implementation; and
- To address forest health and resiliency needs identified statewide on nonfederal lands, CAL FIRE has estimated that the rate of treatment of all types would need to be increased to approximately 500,000 acres per year to make an ecologically meaningful difference at a landscape scale. This estimate is based on consideration of ecological need and predictions of capacity to implement treatments. It should be considered an aspirational target to work toward. This goal is achievable with increased resources and expanded markets for woody materials. These treatments include those that generate revenue from harvest materials, such as commercial thinning and regeneration harvests.

AB 1757 California's Nature-Based Solutions Climate Targets

AB 1757 (September 2022) requires the CRNA to determine a range of targets for natural carbon sequestration, and for nature-based climate solutions that reduce GHG emissions for future years 2030, 2038, and 2045. These targets were released April 22, 2024, and are established to support the state's goals to achieve carbon neutrality and foster climate adaptation and resilience (CNRA 2024).

The California legislature recognizes the crucial role of NWLs in achieving the state's climate goals and carbon neutrality. EO N-82-20 instructed the CNRA to create the Natural and Working Lands Climate Smart Strategy, which outlines nature-based solutions to advance carbon neutrality. Under AB 1757, the CNRA, in collaboration with CARB and an expert advisory committee (EAC), established targets for natural carbon sequestration and nature-based climate solutions to reduce GHG emissions. The 2022 Scoping Plan proposed a target of achieving a -4% total carbon stock change by 2045 from the 2014 baseline conditions within the state's NWLs (CARB 2022).

While NWLs offer unique opportunities for long-term climate goals, CARB's modeling indicates that these lands are projected to be a net source of emissions until 2045, driven by human activities (such as land use change) and natural disturbances (like wildfire and drought). To transform the NWL sector into a reliable carbon sink, increased climate-smart land management is necessary (CARB 2022).

The AB 1757 EAC emphasizes that NWL actions can yield immediate, durable emissions reductions at a lower cost than other sectors. Over the next decade, the state could reduce CO_2 emissions by approximately 250-400 million metric tons through NWL management, restoration, and conservation (AB 1757 EAC 2023).

Forests make up 27% of California, or 28.7 million acres, from northern to southern California. Their trees, soils, and plants currently store the largest proportion of carbon across all of California's landscape types. Over the past century, forests have largely served as a carbon sink that removed carbon from our atmosphere. They are now a carbon source--emitting more carbon than they remove from the atmosphere. This shift is largely a result of a century of fire exclusion practices; historic timber harvesting methods that removed large, fire-resilient trees; and climate change impacts, such as drought and pest migration. One of the largest sources of carbon emissions from California's lands over the last eight years comes from catastrophic wildfire. Limiting huge, dangerous, and catastrophic wildfires and restoring a natural wildfire regime across the state is one of the most important actions to limit carbon emissions from our landscapes (CNRA 2024).

The nature-based solutions for wildfire risk reduction include other fuel reduction activities, such as thinning; invasive species removal; prescribed herbivory (grazing); mechanical treatments (first entry and retreatments), and uneven-aged timber harvest. This solution has an acreage target of 700,000 acres/year by 2030, 800,000 acres/year by 2038, and 1 million acres/year by 2045. These targets, including fuel reduction activities, align with and build on California's shared commitment with the U.S. Forest Service to treat a minimum of 1 million acres annually by 2025. They are also complemented by targets on California's developed lands related to reducing community wildfire risk, decreasing wildfire ignition rates caused by vehicles, and treating roadside vegetation. Furthermore, through other fuel reduction activities, the target is to shift the proportion of statewide high severity wildfire to low or moderate severity wildfire such that the total percentage of low to moderate severity wildfire is 75% by 2030, 83% by 2038, and 90% by 2045 (CNRA 2024).

AB 1504

AB 1504 reflects California's commitment to recognizing the critical role of forests in carbon sequestration and climate mitigation. It amended the Z'berg-Nejedly Forest Practice Act of 1973, compelling the state Board of Forestry to ensure that all regulations governing commercial timber harvesting account for forests' capacity to sequester CO_2. The primary objective is to ensure that both public and private forests in California store sufficient CO_2 to meet GHG emission-reduction goals mandated by AB 32.

AB 1504 not only emphasizes the unique role of California's forests in maintaining the state's carbon balance but also promotes the sustainable production of high-quality timber products. Beyond timber, these forests provide essential ecosystem services, including carbon sequestration, recreation, watershed protection, wildlife habitat, and regional economic vitality. The bill sets a target for forests to sequester 5 MMT of CO_2e annually by 2020, reinforcing their critical contribution to climate resilience and environmental well-being.

3.7.2.4 Local

Lassen County

Lassen County General Plan

Lassen County adopted its General Plan in 2000. The County's General Plan does not include any goals or policies directly related to reducing GHG emissions.

Tuolumne County

Tuolumne County General Plan

Tuolumne County adopted its General Plan Update in 2018 (Tuolumne County 2018). The County's General Plan includes various goals and policies related to directly and indirectly reducing GHG emissions. Applicable goals and policies include the following:

Goal 15B. Reduce traffic congestion, vehicle trips and their emissions through more efficient infrastructure, low emission technologies, and support for trip reduction programs.

Policy 15.B.1. Create a land use pattern that will encourage people to walk, bicycle or use public transit for a significant number of their daily trips.

Policy 15.B.2. Develop a modern transportation system that incorporates alternative transportation modes into the system design.

Goal 18A. Reduce Greenhouse Gas (GHG) emissions from community activities and County government facilities and operations within the County to support the State's efforts under Assembly Bill 32 and other state and federal mandates to mitigate the County's GHG emissions impacts.

Policy 18.A.1. Prepare a Climate Action Plan (CAP), or similar GHG emission reduction plan, that establishes a GHG reduction target consistent with the Senate Bill (SB) 32 goal to reduce statewide GHG emissions to 40 percent below 1990 levels by 2030. The CAP shall identify specific measures to reduce countywide emissions consistent with the established target and will also include adaptation strategies for the County to appropriately adjust to the environmental effects of climate change. Many of the measures in the CAP will overlap with and help implement goals, policies, and implementation programs identified in this General Plan.

Tuolumne County Climate Action Plan

Tuolumne County adopted their Climate Action Plan in November 2022 (Tuolumne County 2022). The CAP's main objectives are to build resilience to climate related hazards that threaten the community; to reduce (or "mitigate") local GHG emissions; and to preserve and improve the county's natural resources and quality of life. Climate change mitigation and adaptation strategies are organized into five focus areas: Health and Safety, Conservation and Recreation, Buildings, Infrastructure, and Agriculture and Forestry. Furthermore, the CAP developed GHG efficiency thresholds that projects could use to determine significance for GHG analyses in CEQA documents based on the project's anticipated operational year. The following goals and policies are relevant to the project.

Conservation and Recreation

Ecosystem Preservation and Conservation

Measure 1.1: Enhance the protection of the county's natural assets and ecosystems and expand natural capital throughout the county, while building climate resilience in the environment.

Measure 1.3: Conserve areas, such as wildlife habitat and corridors, wetlands, watersheds, and groundwater recharge areas, that provide carbon sequestration benefits.

Agriculture and Forestry

Forest Resilience

Measure 6.1: Improve long-term forest resilience.

Measure 6.2: Increase forest resilience to wildfire and drought while protecting dense forest species.

Measure 6.3: Manage vegetation and reduce wildfire risk to promote sequestration.

City of Stockton

City of Stockton Envision 2040 General Plan

Applicable GHG standards in the City's 2040 General Plan are contained within the Safety, and Community Health and Transportation chapters (City of Stockton 2018). The Safety and Community Health chapters contains specific goals, policies, and actions for reducing air quality and GHGs within the City. The following goals and policies are relevant to the project.

Safety

Goal SAF-4: Clean Air. Improve local air quality.

Policy SAF-4.1: Reduce air impacts from mobile and stationary sources of air pollution.

Policy SAF-4.2: Encourage major employers to participate in a transportation demand management program (TDM) that reduces vehicle trips through approaches such as carpooling, vanpooling, shuttles, car-sharing, bike sharing, end-of-trip facilities like showers and bicycle parking, subscription bus service, transit subsidies, preferential parking, and telecommuting.

Community Health

Goal CH-5: Sustainability Leadership.

Policy CH-5.1: Accommodate a changing climate through adaptation, mitigation, and resiliency planning and projects.

Policy CH-5.2: Expand opportunities for recycling, re-use of materials, and waste reduction.

Transportation

Goal TR-3: Sustainable Transportation. Design transportation infrastructure to help reduce pollution and vehicle travel.

Policy TR-3-2: Require new development and transportation projects to reduce travel demand and greenhouse gas emissions, support electric vehicle charging, and accommodate multi-passenger autonomous vehicle travel as much as feasible.

City of Stockton Climate Action Plan

In August 2014, the City of Stockton adopted a CAP in compliance with a Settlement Agreement with the California Attorney General and the Sierra Club related to the City's adopted General Plan 2035 and associated EIR. The CAP "outlines a framework to feasibly reduce community GHG emissions in a manner that is supportive of AB 32 and is consistent with the Settlement Agreement and 2035 General Plan policy" (City of Stockton 2014).

The CAP sets a GHG emission reduction target of 10% below 2005 GHG emission levels by 2020, or approximately 29% below "business as usual" GHG emissions (i.e., 2020 GHG emissions that are unmitigated), which is the level by which the state has set its emission reduction goal. Approximately 83% of the reductions needed to achieve the City's GHG reduction goal are achieved through state-level programs, and 17% are achieved through City-level programs. The largest GHG reductions are identified in the areas of building energy (both energy efficiency and renewable energy), transportation, and waste. It should be noted that the GHG emission inventory on which CAP targets and policies are based did not include heavy industrial sources.

Furthermore, Appendix F of the City's CAP has a Climate Impact Study Process (CISP), which is part of the Development Review Process, that describes best management practices (BMPs) to reduce GHG emissions from construction and operational activities. Development must identify the BMPs or other mitigation that would provide the reduction in GHG emissions (City of Stockton 2014).

Port of Stockton

Port of Stockton Clean Air Plan

The Port of Stockton adopted a Clean Air Plan in April 2023 (Port of Stockton 2023). The Port of Stockton Clean Air Plan defines strategies for reducing air emissions in the near term while charting a long-term path for the Port to reach zero emissions. It focuses on the five main sources of Port-related emissions: heavy-duty trucks, cargo-handling equipment, harbor craft, ships, and locomotives, among other strategies. The strategies set forth in the Port of Stockton Clean Air Plan to reduce air- and climate-related community impacts are identified below.

Heavy-Duty Trucks

TRUCKS-3. Collaborate with other agencies on a regional anti-idling plan and increased enforcement of idling limits at distribution centers, warehouses or other facilities within the Port.

TRUCKS-4. Identify ways to enhance goods movement efficiency and improve traffic flow, particularly around neighborhoods impacted by trucks.

TRUCKS-5. Assist truck operators in securing grant funds for zero-emission trucks and infrastructure.

TRUCKS-6. Develop the Port of Stockton Electric Vehicle Blueprint to identify the actions needed to support a zero-emissions truck transition.

TRUCKS-7. In partnership with tenants, facilitate the development and implementation of Zero-Emissions Truck Transition Plans at each facility to accelerate the introduction of zero-emission trucks.

Cargo-Handling Equipment

EQUIP-1. Develop the Port of Stockton Electric Vehicle Blueprint to identify the actions needed to support a zero-emissions equipment transition.

EQUIP-2. Seek grants to buy zero-emissions equipment and help terminal operators secure grants.

EQUIP-3. In partnership with tenants, facilitate the development and implementation of Zero-Emissions Terminal Transition Plans at each facility to accelerate the introduction of zero-emissions equipment.

EQUIP-4. Transition all Port-owned equipment to zero emissions by 2030 or in advance of the State regulation, whichever is earlier, when feasible.

EQUIP-5. Set a goal to transition tenant-owned equipment to zero emissions by 2035 or in advance of the State regulation, when feasible.

EQUIP-6. Evaluate the use of renewable diesel in cargo-handling equipment.

Harbor Craft

TUGS-1. Provide assistance for harbor craft operators in securing grant funds to transition to cleaner tugboats and to fund zero-emission tugboat demonstrations.

TUGS-2. Require harbor craft operators to have shore power infrastructure at their berths and to use this infrastructure to eliminate at-berth idling emissions.

Ships

SHIPS-1. Conduct technology demonstrations for barge- or land-based systems that eliminate at-berth emissions.

SHIPS-2. Develop an incentive program to encourage the deployment of the cleanest ships to Stockton.

Rail

RAIL-1. Secure grants to help rail operators transition to the cleanest available locomotives and to demonstrate advanced zero-emission technologies.

RAIL-2. Evaluate the possibility of contractual conditions to require Central California Traction Company, the short-line rail operator, to deploy cleaner locomotives in advance of the State's locomotive regulation.

Other Strategies

FLEET-1. Transition the Port's fleet of on-road vehicles to zero emissions by 2035.

FLEET-2. Develop the Port of Stockton Electric Vehicle Blueprint to identify the actions needed to support a zero-emissions on-road fleet transition.

BARRIERS-1. Evaluate potential locations for vegetative barriers and work with the community and regional partners to install such barriers, particularly around facilities and along truck routes in close proximity to residents, schools, and other neighborhood uses.

TREES-1. Expand the Port's urban greening program through more tree plantings, particularly in parts of the community that are highly impacted by trucks and Port-related uses.

3.7.3 Thresholds of Significance

The significance thresholds used to evaluate the project's GHG emissions impacts are based on the recommendations provided in Appendix G of the CEQA Guidelines (14 CCR 15000 et seq.). For the purposes of this GHG emissions analysis, the project would have a significant environmental impact if it would:

1. Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?
2. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs?

Global climate change is a cumulative impact; a project participates in this potential impact through its incremental contribution combined with the cumulative increase of all other sources of GHGs. There are currently no established thresholds for assessing whether the GHG emissions of a project, such as the Project, would be considered a cumulatively considerable contribution to global climate change; however, all reasonable efforts should be made to minimize a project's contribution to global climate change. In addition, while GHG impacts are recognized exclusively as cumulative impacts (CAPCOA 2008), GHG emissions impacts must also be evaluated on a project-level under CEQA.

With respect to GHG emissions, CEQA Guidelines Section 15064.4(a) states that lead agencies "shall make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate" GHG emissions resulting from a project. The CEQA Guidelines note that an agency has the discretion to either quantify a project's GHG emissions or rely on a "qualitative analysis or performance-based standards" (14 CCR 15064.4[a]). A lead agency may use a "model or methodology" to estimate greenhouse gas emissions and has the discretion to select the model or methodology it considers "most appropriate to enable decision makers to intelligently take into account the project's incremental contribution to climate change" (14 CCR 15064.4[c]). The CEQA Guidelines provide that the lead agency should consider the following when determining the significance of impacts from GHG emissions on the environment (14 CCR 15064.4[b]):

1. The extent a project may increase or reduce GHG emissions as compared to the existing environmental setting.
2. Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.
3. The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.

In addition, the CEQA Guidelines specify that "[w]hen adopting or using thresholds of significance, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies, or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence" (14 CCR 15064.7[c]).

The extent to which a project increases or decreases GHG emissions in the existing environmental setting should be estimated in accordance with State CEQA Guidelines Section 15064.4 titled, "Determining the Significance of Impacts from Greenhouse Gas Emissions." The State CEQA Guidelines indicate that when calculating GHG emissions resulting from a project, lead agencies shall make a good-faith effort based on scientific and factual data (Section 15064.4 (a)), and lead agencies have discretion to select the model or methodology deemed most appropriate for enabling decision makers to intelligently assess the project's incremental contribution to climate change (Section 15064.4 [c]).

The State CEQA Guidelines do not indicate an amount of GHG emissions that constitutes a significant impact on the environment. Instead, they authorize the lead agency to consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence (State CEQA Guidelines Sections 15064.4[a] and 15064.7[c]).

Governor's Office of Planning and Research Guidance

The Governor's Office of Planning and Research technical advisory titled, "CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review," states that "public agencies are encouraged but not required to adopt thresholds of significance for environmental impacts. Even in the absence of clearly defined thresholds for GHG emissions, the law requires that such emissions from CEQA projects must be disclosed and mitigated to the extent feasible whenever the lead agency determines that the project contributes to a significant, cumulative climate change impact" (OPR 2018). Furthermore, the advisory document indicates that "in the absence of regulatory standards for GHG emissions or other scientific data to clearly define what constitutes a 'significant impact,' individual lead agencies may undertake a project-by-project analysis, consistent with available guidance and current CEQA practice" (OPR 2008).

Air District Numeric Thresholds

Although several air districts have established thresholds of significance for GHG emissions, these thresholds are generally meant for evaluating GHGs associated with land use development projects, including residential, commercial, industrial, and public land uses and facilities. Thus, they are not applicable to evaluation of sustainable forest management projects under the proposed project, which include a unique mix of activities and land uses occurring across multiple air districts.

Regarding the pellet facilities and the Port of Stockton, no thresholds of significance have been established by an applicable air district or any other government agencies that is aligned with the 2030 statewide GHG target mandated by SB 32 or the 2045 statewide GHG target mandated by AB 1279.

Approach to Determining Significance

This analysis qualitatively evaluates whether the annual GHG emissions generated by sources implemented under the project would be substantial, based upon consideration of the goals and requirements of applicable statewide, regional, or local plans for the reduction or mitigation of GHG emissions, especially in regard to the statewide GHG goals mandated by SB 32 and AB 1279. This qualitative approach best fulfils CEQA's informational purposes due to both to the lack of any established quantitative standards for a project of this nature (which includes a unique mixture of fuels treatment activities, facility construction and operations, and transportation activities), and the uncertainties discussed below in assessing the project's carbon effects (which would render the application of any quantitative threshold speculative).

While the GHG impact thresholds will be evaluated qualitatively, project-generated construction and operational GHG emissions and the project's carbon effects have been quantified for disclosure purposes. The GHG emissions associated with implementation of the project were estimated using industry standard and accepted software tools, techniques, and emissions factors, as described in Section 3.7.4.1, Methodology, below. In addition, GHG emissions associated with potential changes to forest carbon is also estimated and disclosed as explained in further detail under the methodology section.

Due to the global nature of the GHG emissions and that project activities have the potential to occur in multiple air districts across the state, the project's GHG emission significance conclusion will evaluate the project on the whole of its actions.

3.7.4 Impact Analysis

3.7.4.1 Methodology

The project would consist of three primary phases: feedstock acquisition, wood pellet production, and transport to market. The impact analyses below evaluate each of these primary phases as related to GHG emissions.

3.7.4.1.1 Feedstock Acquisition

Sustainable Forest Management Projects

Operational activities associated with the acquisition of feedstock primarily involve use of offroad equipment to remove wood and transport of wood from the forest to the pellet facilities via haul trucks. As such, Sustainable Forest Management Projects were modeled as construction activities using California Emissions Estimator Model (CalEEMod) Version 2022.1.1.25. Construction scenario assumptions, including phasing, equipment mix, and vehicle trips, were based on information provided by the project applicant and CalEEMod default values when project specifics were not known. Because activity would occur within multiple air districts, emission factors representing the Statewide vehicle mix and emissions for 2025 were used to estimate emissions associated with vehicular sources.

Some feedstock acquisition activities would occur as a direct result of the project; other activities are currently occurring and would continue in the absence of the project. The feedstock activities, modeled as concurrent construction phases in CalEEMod, include Harvest Residuals, GSNR Biomass Only Thinning Projects, and Mill Residuals.

All details for construction criteria air pollutants discussed in Section 3.2.4.1.1 within Chapter 3.2, Air Quality, are also applicable for the estimation of feedstock acquisition-related GHG emissions. As such, see Section 3.2.4.1.1 for a discussion of construction emissions calculation methodology and assumptions.

Forest Carbon Change

An assessment was conducted to quantify changes in forest carbon and GHG emissions resulting from GSNR's biomass thinning projects. By removing forest materials, the project impacts forest carbon and GHG in several ways, assessed through the following categories:

1. **Total Removed Biomass:** The removal of forest materials initially reduces the amount of carbon stored in forests.
2. **Forest Carbon Sequestration and Storage:** While fuel treatments can lead to short-term reductions in carbon storage due to biomass removal, they typically enhance the long-term rate of carbon sequestration. This is due to the enhanced growth of retained trees and improved tree vigor from reduced competition and changes in forest structure.
3. **GHG Emissions During Wildfire:** By strategically removing forest wildfire fuels, fuel treatments lower the risk of severe wildfires. Preventing high-severity fires helps maintain the carbon stored in trees and soil and decreases wildfire emissions.
4. **Tree Mortality From Wildfire:** Fuel treatments have been shown to decrease wildfire-caused mortality through decreasing wildfire severity and reducing damage to trees.

The assessment utilized the Forest Vegetation Simulator (FVS) to simulate the effects of fuel treatments on forest carbon and GHGs. FVS uses forest structure data to simulate forest growth and yield over time, allowing users to input customized fuel treatment parameters to determine how treatments alter forest dynamics. The Fire and Fuels Extension (FFE) of FVS simulates interactions between fire, fuels, and forest dynamics. FFE was used to quantify how GSNR fuel treatments will alter fire severity, carbon loss from wildfire, and wildfire emissions.

The analysis utilized LEMMA forest structure data, created in collaboration with the US Forest Service and Oregon State University. This dataset, which employs the gradient nearest neighbor (GNN) method, imputes forest characteristics to 30-meter grid cells across California, Oregon, and Washington. It is based on over 50,000 field plots and various explanatory variables, integrating vegetation measurements, environmental data, and Landsat imagery to predict forest structure. The 2017 LEMMA dataset, which provides detailed forest conditions, is widely used by organizations like CAL FIRE and the CARB for assessing the impacts of forest treatments on greenhouse gases.

Given the large spatial scale of the project, a scaling approach was used to model the effects of forest treatments. This involved modeling the effects within smaller, representative subsets of the Project area and then scaling these results to the larger area. To effectively account for forest heterogeneity, sample areas were chosen based on Forest Type (e.g., Ponderosa Pine, California Mixed Conifer, White Fir) and SDI. This approach ensures that the diversity of forest structures within the sample areas accurately reflects the forest conditions across the broader project area. For the full methodology, see Appendix B8.

3.7.4.1.2 Wood Pellet Production

Lassen Facility

Construction

CalEEMod Version 2022.1.1.25 was used to estimate potential project-generated GHG emissions during construction of the Lassen Facility. Construction of the Lassen Facility would result in GHG emissions primarily associated with use of off-road construction equipment, on-road hauling and vendor (material delivery) trucks, and worker vehicles. All details for construction criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality are also applicable for the estimation of construction-related GHG emissions. As such, see Section 3.2.4.1.2 for a discussion of construction emissions calculation methodology and assumptions. Construction GHG emissions are amortized over the lifetime of the project, which is assumed to be 20 years based on the project's proposed activities.[3]

Operation

As with the air quality analysis, emissions from the operational phase of the project were estimated using CalEEMod Version 2022.1.1.25. All details for criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality, are applicable for the estimation of operational GHG emissions.

Area Sources

CalEEMod was used to estimate operational emissions from area sources, including emissions from consumer product use and the reapplication of architectural coatings. These area sources would only contribute to criteria air pollutants and not to GHG emissions. As such, there are no GHG emissions associated with consumer product use and the reapplication of architectural coatings at the Lassen Facility.

Energy Sources

Electricity consumption was provided by the project applicant and estimated to be 142,677,840 kWh per year. There would be no natural gas consumption at the Lassen Facility.

The CalEEMod default energy intensity factor (CO_2, CH_4, and N_2O mass emissions per kilowatt-hour) for Pacific Gas and Electric Company (PG&E) has been used for this analysis, which is based on the value for PG&E's energy mix in 2025 (CAPCOA 2022). The default energy intensity factor that was applied was approximately 204 pounds (lbs) CO_2 per MWh, 0.033 lbs CH_4 per MWh, and 0.004 lbs N_2O per MWh. According to PG&E's 2022 Power Content Label, PG&E's base plan has a GHG intensity factor of 56 lbs CO_2e per MWh.

As explained in Section 3.7.2.3, SB 100 and SB 1020 call for further development of renewable energy, with a target of 44% by December 31, 2024; 52% by December 31, 2027; 60% by December 31, 2030; 90% by December 31, 2035; 95% by December 31, 2040; and 100% by December 31, 2045. As such, GHG emissions associated with project electricity demand would continue to decrease over time.

Mobile Sources

All details for criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality, are applicable for the estimation of operational mobile source GHG emissions.

Regulatory measures related to mobile sources include AB 1493 (Pavley) and related federal standards. AB 1493 required that CARB establish GHG emission standards for automobiles, light-duty trucks, and other vehicles that are primarily used for noncommercial personal transportation in the state. In addition, NHTSA and EPA have established CAFE standards and GHG emission standards, respectively, for automobiles and light-, medium-, and

[3] Use of a long project lifetime, such as the commonly applied 30-year assumption, would result in a lower annualized construction GHG emissions value. As such, the 20-year lifetime accurately reflects the project and is more conservative than other industry standard project lifetime assumptions.

heavy-duty vehicles. Implementation of these standards and fleet turnover (replacement of older vehicles with newer ones) will gradually reduce emissions from the Project's motor vehicles.

Solid Waste

The project's land uses generate solid waste and therefore result in CO_2e emissions associated with landfill off-gassing. The CalEEMod default generation rate was applied, which is a reasonable representation of actual conditions based upon the location and characteristics of this project site and activities. In addition, ash produced by dryer furnaces will be landfilled or used for opportunity sale for agricultural purposes. The Applicant estimated that 3,103 tons of ash would be generated per year. The CalEEMod default solid waste tonnage per year was added to the ash tonnage per year to be approximately 3,485 tons of solid waste per year. The GHG emissions associated with this amount of solid waste is expected to be conservative because the estimation is based on a municipal solid waste mix, and the presence of ash would result in less intensive GHG emissions.

Water and Wastewater

Supply, conveyance, treatment, and distribution of water for the on-site well at the Lassen Facility require the use of electricity, which would result in associated indirect GHG emissions. Similarly, wastewater generated by the project and existing land uses requires the use of electricity for conveyance, along with GHG emissions generated during wastewater treatment. A septic system would be used to treat wastewater from the Lassen Facility. Emissions of CH_4 and N_2O from septic wastewater treatment were based on default equations and emission factors from CalEEMod. Annual water use was conservatively assumed to be 50,000,000 gallons per year for purposes of this GHG analysis, which exceeds the anticipated normal operational water demand for the Lassen Facility (15.3 million gallon per year. See Chapter 3.9, "Hydrology and Water Quality").

Refrigerants

Refrigerants are substances used in equipment for air conditioning (A/C) and refrigeration. Most of the refrigerants used today are HFCs or blends thereof, which can have high GWP values. All equipment that uses refrigerants has a charge size (i.e., quantity of refrigerant the equipment contains), and an operational refrigerant leak rate, and each refrigerant has a GWP that is specific to that refrigerant. CalEEMod quantifies refrigerant emissions from leaks during regular operation and routine servicing over the equipment lifetime, and then derives average annual emissions from the lifetime estimate. Default CalEEMod values were applied.

Off-Road Equipment

All details for criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality, are applicable for the estimation of operational off-road equipment GHG emissions. It was assumed that 1 rough terrain forklift would operate in the log storage area, 1 tractor/loader/backhoe would operate in the fuel storage area, and 1 rubber tired loader would operate in the dryer furnace area.

Permitted Sources

All details for permitted sources (i.e. stationary sources) criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality, are applicable for the estimation of operational permitted sources GHG emissions. Specifically, the furnace abort operations, the regenerative thermal oxidizer (RTO) burners, the regenerative catalytic oxidizer (RCO) burners, and the diesel fire pump would generate GHG emissions.

Tuolumne Facility

Construction

CalEEMod Version 2022.1.1.25 was used to estimate potential Project-generated GHG emissions during construction of the Tuolumne Facility. Construction of the Tuolumne Facility would result in GHG emissions primarily associated with use of off-road construction equipment, on-road hauling, and vendor (material delivery) trucks, and worker vehicles. All details for construction criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality are also applicable for the estimation of construction-related GHG emissions. As such, see Section 3.2.4.1.2 for a discussion of construction emissions calculation methodology and assumptions. Construction GHG emissions are amortized over the lifetime of the project, which is assumed to be 20 years based on the project's proposed activities.

Operation

As with the air quality analysis, emissions from the operational phase of the Project were estimated using CalEEMod Version 2022.1.1.25. All details for criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality, are applicable for the estimation of operational GHG emissions.

Area Sources

CalEEMod was used to estimate operational emissions from area sources, including emissions from consumer product use and the reapplication of architectural coatings. These area sources would only contribute to criteria air pollutants and not to GHGs. As such, there are no GHG emissions associated with consumer product use and the reapplication of architectural coatings at the Lassen Facility.

Energy Sources

Electricity consumption was provided by the project applicant and estimated to be 94,807,680 kWh per year. There would be no natural gas consumption at the Tuolumne Facility.

The CalEEMod default energy intensity factor (CO_2, CH_4, and N_2O mass emissions per kilowatt-hour) for PG&E was applied, which is based on the value for PG&E's energy mix in 2025 (CAPCOA 2022). The default energy intensity factor that was applied was approximately 204 lbs CO_2 per MWh, 0.033 lbs CH_4 per MWh, and 0.004 lbs N_2O per MWh. According to PG&E's 2022 Power Content Label, PG&E's base plan has a GHG intensity factor of 56 lbs CO_2e per MWh. As such, the CalEEMod default energy intensity factor used in the analysis herein is conservative. As explained in Section 3.7.2.3, SB 100 and SB 1020 call for further development of renewable energy, with targets of 60% by December 31, 2030, 90% by December 31, 2035, and 100% by December 31, 2045. As such, GHG emissions associated with project electricity demand would continue to decrease over time.

Mobile Sources

All details for criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality, are applicable for the estimation of operational GHG emissions.

Regulatory measures related to mobile sources include AB 1493 (Pavley) and related federal standards. AB 1493 required that CARB establish GHG emission standards for automobiles, light-duty trucks, and other vehicles that are primarily used for noncommercial personal transportation in the state. In addition, NHTSA and EPA have established CAFE standards and GHG emission standards, respectively, for automobiles and light-, medium-, and heavy-duty vehicles. Implementation of these standards and fleet turnover (replacement of older vehicles with newer ones) will gradually reduce emissions from the project's motor vehicles.

Solid Waste

The project's land uses generate solid waste and therefore result in CO_2e emissions associated with landfill off-gassing. The CalEEMod default generation rate was applied, which is a reasonable representation of actual conditions based upon the location and characteristics of this project site and activities. In addition, ash produced by dryer furnaces will be landfilled or used for opportunity sale for agricultural purposes. The Applicant estimated that 1,525 tons of ash would be generated per year. The CalEEMod default solid waste tonnage per year was added to the ash tonnage per year to be approximately 1,845 tons of solid waste per year. The GHG emissions associated with this amount of solid waste is expected to be conservative because the estimation is based on a municipal solid waste mix, and the presence of ash would result in less intensive GHG emissions.

Water and Wastewater

Supply, conveyance, treatment, and distribution of water for the on-site well at the Tuolumne Facility require the use of electricity, which would result in associated indirect GHG emissions. Similarly, wastewater generated by the project and existing land uses requires the use of electricity for conveyance, along with GHG emissions generated during wastewater treatment. A septic system would be used to treat wastewater from the Lassen Facility. Emissions of CH_4 and N_2O from septic wastewater treatment were based on default equations and emission factors from CalEEMod. Annual water use was conservatively assumed to be 25,000,000 gallons per year for purposes of this GHG analysis, which exceeds the anticipated normal operational water demand for the Tuolumne Facility (8.15 million gallon per year. See Chapter 3.9, "Hydrology and Water Quality").

Refrigerants

Refrigerants are substances used in equipment for A/C and refrigeration. Most of the refrigerants used today are HFCs or blends thereof, which can have high GWP values. All equipment that uses refrigerants has a charge size (i.e., quantity of refrigerant the equipment contains), and an operational refrigerant leak rate, and each refrigerant has a GWP that is specific to that refrigerant. CalEEMod quantifies refrigerant emissions from leaks during regular operation and routine servicing over the equipment lifetime, and then derives average annual emissions from the lifetime estimate. Default CalEEMod values were applied.

Off-Road Equipment

All details for criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality, are applicable for the estimation of operational off-road equipment GHG emissions. It was assumed that 1 rough terrain forklift would operate in the log storage area, 1 tractor/loader/backhoe would operate in the fuel storage area, and 1 rubber tired loader would operate in the dryer furnace area. Furthermore, 1 railcar mover (i.e., trackmobile) would move the train cars.

Permitted Sources

All details for criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality, are applicable for the estimation of operational permitted sources GHG emissions. Specifically, the furnace abort operations, the RTO burners, the RCO burners, and the diesel fire pump would generate GHG emissions.

3.7.4.1.3 Transport to Market

Rail Transport

Construction

All potential construction GHG emissions associated with the rail transport aspect of the Project are included in other parts of the analysis contained herein as follows:

- Rail spur construction at the Lassen Facility is included in the Lassen construction scenario.
- Rail spur construction at the Tuolumne Facility is included in the Tuolumne construction scenario.
- Rail spur construction at the Port of Stockton is included in the Port of Stockton construction scenario.

Operation

All details for criteria air pollutants discussed in Section 3.2.4.1.3 within Chapter 3.2, Air Quality, are applicable for the estimation of operational rail transport GHG emissions.

Port of Stockton

Construction

CalEEMod Version 2022.1.1.25 was used to estimate potential project-generated GHG emissions during construction of the Port of Stockton facility. Construction of the Port of Stockton facility would result in GHG emissions primarily associated with use of off-road construction equipment, on-road hauling, and vendor (material delivery) trucks, and worker vehicles. All details for construction criteria air pollutants discussed in Section 3.2.4.1.2 within Chapter 3.2, Air Quality are also applicable for the estimation of construction-related GHG emissions. As such, see Section 3.2.4.1.3 for a discussion of construction emissions calculation methodology and assumptions.

Operation

As with the air quality analysis, emissions from the operational phase of the project were estimated using CalEEMod Version 2022.1.1.25. All details for criteria air pollutants discussed in Section 3.2.4.1.3 within Chapter 3.2, Air Quality, are applicable for the estimation of operational GHG emissions.

Area Sources

CalEEMod was used to estimate operational emissions from area sources, including emissions from consumer product use and the reapplication of architectural coatings. These area sources would only contribute to criteria air pollutants and not to GHGs. As such, there are no GHG emissions associated with consumer product use and the reapplication of architectural coatings at the Lassen Facility.

Energy Sources

Electricity consumption was provided by the project applicant and estimated to be 12,060,000 kWh per year. There would be no natural gas consumption at the Port of Stockton facility.

The CalEEMod default energy intensity factor (CO_2, CH_4, and N_2O mass emissions per kilowatt-hour) for PG&E was applied, which is based on the value for PG&E's energy mix in 2025 (CAPCOA 2022). The default energy intensity factor that was applied was approximately 204 lbs CO_2 per MWh, 0.033 lbs CH_4 per MWh, and 0.004 N_2O per MWh. According to PG&E's 2022 Power Content Label, PG&E's base plan has a GHG intensity factor of 56 lbs CO_2e per MWh. As such, the CalEEMod default energy intensity factor used in the analysis herein is conservative. As explained in Section 3.7.2.3, SB 100 and SB 1020 call for further development of renewable energy and GHG emissions associated with project electricity demand would continue to decrease over time.

Mobile Sources

All details for criteria air pollutants discussed in Section 3.2.4.1.3 within Chapter 3.2, Air Quality, are applicable for the estimation of operational GHG emissions.

Regulatory measures related to mobile sources include AB 1493 (Pavley) and related federal standards. AB 1493 required that CARB establish GHG emission standards for automobiles, light-duty trucks, and other vehicles that are primarily used for noncommercial personal transportation in the state. In addition, NHTSA and EPA have established CAFE standards and GHG emission standards, respectively, for automobiles and light-, medium-, and heavy-duty vehicles. Implementation of these standards and fleet turnover (replacement of older vehicles with newer ones) will gradually reduce emissions from the Project's motor vehicles.

Solid Waste

The project's land uses generate solid waste and therefore result in CO_2e emissions associated with landfill off-gassing. The CalEEMod default generation rate was applied, which is a reasonable representation of actual conditions based upon the location and characteristics of this project site and activities.

Water and Wastewater

Supply, conveyance, treatment, and distribution of water for the project require the use of electricity, which would result in associated indirect GHG emissions. Similarly, wastewater generated by the project and existing land uses requires the use of electricity for conveyance and treatment, along with GHG emissions generated during wastewater treatment. Default CalEEMod values were applied, which are a reasonable representation of actual conditions based upon the location and characteristics of this project site and activities.

Refrigerants

Refrigerants are substances used in equipment for A/C and refrigeration. Most of the refrigerants used today are HFCs or blends thereof, which can have high GWP values. All equipment that uses refrigerants has a charge size (i.e., quantity of refrigerant the equipment contains), and an operational refrigerant leak rate, and each refrigerant has a GWP that is specific to that refrigerant. CalEEMod quantifies refrigerant emissions from leaks during regular operation and routine servicing over the equipment lifetime, and then derives average annual emissions from the lifetime estimate. Default CalEEMod values were applied.

Off-Road Equipment

All details for criteria air pollutants discussed in Section 3.2.4.1.3 within Chapter 3.2, Air Quality, are applicable for the estimation of operational off-road equipment GHG emissions. It was assumed that 1 yard truck and 1 tractor/loader/backhoe would operate at the facility 24 hours per day and 100 days per year.

Permitted Sources

All details for criteria air pollutants discussed in Section 3.2.4.1.3 within Chapter 3.2, Air Quality, are applicable for the estimation of operational permitted sources GHG emissions. Specifically, the two diesel fire pumps would generate GHG emissions.

Ship Transport

All details for criteria air pollutants discussed in Section 3.2.4.1.3 within Chapter 3.2, Air Quality, are applicable for the estimation of operational ship transport GHG emissions. Specifically, the cargo ships and tugboats would generate GHG emissions.

3.7.4.2 Project Impacts

Impact GHG-1 The project would potentially generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.

Estimated GHG Emissions[4]

Feedstock Acquisition

Sustainable Forest Management Projects

Feedstock acquisition within the Lassen and Tuolumne feedstock areas would result in GHG emissions that are primarily associated with use of off-road equipment, vendor (i.e. water) trucks, haul trucks, and worker vehicles.

The estimated Project-generated GHG emissions from feedstock activities in the Lassen feedstock area are shown in Table 3.7-5.

Table 3.7-5. Estimated Annual Feedstock Greenhouse Gas Emissions – Lassen Feedstock Area

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
2025 and Subsequent[5]	27,105.11	1.01	1.92	14.17	**27,717.13**

4 An example of a direct GHG emission source is combustion of fossil fuel at the site. An example of an indirect GHG emission source is from the use of electricity, which is generated at a power plant offsite. The analysis contained herein includes all direct and indirect GHG emission sources anticipated to result from project implementation.

5 As explained in Chapter 3.2 ("Air Quality"), this analysis assumes an operational year of 2025, which represents the earliest year feedstock operations could initiate. Assuming the earliest start date for operation represents the worst-case scenario for criteria

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent.
See Appendix B1.

As shown in Table 3.7-5, the estimated total GHG emissions from feedstock acquisition activities in the Lassen feedstock area would be approximately 27,717 MT CO_2e per year.

Table 3.7-6 presents the estimated Project-generated GHG emissions from feedstock activities in the Tuolumne feedstock area.

Table 3.7-6. Estimated Annual Feedstock Greenhouse Gas Emissions – Tuolumne Feedstock Area

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
2025 and Subsequent	11,822.92	0.45	0.83	6.28	**12,087.81**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent.
See Appendix B1.

As shown in Table 3.7-6, the estimated total GHG emissions from feedstock acquisition activities in the Tuolumne feedstock area would be approximately 12,088 MT CO_2e per year.

Wood Pellet Production

Lassen Facility

Construction Emissions

Construction of the Lassen Facility would result in GHG emissions that are primarily associated with use of off-road construction equipment, vendor and haul trucks, and worker vehicles. Construction GHG emissions were amortized assuming a 20-year development life after completion of construction. A detailed depiction of the construction schedule—including information regarding phasing, equipment used during each phase, trucks, and worker vehicles—is included in Appendix B1. As with Project-generated construction criteria air pollutant emissions, GHG emissions generated during construction of the Project would be short term in nature, lasting only for the duration of the construction period, and would not represent a long-term source of GHG emissions. Because there is no separate GHG threshold for construction, the evaluation of significance is discussed in the operational emissions analysis in the following text.

The estimated project-generated GHG emissions from construction activities for the Lassen Facility are shown in Table 3.7-7.

air pollutant emissions because equipment and vehicle emission factors for later years would be slightly less due to more stringent standards for in-use off-road equipment and heavy-duty trucks, as well as fleet turnover replacing older equipment and vehicles in later years.

Table 3.7-7. Estimated Annual Construction Greenhouse Gas Emissions – Lassen Facility

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
2024[6]	241.03	0.01	0.01	0.10	245.38
2025	4,816.33	0.14	0.28	3.03	4,905.45
				Total	**5,150.83**
				Amortized Over 20 Years	*257.54*

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent.
Total emissions may not sum due to rounding.
See Appendix B1.

As shown in Table 3.7-7, the estimated total GHG emissions during construction would be approximately 5,151 MT CO_2e over the construction period. Estimated total Project-generated construction emissions amortized over the project's anticipated 20-year lifetime would be approximately 258 MT CO_2e per year.

Operational Emissions

Operation of the Project would generate GHG emissions through mobile sources (motor vehicle trips to and from the Lassen Facility); energy use (electricity consumed by the Project); solid waste disposal; water supply, treatment, and distribution; wastewater treatment; refrigerants; off-road equipment; and stationary sources. CalEEMod was used to calculate the annual GHG emissions based on the operational assumptions described in Section 3.7.4.1.2.

Table 3.7-8 presents the estimated annual operational GHG emissions for the Lassen Facility.

Table 3.7-8. Estimated Annual Operational Greenhouse Gas Emissions – Lassen Facility

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
Mobile	809.91	0.01	0.06	1.07	828.52
Area	N/A	N/A	N/A	N/A	N/A
Energy	13,201.30	2.14	0.26	N/A	13,331.84
Water	29.62	1.63	0.04	N/A	308.91
Waste	310.92	31.08	0.00	N/A	1,087.80
Refrigerants	N/A	N/A	N/A	13.22	13.22
Off-Road Equipment	524.08	0.02	<0.01	N/A	525.88
Stationary Equipment	10,692.86	0.24	0.82	N/A	10,927.23
Logging/Haul Trucks[a]	8,205.40	0.28	1.28	8.75	8,602.09
				Rail[b]	1,267.17
				Switcher Locomotive	17.54
				Amortized Construction Emissions (Table 3.7-9)	*257.54*
				Total	**37,167.74**

6 The analysis assumes a construction start date of October 2024, which represents the earliest date construction was anticipated to potentially initiate at the time the analysis was performed. Assuming the earliest start date for construction represents the worst-case scenario for criteria air pollutant and GHG emissions because equipment and vehicle emission factors for later years would be slightly less due to more stringent standards for in-use off-road equipment and heavy-duty trucks, as well as fleet turnover replacing older equipment and vehicles in later years.

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent; N/A = not applicable; <0.01 = value is less than 0.005.
Total emissions may not sum due to rounding.
See Appendix B1.

[a] Logging/Haul Trucks emissions includes the emissions from all of the Lassen logging/haul trucks assuming a 54.5-mile one-way trip length. This assumption is conservative because it is unlikely that all logging/haul trucks would be traveling within the LCAPCD boundaries concurrently. These emissions are also represented in Table 3.7-7.

[b] Rail emissions include the line haul train emissions within the LCAPCD. These emissions are also represented in Table 3.7-13.

As shown in Table 3.7-8, the estimated operational GHG emissions for the Lassen Facility would be approximately 37,168 MT CO_2e per year.

Implementation of MM-AQ-9 (Operational Switcher Locomotive Exhaust Minimization – Lassen Facility) would reduce GHG emissions by requiring a Tier 4 Final engine for the on-site switcher locomotive at the Lassen Facility, which is quantified. The annual switcher locomotive emissions would be reduced from 18 MT CO_2e to 13 MT CO_2e per year with incorporation of MM-AQ-9, a reduction of 5 MT CO_2e. Therefore, with implementation of MM-AQ-9, the total annual emissions at the Lassen Facility would be approximately 37,163 MT CO_2e per year.

Biomass storage at the Lassen Facility would result in emissions of methane from woody biomass decomposition. However, CH_4 concentrations associated with storage of wood pellets are very low, especially at shorter storage durations. Higher temperatures, longer storage periods, and higher moisture contents would result in more degradation and methane released (Yazdanpanah et al. 2014). Due to the low moisture content expected for GSNR pellets (~9%), average temperatures, and short storage duration, the methane emissions from pellet storage would be negligible.

Tuolumne Facility

Construction Emissions

Construction of the Tuolumne Facility would result in GHG emissions that are primarily associated with use of off-road construction equipment, vendor and haul trucks, and worker vehicles. Construction GHG emissions were amortized assuming a 20-year development life after completion of construction. A detailed depiction of the construction schedule—including information regarding phasing, equipment used during each phase, trucks, and worker vehicles—is included in Appendix B1. As with Project-generated construction criteria air pollutant emissions, GHG emissions generated during construction of the Project would be short term in nature, lasting only for the duration of the construction period, and would not represent a long-term source of GHG emissions. Because there is no separate GHG threshold for construction, the evaluation of significance is discussed in the operational emissions analysis in the following text.

The estimated project-generated GHG emissions from construction activities for the Tuolumne Facility are shown in Table 3.7-9.

Table 3.7-9. Estimated Annual Construction Greenhouse Gas Emissions – Tuolumne Facility

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
2024	455.73	0.01	0.04	0.26	469.24
2025	3,257.98	0.08	0.22	2.09	3,327.81

Table 3.7-9. Estimated Annual Construction Greenhouse Gas Emissions – Tuolumne Facility

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
				Total	**3,797.05**
				Amortized Over 20 Years	*189.85*

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent.
Total emissions may not sum due to rounding.
See Appendix B1.

As shown in Table 3.7-9, the estimated total GHG emissions during construction would be approximately 3,797 MT CO_2e over the construction period. Estimated total Project-generated construction emissions amortized over the project's anticipated 20-year lifetime would be approximately 190 MT CO_2e per year.

Operational Emissions

Operation of the Project would generate GHG emissions through mobile sources (motor vehicle trips to and from the Lassen Facility); energy use (electricity consumed by the Project); solid waste disposal; water supply, treatment, and distribution; wastewater treatment; refrigerants; off-road equipment; and stationary equipment. CalEEMod was used to calculate the annual GHG emissions based on the operational assumptions described in Section 3.7.4.1.2.

Table 3.7-10 presents the estimated annual operational GHG emissions for the Tuolumne Facility.

Table 3.7-10. Estimated Annual Operational Greenhouse Gas Emissions – Tuolumne Facility

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
Mobile	784.61	0.02	0.04	1.22	798.63
Area	N/A	N/A	N/A	N/A	N/A
Energy	8,772.10	1.42	0.17	N/A	8,858.84
Water	15.47	0.81	0.02	N/A	155.12
Waste	164.61	16.45	0.00	N/A	575.90
Refrigerants	N/A	N/A	N/A	11.04	11.04
Off-Road Equipment	583.58	0.02	<0.01	N/A	585.58
Stationary Equipment	7,184.34	0.15	0.54	N/A	7,341.56
Logging/Haul Trucks[a]	4,001.95	0.14	0.62	4.27	4,195.42
				Rail[b]	59.30
				Amortized Construction Emissions (Table 3.7-11)	*189.85*
				Total	**22,771.24**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent; N/A = not applicable; <0.01 = value is less than 0.005.
Total emissions may not sum due to rounding.
See Appendix B1.

[a] Logging/Haul Trucks emissions include the emissions from all of the Tuolumne logging/haul trucks assuming a 55.7-mile one-way trip length. This assumption is conservative because it is unlikely that all logging/haul trucks would be traveling within the TCAPCD boundaries concurrently. These emissions are also represented in Table 3.7-8.

[b] Rail emissions include the line haul train emissions within the TCAPCD. These emissions are also represented in Table 3.7-13.

As shown in Table 3.7-10, the estimated operational GHG emissions for the Tuolumne Facility would be approximately 22,771 MT CO_2e per year.

Biomass storage at the Tuolumne Facility would result in emissions of methane from woody biomass decomposition. As described with the Lassen Facility, due to the low moisture content expected for GSNR pellets (~9%), average temperatures, and short storage duration, the methane emissions from pellet storage would be negligible (Yazdanpanah et al. 2014).

Transport to Market

Rail Transport

Rail transport would generate GHG emissions. As discussed in Section 3.2.4.1.3 within Chapter 3.2, Air Quality, emissions associated with long-term operations were quantified using a spreadsheet model.

Table 3.7-11 presents the estimated total annual GHG emissions from line haul rail travel from the Lassen Facility and the Tuolumne Facility to the Port of Stockton in each respective air district.

Table 3.7-11. Estimated Annual Greenhouse Gas Emissions – Line Haul Rail

Scenario	CO_2e Metric Tons per Year
Total Emissions by Air District	
Lassen County APCD	1,267.17
Northern Sierra AQMD	1,152.17
Butte County AQMD	827.09
Feather River AQMD	669.61
Sacramento Metropolitan AQMD	550.03
Tuolumne County APCD	59.30
San Joaquin Valley APCD	784.06
Total Annual Emissions	**5,234.28**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent; APCD = Air Pollution Control District; AQMD: Air Quality Management District.

As shown in Table 3.7-11, the estimated total line haul rail GHG emissions would be approximately 5,234 MT CO_2e per year.

Port of Stockton

Construction Emissions

Construction of the Port of Stockton facility would result in GHG emissions that are primarily associated with use of off-road construction equipment, vendor and haul trucks, and worker vehicles. Construction GHG emissions were amortized assuming a 20-year development life after completion of construction. A detailed depiction of the construction schedule—including information regarding phasing, equipment used during each phase, trucks, and worker vehicles—is included in Appendix B1. As with Project-generated construction criteria air pollutant emissions, GHG emissions generated during construction of the Project would be short term in nature, lasting only for the duration of the construction period, and would not represent a long-term source of GHG emissions. Because there is no separate GHG threshold for construction, the evaluation of significance is discussed in the operational emissions analysis in the following text.

The estimated project-generated GHG emissions from construction activities for the Port of Stockton are shown in Table 3.7-12.

Table 3.7-12. Estimated Annual Construction Greenhouse Gas Emissions – Port of Stockton

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
2024	144.70	<0.01	<0.01	0.03	146.15
2025	1,853.03	0.07	0.02	0.13	1,861.90
				Total	**2,008.05**
				Amortized Over 20 Years	*100.40*

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent.
Total emissions may not sum due to rounding.
See Appendix B1.

As shown in Table 3.7-12, the estimated total GHG emissions during construction would be approximately 2,008 MT CO_2e over the construction period. Estimated total Project-generated construction emissions amortized over 20 years would be approximately 100 MT CO_2e per year.

Operational Emissions

Operation of the Project would generate GHG emissions through mobile sources (motor vehicle trips to and from the Lassen Facility); energy use (electricity consumed by the Project); solid waste disposal; water supply, treatment, and distribution; wastewater treatment; refrigerants; off-road equipment; and stationary equipment. CalEEMod was used to calculate the annual GHG emissions based on the operational assumptions described in Section 3.4.2.2, Operation.

Table 3.7-13 presents the estimated annual operational GHG emissions for the Port of Stockton.

Table 3.7-13. Estimated Annual Operational Greenhouse Gas Emissions – Port of Stockton

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
Mobile	58.71	<0.01	0.01	0.08	60.56
Area	N/A	N/A	N/A	N/A	N/A
Energy	2,231.71	0.36	0.04	N/A	2,253.78
Water	10.29	0.54	0.01	N/A	27.68
Waste	7.95	0.79	0.00	N/A	27.82
Refrigerants	N/A	N/A	N/A	3.10	3.10
Off-Road Equipment	140.96	0.01	<0.01	N/A	141.44
Stationary Equipment	5.22	<0.01	<0.01	N/A	5.23
Ships[a]	1,010.11	0.01	0.05	N/A	1,026.04

Table 3.7-13. Estimated Annual Operational Greenhouse Gas Emissions – Port of Stockton

Year	CO_2	CH_4	N_2O	R	CO_2e
	Metric Tons per Year				
				Rail[b]	*784.06*
				Switcher[c]	*61.53*
				Amortized Construction Emissions (Table 3.7-14)	*100.40*
				Total	**4,491.64**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent; N/A = not applicable; <0.01 = value is less than 0.005.
Total emissions may not sum due to rounding.
See Appendix B1.
[a] Ships include the total emissions from cargo ships, tugboats, and pellet loadout within the SJVAPCD. These emissions are also represented in Table 3.7-14.
[b] Rail include the line haul train emissions within the SJVAPCD. These emissions are also represented in Table 3.7-11.
[c] The Port of Stockton switcher includes the total emissions for switching material from the Lassen and Tuolumne facilities.

As shown in Table 3.7-13, the estimated operational GHG emissions for the Port of Stockton would be 4,492 MT CO_2e per year.

Pellet storage at the Port of Stockton would result in negligible emissions of CH_4 from woody biomass decomposition. However, CH_4 concentrations associated with storage of wood pellets are very low, especially at shorter storage durations. Higher temperatures, longer storage periods, and higher moisture contents would result in more degradation and CH_4 released (Yazdanpanah et al. 2014). Due to the low moisture content expected for GSNR pellets (~9%), average temperatures, and short storage duration, the CH_4 emissions from pellet storage would be negligible.

Ship Transport

Ship transport would generate GHG emissions. The estimated annual GHG emissions from cargo ships, tugboats, and pellet loadout drop emissions within the SJVAPCD, as well as emissions from cargo ships and tugboats traveling through the BAAQMD are shown in Table 3.7-14.

Table 3.7-14. Estimated Annual Greenhouse Gas Emissions – Marine

Air District	CO_2	CH_4	N_2O	CO_2e
	Metric Tons per Year			
BAAQMD	869.80	0.02	0.04	883.34
SJVAPCD	1,010.11	0.01	0.05	1,026.04
			Total	**1,909.38**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; R= refrigerant; CO_2e = carbon dioxide equivalent; SJVAPCD = San Joaquin Valley Air Pollution Control District; BAAQMD = Bay Area Air Quality Management District.

As shown in Table 3.7-14, the estimated GHG emissions in the SJVAPCD and BAAQMD would be approximately 1,909 MT CO_2e per year.

Overall, estimated GHG emissions associated with the project are associated with various emission sources including amortized construction emissions, stationary sources, energy sources (electricity), mobile (passenger vehicles and trucks), train travel and switcher use (rail), ship transport (marine vessels), water and wastewater, solid waste, refrigerants, and off-road equipment usage. In total, annual GHG emissions across the state is anticipated to be approximately **95,445 MT CO_2e per year**.[7]

Forest Carbon Change

As outlined in 3.7.4.1 Methodology, an assessment of potential changes to forest carbon was performed to evaluate the balance between carbon loss as a result of fuel treatment activities and the carbon gain (carbon sequestration) through changes in forest structure and tree-to-tree competition, as well as forest carbon changes due to wildfires.

GSNR Treated Acres

To accurately identify the effects of the project's forest treatment activities on forest carbon dynamics, the extent of annual treatment acreages was first determined. For purposes of this analysis, it was assumed that the roject's pellet processing facilities will obtain an annual feedstock of 509,740 Bone Dry tons (BDTs) from GSNR Biomass Only Thinning Projects[8]. (Residuals, which have already been cut by third-parties unaffiliated with GSNR, account for the remainder of the Project's feedstock.) The total removed biomass output from FVS was used to determine the amount of forest biomass that would be supplied from these forest treatments. After converting total biomass to BDTs, it was estimated that approximately 85,779 acres are required to be treated annually to provide the anticipated feedstock supply from GSNR Biomass Only Thinning Projects. This equates to roughly 1.7 million acres treated from GSNR Biomass Only Thinning Projects over the project's 20-year life span.

Predicted Wildfire Impacts

Historic wildfire perimeters were utilized to predict the proportion of the project area likely to experience wildfire over the course of the 20-year Project life. This estimate is important for quantifying the breadth of wildfire impacts such as wildfire emissions, wildfire caused mortality, and forest carbon loss from wildfire. It has been estimated that 24% of the project's Working Area will likely experience wildfire over the 20-year project life, equating to roughly 1.2% annually. See Section 1.2 of Appendix B8 - *Methodology: Effect of Forest Treatments on Forest Carbon Storage and Greenhouse Gases* for a description of how estimated future wildfire impacts were determined.

Total Removed Carbon

As discussed, forest fuel treatments result in a near-term reduction in forest carbon. The degree of near-term above-ground, live carbon loss from GSNR's fuels treatments was estimated using FVS data to be approximately 11.9 tons of carbon per acre (or 1,019,912 tons of carbon per year, based upon the annual treated acreage assumptions discussed above). Table 3.7-15 shows the impacts of this initial carbon removal over the anticipated 20-year life of the project, expressed in both tons of carbon and metric tons of CO_2e.[9] Note that this calculation is conservative, as it presents <u>unadjusted</u> figures that do not account for either increased sequestration resulting from fuel treatments or the occurrence of wildfire on affected landscapes, which are addressed in subsequent sections.

---

7 This amount does not sum the total figures shown in the individual tables, due to the inclusion of certain emissions in multiple tables (e.g., logging/haul trucks; rail transport within LCAPCD, TCAPCD, SJVAPCD; ship transport within SJVAPCD), which should not be double-counted.

8 The annual feedstock assumption (509,740 BDTs) used in this Forest Carbon Change analysis is slightly more than the true annual amount of feesdtock anticipated (508,740 BDTs), which was used to determine feedstock acquisition assumptions (i.e., treatment crews, logging/haul trips, off-road equipment, etc.). Therefore, the forest carbon change analysis herein is considered conservative.

9 One ton of carbon (C) equals 3.67 tons of CO_2e, or ~3.33 metric tons (MT).

Table 3.7-15. Initial Carbon Impact of GSNR Biomass Only Thinning Projects

	Initial Carbon Removal Impact (Unadjusted)
Carbon - Tons/acre	11.9
Carbon Tons/year	1,020,770
CO_2e – Metric tons/year	3,398,519
Carbon - Total tons (20 yr) Project Life	20.4 million
CO_2e – Total metric tons (20 yr) Project Life	67,913,288

Carbon Sequestration Effects

The effects of the project's forest treatments on carbon sequestration stem from changes in forest structure, tree-to-tree competition, and changes in wildfire severity. While forest treatments result in near-term carbon loss, they often have a long term-effect of increased carbon storage and wildfire resilience (Stephens et al. 2009, North and Hurteau 2011). In wildfire-prone forests, it has been observed that fuel treatments that target smaller diameter trees and retain large, fire-resistant trees were most effective in protecting tree-based carbon stocks over the long-term and ensuring that forests remain carbon sinks rather than carbon sources (Hurteau and North 2008). Additionally, treated forest stands have been found to retain greater levels of above ground carbon stored in live trees following wildfire. Therefore, treated stands recover baseline carbon storage more quickly than untreated, overcrowded stand (Carlson et al. 2012).

Rates of carbon sequestration were calculated by measuring changes in above-ground, live carbon over a sixty-year period (2024-2084)[10] in both untreated and treated stands. This time frame allows for the assessment of forest treatment impacts during and beyond the Project's lifespan. As shown in 3.7-16, treated stands sequester more carbon over time. In modeling scenarios where wildfire is not assumed to occur, treated stands sequester approximately 4.6 million more tons of carbon in live trees over this period compared to untreated stands. In scenarios where wildfire is assumed to occur, carbon sequestration in treated stands equates to roughly 4.8 million more tons of carbon in live trees over this period compared to untreated stands.

Table 3.7-16. Effects of GSNR Biomass Only Thinning Projects on Carbon Sequestration

	Sequestered Above Ground, Live Carbon (2024-2084)		
Forest Condition	Carbon – Tons/acre	Carbon – Total tons	CO2e – Total metric tons
Untreated, no fire	51.02	87.5 million	291.3 million
Treated, no fire	53.66	92.1 million	306.6 million
Untreated, with fire	50.68	86.9 million	289.3 million
Treated, with fire	53.46	91.7 million	305.3 million

As an initial matter, this data in Table 3.7-16 (an average of 305.9 MMT CO_2e over 60 years under no fire and with fire conditions) demonstrates that the carbon sequestration of the treated forest acreage more than recovers the

[10] The 60-year time scale is utilized to assess the impacts of GSNR Biomass Only Thinning Projects because forest thinning treatments have lasting impacts, and the forest responds to the improved growing conditions over a longer period than the anticipated life of the project.

initial carbon loss noted in Table 3.7-15 (67,913,288 MT CO_2e over 20 years) as a result of the project's feedstock acquisition activities. Carbon sequestration also occurs in untreated stands, but at a lower rate compared to treated stands (an average of 290.3 MMT CO_2e over 60 years under no fire and with fire conditions); however, untreated stands do not involve initial carbon loss from forest management activities. Notably, there was a substantial increase in the amount of carbon sequestered on treated lands, both with and without the occurrence of wildfire on the landscape. 4.6 to 4.8 million additional tons of carbon sequestered is equivalent to approximately 15.3 to 16 MMT additional CO_2e sequestered over 60 years. Similarly, while sequestered forest carbon should be evaluated on a long-term basis, when amortized over 60 years, the project's treated stands are estimated to sequester approximately 260,833 MT additional CO_2e per year, or 15,650,000 MT additional CO_2e over the 60-year timescale.

Decrease in Emissions from Wildfire

Forest fuel treatments can result in substantial reductions in emissions produced by wildfires (Brodie et al. 2024, North and Hurteau 2011, Stephens et al. 2012a). Fuels treatments reduce the severity of wildfires and therefore result in reduced fuel consumption and emissions. Treated stands often experience greater levels of carbon retained in live trees compared to untreated stands following wildfire.

FVS provides particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$) emissions during wildfire based on fuels composition and wildfire severity. Predicted $PM_{2.5}$ emissions from wildfires in treated and untreated stands were then cross walked to the Fire Order Fire Effects Model (FOFEM) to quantify other emission types. FOFEM uses emission factors to calculate particulate and chemical emissions based on the fuel consumed during flaming and smoldering combustion (Ward and Hardy 1991). These emission factors allow the determination of CO_2 and CH_4 (in addition to other criteria air pollutants) emissions from the known $PM_{2.5}$ emissions calculated in FVS.

As presented below in Table 3.7-17, emissions from wildfires predicted to occur over the life of the project are substantially reduced in treated stands. Carbon dioxide emissions are reduced by approximately 4 million MT CO_2e, and CH_4 (methane) emissions are reduced by roughly 1 million MT CO_2e, over the life of the project. Wildfire GHG emissions from each GHG were then converted to CO_2e to account for the associated GWP.

Table 3.7-17. Changes in Wildfire GHG Emissions Due to GSNR Biomass Only Thinning Projects

Emission Type	Untreated Stands (tons)	Treated Stands (tons)	Emissions Reduction (tons)[a]	Emissions Reduction (tons CO_2e)[b]	Emissions Reduction (MT CO_2e)[c]
CO_2	32,276,328	28,309,811	3,966,517	3,966,517	3,598,364
CH_4	335,967	294,371	41,597	1,039,900	943,381
				Total	**4,541,745**

Notes: CO_2e = carbon dioxide equivalent; MT = metric tons.

a The emissions reduction in tons of CO_2 was calculated by subtracting the tons of CO_2 of treated stands from the tons of CO_2 of untreated stands.

b The emissions reduction in tons of CO_2e was calculated by multiplying the tons of CO_2 by the global warming potential for CO_2, which is 1, and CH_4, which is 25 (IPCC 2014). c The emissions reduction in MT of CO_2e was calculated by multiplying the tons of CO_2e by the conversion factor of 0.907.

As provided above in Table 3.7-17, the project is estimated to reduce CO_2e emitted by wildfires by roughly 4.5 MMT over course of the project's 20-year span, or approximately 227,087 MT or 0.2 MMT of CO_2e annually. This equates to roughly 0.06% of California's annual GHG inventory in 2021 (0.2 MMT CO_2e of forest carbon benefit compared to 381.3 MMT CO_2e of total statewide emissions) (CARB 2023a).

Decreased Tree Mortality

The effect of fuels treatments on wildfire-caused tree mortality has been found to be beneficial, with fuel treatments often decreasing the rate of tree mortality (Prichard and Kennedy 2012, Stephens et al., 2009, Stephens and Moghaddas 2005, Steel et al. 2021). By removing smaller diameter trees, brush, and other highly flammable materials, fuels treatments create conditions that make it harder for fires to reach and damage larger, more resilient trees. These strategic reductions in forest fuels decrease wildfire severity and therefore allow treated stands to better withstand wildfire impacts.

FVS provides outputs for wildfire-caused mortality in the form of percent forest stand basal area experiencing mortality. This output allows for a relative comparison of wildfire caused morality between untreated and treated stands. As provided below in Table 3.7-18, the project's fuel treatments are predicted to reduce wildfire caused mortality by **24.1%** when compared to untreated, baseline conditions. These reductions are captured in carbon sequestration rates provided in Table 3.7.16, as dead trees are not actively sequestering carbon.

Table 3.7-18. Changes in Wildfire Caused Tree Mortality Due to GSNR Biomass Only Thinning Projects

Forest Condition	Mortality (Percent basal area)	Mortality Reduction
Untreated, with fire	56.69%	
Treated, with fire	32.59%	24.1%

As presented in Table 3.7-18, the project's fuel treatments are expected to result in large reductions of wildfire caused mortality resulting in the retention of mature seed producing conifers. Therefore, the Project's fuel treatments are expected to decrease the potential for type conversion and help ensure that high levels of forest carbon storage will be sustained over time.

In addition, rates of non-wildfire caused tree mortality are also expected to decrease in treated forests. As forest stands become overstocked, stand density related mortality increases due to increased competition and higher likelihood of forest diseases and pests. This is especially true in drought prone regions such as the Project area. Research suggests that forests begin to experience stand density-related mortality at 55% of the maximum SDI, with peak mortality occurring at 85% of maximum SDI (Sherlock 2007). Forest treatments have been proven to reduce density and drought related mortality (Restaino et al. 2019, Zhang et al. 2019)

Impact on Soil Carbon

As stated in Section 3.7.1.4, the specific effects of forest fuels treatments on soil carbon will depend on factors such as treatment intensity, frequency, and site characteristics. Standard forest harvests have been found to have little effect on soil organic carbon levels, whereas aggressive harvest methods resulted in carbon losses across all layers of forest soil (Achat et al. 2015). Fuels treatments have been found to have little to no effect on forest soil carbon stocks (Boerner et al. 2008, North et al. 2009, Dore et al. 2016, Stephens et al 2012b). In fact, fuel treatments may reduce future soil carbon losses by preventing soil erosion following high intensity wildfires. Based on research on different fuel treatment methods, it was found that there were no notable disparities in soil carbon levels between thinned and untreated forest stands (Moghaddas and Stephens 2007).

The project is unlikely to result in substantial changes to soil carbon levels. Proposed fuels reduction activities are not expected to result in substantial soil disturbance or degradation through the implementation of best management practices for erosion control and soil protection. In addition, the project's fuels reduction activities resemble conventional harvest methods which do not result in a high degree of soil carbon loss observed during aggressive harvest methods. Finally, through facilitating a reduction in wildfire severity, the Project's fuels treatments are expected to reduce the likelihood of extensive soil erosion and carbon loss from high severity wildfires.

Forest Carbon Change Summary

As shown in Table 3.7-16, treated forests sequester above-ground carbon at a faster rate compared to untreated forest stands. As such, over a timescale of 60 years, treated forests under the project would sequester more carbon compared to untreated forests under existing conditions. For the project area of effect, the project results in a range of 305.3 to 306.6 million MT CO_2e sequestered for treated forests compared to a range of 289.3 to 291.3 million MT CO_2e if the forest remain untreated.

However, treated forests result in an initial loss of carbon associated with treatment activities that remove biomass and associated carbon stored. The initial loss of carbon storage (i.e., the amount of carbon in a forest at a given time) is often characterized as a "one-time" loss, while carbon sequestration (i.e., the rate at which carbon is removed from the atmosphere within a given time) is often characterized as a long-term, ongoing process. Untreated forests do not undergo treatment activities so the initial loss of carbon would not occur under existing conditions. As presented in Table 3.7-15, the initial loss of carbon associated with the proposed treatment activities over 20 years is 20.4 million tons of carbon, which equates to 67,913,288 MT CO_2e.

Treated forests reduce the risk of density-related mortality and wildfire and associated emissions, while this benefit does not occur under untreated forest conditions. As shown in Table 3.7-17, treated forests under the project are estimated to avoid approximately 4.5 MMT CO_2e over 20 years. The wildfire emissions avoidance estimate is anticipated to be undervalued as avoided wildfire benefits may continue beyond 20 years.

Table 3.7-19 presents the forest carbon considerations discussed above in terms of CO_2e for treated and untreated forest stands: initial carbon removal, forest stand carbon sequestration, and avoided wildfire.

Table 3.7-19 GSNR Biomass Only Thinning Projects Treated and Untreated Forest Stand GHG Emissions

	Treated Forest Stand (MT CO_2e)	Untreated Forest Stand (MT CO_2e)
Initial carbon removal from GSNR thinning activities (total over 20 years)	-67,913,288	0
Forest stand carbon sequestration (total over 60 years)	305,950,000	290,300,000
Avoided wildfire due to GSNR thinning activities (total over 20 years)	4,541,745	0
Total	**242,578,457**	**290,300,000**

As shown in Table 3.7-19, both treated and untreated forests sequester and store carbon, though the untreated forest condition does not involve an initial carbon removal, resulting in a greater total CO_2e of the quantified factors herein, or provide avoided wildfire benefits. While not quantified, the untreated forests also do not provide reduced tree mortality benefits (beyond the wildfire avoidance benefits) anticipated to occur under the proposed forest treatment.

It is important to note that maximizing carbon stored in forest stands is not the goal of forest resiliency. Instead, as stated in the State's Forest Carbon Plan, forest health improvements aim to ensure the state's forest operate as a carbon sink (State of California 2021). Forest carbon carrying capacity, which is the amount that a forest can store and still be resilient (i.e., have low levels of mortality) to fire, drought, and other disturbances (e.g., bark beetle), is a key consideration in assessing forest health and carbon storage (U.S. Forest Service 2023). The concept of forest carbon carrying capacity emphasizes carbon stability and the level of carbon storage that forests can maintain, rather than the maximum level of carbon forests can store.

Without disturbance, forests continue to accumulate more carbon as tree size and density increases. This additional biomass beyond sustainable levels, however, makes the forest prone to disturbances, such as drought stress, pests, pathogens, and higher severity wildfire, which increase tree mortality and carbon loss. Tree mortality reduces carbon stocks as dead trees decompose and return carbon and other GHGs such as CH_4 into the atmosphere. Additionally, forests with stocking rates beyond appropriate carbon carrying capacity are more vulnerable to large-scale mortality and subsequent type conversion, resulting in decreased carbon sequestration as forests are replaced by other vegetation types (Campbell et al. 2012, Liang et. al. 2017). Therefore, forest carbon carrying capacity is lower than the maximum carbon storage potential of a forest but represents the biomass that can be sustainably maintained given disturbance and mortality agents in the ecosystem, which increases the stability of the forest as a carbon sink (Hall et Al. 2024). Thus, rather than managing forests to maximum the level of stored carbon at the detriment of overall forest health, management activities should aim to return forest conditions to a sustainable carbon capacity with high rates of carbon sequestration. Treatments may need to accept short-term carbon losses to achieve the desired conditions conducive to forest resiliency and their longevity as carbon sinks rather than sources (UC Berkeley 2020).

Management activities that change the amount of presently stored carbon and increase the future rate of sequestered forest carbon often result in healthier forests with sustainable levels of carbon storage and high resilience to drought, disease, and wildfire. In general, forests managed so that growth and carbon accumulation are concentrated in large trees will also have longer, more secure carbon storage than stands where growth is concentrated in a high density of small trees prone to pest, pathogen, and fire mortality (U.S. Forest Service 2023).

The project addresses the increasing wildfire risks in California by managing high hazard and unsustainable levels of forest carbon/ fuel loads and promoting economic activity in rural areas. This initiative focuses on converting low or negative value woody biomass, such as brush and small trees, into industrial wood pellets. These actions help mitigate wildfire hazards while utilizing materials from sustainable forest management practices across various land types.

This assessment evaluates the project's impact on forest carbon dynamics and GHG emissions. Despite initial carbon reductions, treated forests are projected to sequester more carbon over time and exhibit greater resilience to wildfires compared to untreated forests. Fuel treatments are modeled to significantly decrease wildfire severity, thereby maintaining carbon stocks in live trees, and substantially reducing wildfire emissions. The project is also expected to result in large reductions in wildfire caused mortality, diminishes the risk of forest type conversion to less carbon-dense ecosystems and preserving long-term carbon storage potential.

In summary, the key findings include:

- Treated stands are modeled to sequester an additional 4.6-4.8 million tons of carbon stored in live trees over 60 years compared to untreated stands, which equates to approximately 15,315,092-15,980,966 MT CO_2e over 60 years. Similarly, while sequestered forest carbon should be evaluated on a long-term basis, when amortized over 60 years (20 years of project life plus an additional 40 years of long-term effects), the project's treated stands are estimated to sequester approximately 260,800 MT CO_2e per year. These findings align with the State's goal of improving forest health and carbon sequestration (State of California 2021)
- The project's fuel treatments would result in an initial loss of sequestered carbon (20.4 million tons C over the life of the project); however, this is less than the amount of carbon that will naturally be sequestered by the treated lands over the relevant timescale (86.9 million tons C over 60 years with fire, or 29 million tons C over 20 years), even without accounting for the additional beneficial effects of these treatments.
- The project's fuel treatments are predicted to result in approximately 4.5 MMT of avoided CO_2e emissions from wildfires. While forest fuel treatments should be evaluated on a long-term basis, for mathematical purposes, on an annual basis (total avoided CO_2e divided by 20 years[11]), the project's fuel treatments are anticipated to result approximately 227,087 MT of avoided CO_2e per year.
- While overall, untreated forest stands store more carbon compared to untreated forest stands due to no initial loss of carbon, forest resiliency and balanced carbon carrying capacity, which emphasizes restoring forest health and maintaining carbon stability to keep forests as a carbon sink, is the appropriate forest management goal over maximizing stored carbon.
- The project is estimated to result in an approximate 24% reduction in wildfire-caused tree mortality.

In conclusion, the project not only addresses immediate wildfire risks but also contributes to long-term carbon sequestration and forest health, aligning with state and national broader environmental and economic goals. By implementing strategic fuel treatments, the project improves forest conditions and reduces the adverse impacts of severe wildfires within the project's landscapes.

Conclusion

Estimated GHG emissions associated with the project are associated with various emission sources including stationary sources, area sources, energy sources (natural gas and electricity), mobile (passenger vehicles and trucks), train travel and switcher use (rail), ship transport (marine vessels), water and wastewater, solid waste, refrigerants, and off-road equipment usage. In total, annual GHG emissions across the state is anticipated to be 94,922 MT CO_2e per year. [12]

The potential exists for long-term, cumulative forest carbon benefits as explained above. On an annual basis (forest carbon benefits amortized over 60 years), the project's fuel treatments are predicted to result in approximately 227,087 MT of avoided CO_2e emissions from wildfires and treated stands are modeled to sequester an additional approximately 260,800 MT of carbon stored in live trees compared to untreated stands. The project's fuel treatments would result in an initial loss of stored carbon (67,913,288 MT CO_2e over 20 years). When considering total carbon sequestered by the GSNR-treated forest stands (an average of 305,950,000 MT CO_2e over 60 years under with fire and no fire conditions), the initial stored carbon loss would be recovered; however, untreated forests

11 Fuel treatment is evaluated over 20 years to evaluate the immediate impact on wildfire emissions over the course of the project, which is 20 years.

12 This amount does not sum the total figures shown in the individual tables, due to the inclusion of certain emissions in multiple tables (e.g., logging/haul trucks; rail transport within LCAPCD, TCAPCD, SJVAPCD; ship transport within SJVAPCD), which should not be double-counted.

also continue to sequester carbon overtime (an average of 290,300,000 MT CO_2e over 60 years under with fire and no fire conditions) with no initial carbon loss associated with biomass removal.

While the project would result in forest carbon benefits, the project also directly or indirectly generates substantial GHG emissions and initial loss of sequestered carbon. To meet CEQA's mandate of good faith disclosure (*California Native Plant Society v. City of Santa Cruz, supra,* 177 Cal.App.4th) by acknowledging potential future impacts in light of the uncertainties, this EIR classifies this GHG impact as **potentially significant**, recognizing the reliability of estimates of direct GHG emissions and carbon loss, and the potential uncertainty of the intended net carbon benefits of reduced wildfire intensity and increased carbon sequestration in treated areas. It is consequently possible that the project's GHG emissions may have a significant impact on the environment for purposes of Impact GHG-1. Even though the predicted long-term outcome may be beneficial, the "potentially significant" determination is intentional as an expression of GSNR's commitment to continued support of ongoing research and adjustment of carbon management approaches as the science evolves.

Mitigation measures introduced in Chapter 3.2, Air Quality and 3.14 Transportation, would also reduce GHG emissions, as listed in Section 3.7.4.4. No additional feasible GHG-specific mitigation measures have been identified. While these measures will reduce the project's direct GHG emissions, they would not mitigate those emissions to a level of insignificance.

This EIR classifies this GHG impact as **significant and unavoidable**. Even though the long-term outcome may yet become beneficial, the "significant and unavoidable" determination alerts the public to the potential that net positive emissions may persist over time, and any more definitive conclusion would be speculative in light of the above-noted uncertainties.

Impact GHG-2 — The project would potentially conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

CARB 2022 Scoping Plan

As defined by AB 32, CARB is required to develop the Scoping Plan, which provides the framework for actions to achieve the State's GHG emission targets. The Scoping Plan is required to be updated every five years and requires CARB and other state agencies to adopt regulations and initiatives that will reduce GHG emissions statewide. The first Scoping Plan (*Climate Change Proposed Scoping Plan: A Framework for Change)* was adopted in 2008, and was updated in 2014, 2017, and most recently in 2022. The Scoping Plan is not directly applicable to specific projects, nor is it intended to be used for project-level evaluations.[13] However, given that the Scoping Plan establishes the official framework for the measures and regulations that will be implemented to reduce California's GHG emissions in alignment with the adopted targets, a project would be found to not conflict with the statutes if it would meet the general policies in reducing GHG emissions in order to facilitate the achievement of the state's goals and would not impede attainment of those goals. CARB's 2017 Scoping Plan update was the first to address the state's strategy for achieving the 2030 GHG reduction target set forth in SB 32 (CARB 2017a), and the most recent CARB 2022 Scoping Plan update outlines the state's plan to reduce emissions and achieve carbon neutrality by 2045 in alignment with AB 1279 and assesses progress is making toward the 2030 SB 32 target (CARB 2022).

---

13 The Final Statement of Reasons for the amendments to the CEQA Guidelines reiterates the statement in the Initial Statement of Reasons that "[t]he Scoping Plan may not be appropriate for use in determining the significance of individual projects because it is conceptual at this stage and relies on the future development of regulations to implement the strategies identified in the Scoping Plan" (CNRA 2009).

As such, given that SB 32 and AB 1279 are the relevant GHG emission targets, 2022 Scoping Plan update that outlines the strategy to achieve those targets, is the most applicable to the Project.

CARB approved the 2022 Scoping Plan in December 2022 to outline the state's plan to reduce anthropogenic emissions to 85% below 1990 levels by 2045 and achieve carbon neutrality by 2045 or earlier. The 2022 Scoping Plan also assesses the progress the state is making towards reducing GHG emissions by at least 40% below 1990 levels by 2030, as is required by SB 32 and laid out in the 2017 Scoping Plan. However, the plan found that additional reductions are needed by 2030 (i.e., 48% below 1990 levels) for the state to remain on track to achieve net zero GHG emissions by 2045. Therefore, carbon reduction programs included in the 2022 Scoping Plan build on and accelerate those currently in place, including moving to zero-emission transportation; phasing out use of fossil gas use for heating homes and buildings; reducing chemical and refrigerants with high GWP; providing communities with sustainable options for walking, biking, and public transit; and displacement of fossil-fuel fired electrical generation through use of renewable energy alternatives (e.g., solar arrays and wind turbines) (CARB 2022). Implementation of the measures and programs included in the 2022 Scoping Plan largely are the responsibility of policymakers and would result in the reduction of project-related GHG emissions with no action required at the project-level.

The project would involve no natural gas consumption and would include no natural gas fireplaces, which supports the Scoping Plan's building decarbonization, other industrial manufacturing .

As discussed previously, the 2045 carbon neutrality goal required CARB to expand proposed actions in the 2022 Scoping Plan to include those that capture and store carbon in addition to those that reduce only anthropogenic sources of GHG emissions. The 2022 Scoping Plan is the first to include discussion of the Natural and Working Lands (NWL) sectors as a source of emissions and opportunity for carbon capture and storage. The Scoping Plan modeling indicates that in the near future, NWL will act as a net source of emissions, due to the effects of climate change (e.g., extreme wildfires, drought) and land management. As such, while avoided conversion of the state's NWL is important to long-term climate goals, land preservation on its own will not ensure GHG emissions or carbon storage benefits from NWL. Instead, NWL must be properly managed with climate-smart actions to support carbon neutrality and healthy and resilient lands. By converting low-value woody biomass into industrial wood pellets, the Project not only mitigates wildfire hazards but also promotes sustainable forest management practices across diverse land types. The project would accelerate natural removal of carbon and build climate resilience in our forests, thereby indirectly conserving the state's NWL.

Overall, the proposed project would comply with the regulations adopted in furtherance of the Scoping Plan to the extent applicable and required by law. As mentioned above, several Scoping Plan measures would result in reductions of project-related GHG emissions with no action required at the project-level, including those related to reduced fossil fuel use and NWL. As demonstrated herein, the project would not conflict with the majority of the CARB's 2022 Scoping Plan actions and with the state's ability to achieve the 2030 and 2045 GHG reduction and carbon neutrality goals. Further, the proposed project's consistency with the applicable measures and programs would assist in meeting GHG emission reduction targets in California. However, the project would potentially conflict with CARB's 2022 Scoping Plan VMT action, as the project's VMT impact is significant and unavoidable. Additionally, as discussed under Impact GHG-1, while the project is predicted to result in substantial forest carbon benefits, the extent of these benefits are potentially uncertain, and project activities also cause substantial GHG emissions and initial forest carbon loss. If these negative impacts occur, but the benefits are less than expected, this could result in GHG increases that conflict with the goals of the 2022 Scoping Plan.

Table 3.7-20 evaluates the project's potential to conflict with the measures from the 2022 Scoping Plan, that are relevant and applicable to the project.

Table 3.7-20. Project Potential to Conflict with 2022 Scoping Plan

Sector	Action	Potential to Conflict
GHG Emissions Reductions Relative to the SB 32 Target	40% below 1990 levels by 2030	***Potential conflict.*** While the SB 32 GHG emissions reduction target is not an Action that is analyzed independently, it is included in Table 2-1 of the 2022 Scoping Plan for reference. The project is not expected to obstruct or interfere with agency efforts to meet the SB 32 reduction goal; however, in light of the uncertainties discussed above, it is possible that project emissions may not support achievement of the Scoping Plan's reduction target.
Smart Growth/VMT	VMT per capita reduced 25% below 2019 levels by 2030, and 30% below 2019 levels by 2045	***Potential conflict.*** The project's VMT impacts related to sustainable forest management projects and the Lassen Facility are significant and unavoidable. Therefore, the project would potentially obstruct or interfere with agency efforts to meet this regional VMT reduction goal, including through implementation of SB 375.
Light-duty Vehicle (LDV) Zero Emission Vehicles (ZEVs)	100% of LDV sales are ZEV by 2035	***No conflict.*** As this action pertains to LDV sales within California, the project would not obstruct or interfere with its implementation. Furthermore, the project would support the transition from fossil fuel LDV to ZEV through its provision of EV chargers in compliance with CALGreen standards.
Truck ZEVs	100% of medium-duty vehicle (MDV)/ heavy-duty vehicle (HDV) sales are ZEV by 2040	***No conflict.*** As this action pertains to MDV and HDV sales within California, the project would not obstruct or interfere with its implementation. Furthermore, the project would comply with the 2022 CALGreen code.
Ocean-going Vessels (OGV)	2020 OGV At-Berth regulation fully implemented, with most OGVs utilizing shore power by 2027. 25% of OGVs utilize hydrogen fuel cell electric technology by 2045.	***No conflict.*** As this action pertains to port technologies across California, the project would not obstruct or interfere with its implementation. The project would comply with the OGV At-Berth regulation. Furthermore, the project would work with the Port of Stockton to incorporate cleaner technologies, such as hydrogen fuel cell electric technology, as they become available.

Table 3.7-20. Project Potential to Conflict with 2022 Scoping Plan

Sector	Action	Potential to Conflict
Port Operations	100% of cargo handling equipment is zero-emission by 2037. 100% of drayage trucks are zero emission by 2035.	***No conflict.*** As this action pertains to cargo handling equipment manufacturers across California, the project would not obstruct or interfere with its implementation. The project would comply with all CARB cargo handling equipment regulations. Furthermore, the project would work with the Port of Stockton to incorporate cleaner technologies as they become available.
Freight and Passenger Rail	100% of passenger and other locomotive sales are ZEV by 2030. 100% of line haul locomotive sales are ZEV by 2035. Line haul and passenger rail rely primarily on hydrogen fuel cell technology, and others primarily utilize electricity.	***No conflict.*** As this action pertains to the sale of locomotives, the project would not obstruct or interfere with its implementation. The project would comply with CARB line haul locomotive regulations. The project would work with their rail operators to incorporate cleaner technologies as they become available.
Electricity Generation	Sector GHG target of 38 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) in 2030 and 30 $MMTCO_2e$ in 2035 Retail sales load coverage[1] 20 gigawatts (GW) of offshore wind by 2045 Meet increased demand for electrification without new fossil gas-fired resources	***No conflict***. As this action pertains to the statewide procurement of renewable energy, the project would not obstruct or interfere with its implementation.
New Residential and Commercial Buildings	All electric appliances beginning 2026 (residential) and 2029 (commercial), contributing to 6 million heat pumps installed statewide by 2030	***No conflict***. The project would not obstruct or interfere with CARB's efforts to meet the all-electric appliance and heat pump goals. As designed, the project would be all electric and would not use natural gas.
Construction Equipment	25% of energy demand electrified by 2030 and 75% electrified by 2045	***No conflict***. As this action pertains to the electrification of off-road equipment across California, the project would not obstruct or interfere with its implementation. The project includes construction equipment with higher tier engines and would transition electric equipment as regulations become effective.
Other Industrial Manufacturing	0% energy demand electrified by 2030 and 50% by 2045	***No conflict***. The project would not obstruct or interfere with CARB's efforts to meet 0% energy demand electrified by 2030 and 50% by 2045. As designed, the

Table 3.7-20. Project Potential to Conflict with 2022 Scoping Plan

Sector	Action	Potential to Conflict
		project would be all electric and would not use natural gas.
Low Carbon Fuels for Transportation	Biomass supply is used to produce conventional and advanced biofuels, as well as hydrogen	***No conflict***. The project would not obstruct or interfere with CARB's efforts to increase the provision of low carbon fuels for transportation. The development and use of biofuels in trucks and automobiles would occur at the state and regional level. Regardless, the project would implement MM-AQ-3 (Construction and Operation Renewable Diesel Fuel – Feedstock Acquisition, Lassen Facility, Tuolumne Facility, and Port of Stockton) which would incorporate renewable diesel as feasible.
Low Carbon Fuels for Buildings and Industry	In 2030s biomethane blended in pipeline Renewable hydrogen blended in fossil gas pipeline at 7% energy (~20% by volume), ramping up between 2030 and 2040 In 2030s, dedicated hydrogen pipelines constructed to serve certain industrial clusters	***No conflict***. The project would not obstruct or interfere with CARB's efforts to increase the provision of low carbon fuels for use in buildings and industry. The blending of biomethane and use of renewable hydrogen in existing natural gas pipelines would happen at the scale of the utility provider and without action required by the project. Furthermore, the project would not use natural gas.
High GWP Potential Emissions	Low GWP refrigerants introduced as building electrification increases, mitigating HFC emissions	***No conflict***. The project would not obstruct or interfere with agency efforts to introduce low GWP refrigerants. The State has established a prohibition on the sale or distribution of bulk HFCs identified as having a high GWP through SB 1206.
Natural and Working Lands	Conserve 30% of the state's NWL and coastal waters by 2030. Implement near- and long-term actions to accelerate natural removal of carbon and build climate resilience in our forests, wetlands, urban greenspaces, agricultural soils, and land conservation activities in ways that serve all communities—and in particular low-income, disadvantaged, and vulnerable communities.	***No conflict.*** By converting low-value woody biomass into industrial wood pellets, the Project not only mitigates wildfire hazards but also promotes sustainable forest management practices across diverse land types. As discussed under Impact GHG-1, the project would accelerate natural removal of carbon through sequestration and build climate resilience in our forests, thereby indirectly conserving the state's NWL.
Forests and Shrublands	At least 2.3 million acres treated statewide annually in forests, shrublands/chaparral, and grasslands, comprised of regionally specific management strategies that include prescribed fire, thinning, harvesting, and other management actions. No	***No conflict.*** The project would conduct forest thinning projects to increase forest wildfire resiliency. The Project would also increase the pace and scale of commercial thinning operations conducted by other entities through

Table 3.7-20. Project Potential to Conflict with 2022 Scoping Plan

Sector	Action	Potential to Conflict
	land conversion of forests, shrublands/chaparral, or grasslands.	utilization of forest biomass such as unmerchantable material.

Source: CARB 2022.

Based on the analysis in Table 3.7-5, the project would not conflict with the majority of strategies and measures in the 2022 Scoping Plan. However, the project would conflict with the Smart Growth/VMT strategy, and, in light of the uncertainties regarding forest carbon benefits, also has the potential to conflict with the "GHG Emissions Reductions Relative to the SB 32 Target" strategy. Therefore, the project is deemed to conflict with the 2022 Scoping Plan.

California 2030 Natural and Working Lands Climate Change Implementation Plan

The *Natural and Working Lands Climate Smart Strategy* provides priority actions and approaches that will help achieve carbon neutrality using nature-based solutions for the eight NWL types contained in California (CARB 2019). The Project's consistency with the priority nature-based climate solutions for the dominant NWL type (i.e., forests) is provided in Table 3.7-21.

Table 3.7-21. Project Potential to Conflict with Natural and Working Lands Implementation Plan

Applicable Nature-Based Climate Solutions	Potential to Conflict
Advance proactive vegetation management, ecological thinning, managed and science-based grazing, prescribed and cultural burns, and managed natural wildfire to reduce the risk of catastrophic wildfire.	***No conflict.*** The project increases the pace and scale of vegetation management to increase forest resiliency. By converting low-value woody biomass into industrial wood pellets, the project not only mitigates wildfire hazards but also promotes sustainable forest management practices across diverse land types.
Increase active reforestation efforts in areas recovering from severe wildfires and suffering from reduced natural regeneration as a result. Timely post-wildfire reforestation efforts can also prevent conversion of forest to shrublands and reduced water storage capacity in watersheds.	***No conflict.*** The project would likely expedite the pace and scale of post-fire restoration efforts through facilitating biomass utilization of burned woody material.
Increase commercial thinning to achieve disturbance-resilient forest structure on federal and privately owned forested parcels.	***No conflict.*** The project would conduct forest thinning projects to increase forest wildfire resiliency. The Project would also increase the pace and scale of commercial thinning operations conducted by other entities through utilization of forest biomass such as unmerchantable material.

Source: CARB 2019.

As shown in Table 3.7-21, the proposed project would not conflict with the applicable nature-based climate solutions for the dominant NWL type for the Sustainable Forest Management Projects. Climate smart land management through Sustainable Forest Management Projects would enable forests to be resilient to future climate changes (e.g., wildfire, drought, pest, etc.) that threaten the forests' ability to store and sequester carbon.

California Forest Carbon Plan

As described above under Impact GHG-1, it was estimated that 85,779 acres are required to be treated annually to provide the feedstock supply anticipated from GSNR Biomass Only Thinning Projects. This equates to roughly 1.7 million acres treated from GSNR Biomass Only Thinning Projects over the Project's 20-year life span. One of the California Forest Carbon Plan's goals is to increase forest restoration and fuels treatments, including mechanical thinning and prescribed burning, from the current rate of approximately 17,500 acres per year to 60,000 acres per year. As such, GSNR's Sustainable Forest Management Projects exceed the goals set in the California Forest Carbon Plan for forest fuel treatment acreages.

AB 1757 California's Nature-Based Solutions Climate Targets

As described above under Impact GHG-1, it was estimated that 85,779 acres are required to be treated annually to provide the feedstock supply anticipated from GSNR Biomass Only Thinning Projects. This equates to roughly 1.7 million acres treated from GSNR Biomass Only Thinning Projects over the Project's 20-year life span. This nature-based solution has an acreage target of 700,000 acres/year by 2030, 800,000 acres/year by 2038, and 1 million acres/year by 2045. As such, GSNR's Sustainable Forest Management Projects would greatly contribute to the nature-based solution goal for fuel reduction treatment acreages. Furthermore, by converting low-value woody biomass into industrial wood pellets, the project would not only mitigate wildfire hazards but would also promote sustainable forest management practices across diverse land types. As described below in the Forest Carbon Change section, the project is estimated to result in an approximate 24% reduction in wildfire-caused tree mortality, thereby decreasing wildfire severity. The project would help achieve the nature-based solution percentage targets for low to moderate severity wildfire such that the total percentage of low to moderate severity wildfire is 75% by 2030, 83% by 2038, and 90% by 2045.

Local GHG Reduction Plans

Feedstock Acquisition

Feedstock acquisition would take place in multiple jurisdictions and counties with potential local GHG reduction plans. These activities would be temporary in nature and would follow best management practices from the applicable lead agencies to reduce GHG emissions to the extent feasible.

Lassen Facility

Lassen County does not have an adopted local GHG reduction plan.

Project Consistency with the Tuolumne County Climate Action Plan

The Project would be consistent with the Ecosystem Preservation and Conservation strategy in the Tuolumne CAP by directly contributing to enhancing the protection of natural assets and ecosystems. By strategically managing vegetation, such as thinning out dense forest areas, the Project helps prevent catastrophic wildfires. This, in turn, preserves wildlife habitat, wetlands, and watersheds. Additionally, reducing the risk of intense wildfires promotes climate resilience by maintaining healthy ecosystems thereby enhancing biological carbon sequestration.

The Project would enhance forest resilience by reducing the buildup of low or negative value woody biomass, such as brush and small trees. By thinning trees and removing high hazard fuels, the forest becomes more resilient to disturbances like wildfire. The Project would reduce the risk of large-scale wildfires, thereby protecting dense forest species. As shown below in the Forest Carbon Change section, the Project would contribute to carbon sequestration by supporting both forest health and carbon storage, resulting in an additional 4.6-4.8 million tons of carbon stored in live trees over 60 years.

Project Consistency with the City of Stockton Climate Action Plan

The City's CAP has a Climate Impact Study Process (CISP), which is part of the Development Review Process, that describes BMPs to reduce GHG emissions from construction and operational activities (see CAP Appendix F). The CISP explains that applicants can use the CISP to identify BMPs that can feasibly be included within their projects and thereby ascertain their progress towards achieving the level of citywide GHG reduction goal sought by the CAP, namely, a 29% reduction compared with unmitigated conditions (reflecting former statewide 2020 goals under AB 32). The CAP itself acknowledges, however, that it is not intended, and likely not possible for, all projects to adhere to all of the BMPs listed within the CAP.

As previously discussed, the City's CAP is qualified to 2020 and the Project would include development that would occur post-2020, which may not be covered in the CAP. Indeed, the CAP is out of date insofar as it does not address post-2020 reductions called for under SB 32 and AB 1279, and its goal of achieving a 29% reduction compared with unmitigated conditions reflected statewide goals under AB 32, which have already been achieved. In addition, state building codes have become far more stringent since the CAP was approved in 2014, and the percentage of electricity generated by renewable electricity has increased substantially.

Even so, CEQA Guidelines section 15064.4(b)(3), provides that, in determining the significance of impacts associated with GHG emissions, lead agencies should consider the extent to which a project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions. Because the CAP remains in place, the applicable BMPs that will be implemented at the Port of Stockton facility are as follows.

BMP-1: Alternative Fuels. Power gasoline-powered construction vehicles by alternative fuels such as CNG rather than conventional petroleum or diesel products. As described in MM-AQ-3 (Construction and Operation Renewable Diesel Fuel – Feedstock Acquisition, Lassen Facility, Tuolumne Facility, and Port of Stockton), the project would use renewable diesel fuel in diesel-powered off-road equipment and diesel trucks during construction and operation as commercially available.

BMP-3: Equipment and Vehicle Idling. Reduce unnecessary idling through the use of auxiliary power units, electric equipment, and strict enforcement of idling limits. Include language in plans and specifications for construction contracts. The maximum recommended idling time is 3 minutes. While there would be few trucks at the Port of Stockton facility (primarily vendor vehicles), the project would comply with the idling times as required by the California Airborne Toxics Control Measure Title 13, Section 2485 of California Code of Regulations (CCR).

BMP-5: Employee Commutes. Reduce worker-related VMT through use of carpool, vanpool, shuttle services, and utilize alternative modes of transportation, including public transit, reducing single-occupancy VMT. The project would implement MM-AQ-4 (Construction and Operational Worker Commute Optimization – Feedstock Acquisition, Lassen Facility, Tuolumne Facility, and Port of Stockton) which would provide educational materials and encourage employee commute reduction.

BMP-7: Construction Equipment. Require the following technical specifications during all grading and construction activities:

- Tier 2 or Tier 3 engines shall be used on all equipment.
- Global positioning systems (GPS) shall be used to guide grading equipment.
- All diesel-fueled engines used in construction and grading shall have clearly visible tags issued by the on-site designee of the applicant showing that the engine meets these conditions.

The project would comply with CARB regulations and SJVAPCD Rules aimed at requiring fuel efficient off-road construction equipment and will use construction equipment that uses Tier 2 engines at a minimum.

BMP-14: Construction and Demolition Plan. Implement a construction and demolition (C&D) plan that will result in at least 50% diversion of C&D waste through reuse or recycling of non-hazardous construction waste from disposal (including, but not limited to, concrete, lumber, metal, and cardboard). During construction, the proposed project would comply with all state regulations related to solid waste generation, storage, and disposal, including the California Integrated Waste Management Act as amended and the CALGreen code. CALGreen requires recycling and/or salvage for reuse of a minimum of 65% of the non-hazardous construction and demolition waste.

BMP-16: Waste Hauling. Require at least 50% of building or construction materials that are not recyclable or re-usable for another project to be hauled to the nearest waste disposal facility or C&D recycling facility rather than transporting such materials farther from the project site, thereby generating increased emissions from waste transportation. During construction, the proposed project would be required to comply with CALGreen which requires recycling and/or salvage for reuse of a minimum of 65% of the non-hazardous construction and demolition waste. Construction debris would be hauled off site to the closest landfill to the project site such as Clean Planet, Inc. landfill, which is located approximately 1 mile southeast of the project site. Clean Planet, Inc handles construction debris, concrete and asphalt, wood lumber debris, and green waste.

The project would not conflict with the applicable BMPs included in the City's CAP.

Project Consistency with the Port of Stockton Clean Air Plan

The project would implement all available control strategies and would implement cleaner technologies as they become available to support the Port of Stockton's goals to improve air quality and reduce GHG emissions.

There would be little to no heavy-duty trucks traveling to the Port of Stockton as a result of the project, as all material would travel from the processing facilities by rail to the Port of Stockton. Regardless, the project would comply with the idling times as required by the California Airborne Toxics Control Measure Title 13, Section 2485 of California Code of Regulations (CCR). The project would not conflict with the Heavy-Duty Trucks strategy, nor would it obstruct the Port from implementing this strategy and its goals.

The project would comply with the Mobile Cargo Handling Equipment Regulation, which was adopted by CARB in 2005 and fully implemented in 2017. The project has committed to reducing emissions from cargo-handling equipment and off-road equipment during operation to the extent feasible. The project would implement MM-AQ-8 (Operational Equipment Exhaust Minimization – Tier 4 Final – Lassen Facility, Tuolumne Facility, and Port of Stockton), which would require Tier 4 Final engines for all diesel-powered equipment pieces that are 50 horsepower or greater. If Tier 4 Final equipment is not available, the next highest tier will be used, or battery-electric off-road equipment will be used as it becomes available. These actions would support the EQUIP-5 strategy to transition tenant-owned equipment to zero emissions by 2035 or in advance of the State regulation, when feasible. Furthermore, the project would implement MM-AQ-3 (Construction and Operation Renewable Diesel Fuel – Feedstock Acquisition, Lassen Facility, Tuolumne Facility, and Port of Stockton), which would require the project to use diesel fuel in diesel-powered off-road equipment and diesel trucks as commercially available. These actions would support the EQUIP-6 strategy to evaluate the use of renewable diesel in cargo-handling equipment. Therefore, the project would not conflict with the Cargo-Handling Equipment strategy, nor would it obstruct the Port from implementing this strategy and its goals.

The project would comply with the Ocean-Going Vessel At-Berth Regulation, which was adopted by CARB in 2007. The project would work with the Port to utilize cleaner or zero-emission harbor craft and ships as they become available to limit at-berth emissions. The project would not conflict with the Harbor Craft or Ships strategies, nor would it obstruct the Port from implementing these strategies and their goals.

While GSNR does not have operational control over the line haul trains being used, the project would work with rail operators to use the cleanest locomotives as they become available. Furthermore, the project would implement MM-AQ-10 (Operational Switcher Exhaust Minimization – Port of Stockton), which would require the project to use a Tier-4 Final engine for the on-site switcher at the Port of Stockton, if feasible and approved by the Port.

The project would not conflict with any other strategies within the Port of Stockton Clean Air Plan.

Conclusion

The project would not conflict with the majority of strategies and measures in the 2022 Scoping Plan. However, the project would conflict with the Smart Growth/VMT strategy, and, in light of the uncertainties regarding forest carbon benefits, also has the potential to conflict with the “GHG Emissions Reductions Relative to the SB 32 Target” strategy. Therefore, the project is deemed to conflict with the 2022 Scoping Plan.

The project would not conflict with the Draft California 2030 Natural and Working Lands Climate Change Implementation Plan and would in many ways support the plan by increasing the pace and scale of vegetation management through sustainable forest management practices to increase forest wildfire resiliency, thereby indirectly protecting forests and natural and working lands.

Similarly, the project would not conflict with, and would support, California’s Forest Carbon Plan by exceeding the plan’s treatment rate goals for annual forest fuel treatment acreages in California.

The project would also not conflict with, and would support, AB 1757 California’s Nature-Based Solutions Climate Targets. GSNR’s Sustainable Forest Management Projects would greatly contribute to the nature-based solution goal for fuel reduction treatment acreages. Furthermore, by converting low-value woody biomass into industrial wood pellets, the project would reduce wildfire-caused tree mortality, thereby decreasing wildfire severity. The project would also help achieve the nature-based solution percentage targets for low to moderate severity wildfire.

Regarding local GHG reduction plans, there are no applicable local GHG reduction plans for the Lassen Facility, but the project’s activities within Tuolumne County would not conflict with the Tuolumne County CAP, and the project’s activities within the Port of Stockton would not conflict with the City of Stockton’s CAP BMPs or the Port of Stockton Clean Air Plan.

While the project is aligned with these plans and in many ways supports them to meet their goals, the conflict with the 2022 Scoping Plan is **potentially significant.** As described under Impacts TRF-2 and GHG-1, the project will implement feasible Mitigation Measures to reduce the GHG emissions generating this conflict, but those emissions cannot be mitigated to a level of insignificance. Therefore, the impact related to potential conflict with an applicable plan, policy, or regulation of an agency adopted for the purpose of reducing emissions of GHGs is deemed to be **significant and unavoidable.**

3.7.4.3 Cumulative Impacts

Impact GHG-1 The project would potentially generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.

GHG emissions are an inherently cumulative impact resulting from past, current, and future projects—and the cumulative projects described in Section 3.0.3.2, Cumulative Projects and Scope of Analysis, within this EIR, would likely contribute to this widespread cumulative impact given the cumulative nature of GHGs. Given the global scope of climate change, it is not anticipated that a single project would have an individually discernible effect on global climate change. It is more appropriate to conclude that if a project is anticipated to result in a substantial increase in GHG emissions, it would combine with global emissions to cumulatively contribute to global climate change.

While the project would result in substantial forest carbon benefits, the project also directly generates substantial GHG emissions. Further, the project's fuel treatments would result in an initial loss of sequestered carbon, even though it is anticipated that this loss will be recovered through biological sequestration over time. Given the reliability of estimates of direct GHG emissions, and the potential uncertainty of the intended net carbon benefits of reduced wildfire intensity and increased carbon sequestration in treated areas, it is concluded that the project would result in potentially significant and unavoidable impacts to greenhouse gas emissions and, therefore, would result in a **cumulatively considerable impact.**

Impact GHG-1 The project would potentially conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

While the project is aligned with the majority of the goals and requirements in applicable GHG reduction plans, it has been deemed to conflict with certain strategies in CARB's 2022 Scoping Plan. This impact is significant and unavoidable, and, therefore, would result in a **cumulatively considerable impact.**

3.7.4.4 Mitigation Measures

The following mitigation measures applied in the Chapter 3.2, Air Quality and 3.14, Transportation, of this EIR are also applicable to the reduction of GHG emissions.

MM-AQ-2 Construction and Operation Limit Truck and Equipment Idling – Feedstock Acquisition, Lassen Facility, and Tuolumne Facility. During construction and operation, GSNR shall reduce idling time of heavy-duty trucks either by requiring them to be shut off when not in use or limiting the time of idling to no more than 3 minutes (thereby improving upon the 5-minute idling limit required by the state airborne toxics control measure, 13 CCR 2485). These requirements shall be included as enforceable terms in any contract or subcontract by GSNR for these activities and GSNR shall post clear signage reminding workers to limit idling of construction equipment and heavy-duty trucks.

MM-AQ-2 is not quantified in the analysis.

MM-AQ-3 Construction and Operation Renewable Diesel Fuel – Feedstock Acquisition, Lassen Facility, Tuolumne Facility, and Port of Stockton. During construction and operation, GSNR shall use renewable diesel fuel in diesel-powered off-road equipment and diesel trucks during construction and operation whenever commercially available. Renewable diesel fuel must meet the following criteria:

- Meet California's Low Carbon Fuel Standards and be certified by CARB Executive Officer;
- Be hydrogenation-derived (reaction with hydrogen at high temperatures) from 100% biomass material (i.e., non-petroleum sources), such as animal fats and vegetables;
- Contain no fatty acids or functionalized fatty acid esters; and
- Have a chemical structure that is identical to petroleum-based diesel and complies with American Society for Testing and Materials D975 requirements for diesel fuels to ensure compatibility with all existing diesel engines.

Commercially available is herein defined as renewable diesel fuel sourced within 50 vehicle miles of the project/activity site and within 10% of the cost of the equivalent nonrenewable fuel. GSNR or its contractor or subcontractor performing these services must contact at least three vendors within the County of activity and submit to GSFA justification if the renewable diesel fuel is not commercially available. These requirements shall be included as enforceable terms in any contract or subcontract by GSNR for these activities.

MM-AQ-3 is not quantified in the analysis.

MM-AQ-4 Construction and Operational Worker Commute Optimization – Feedstock Acquisition, Lassen Facility, Tuolumne Facility, and Port of Stockton. GSNR or its designee will provide educational materials to encourage workers to carpool to work sites and/or use public transportation for their commutes.

MM-AQ-4 is not quantified in the analysis.

Note that MM-TRF-1 includes providing employee sponsored vanpool for sustainable forest management projects and MM-TRF-4 includes providing electric vehicle charging infrastructure and employee sponsored vanpool for the Lassen Facility, Tuolumne Facility, and Port of Stockton, which would further reduce mobile source emissions and support MM-AQ-4.

MM-AQ-9 Operational Switcher Locomotive Exhaust Minimization – Lassen Facility. During operation of the Lassen Facility, California Air Resources Board (CARB)-certified Tier 4-Final engine shall be used for the on-site switcher locomotive at the Lassen Facility.

This measure can also be achieved by using battery-electric locomotive as it becomes commercially available in Lassen County.

MM-AQ-9 is quantified in the analysis.

MM-TRF-1 Provide Employee Sponsored Vanpool for Sustainable Forest Management Projects. GSNR would be required to provide, or cause to be provided, vanpooling services consistent with CAPCOA Measure T-11 for workers traveling to jobsites when applicable (i.e., when 5 or more employees with similar work hours live close enough to one another for van pooling to be practicable). A

Transportation Manager shall be designated to coordinate vanpooling for each feedstock acquisition project and provide a report detailing recorded annual vanpool usage to the County.

MM-TRF-1 is not quantified in the analysis.

MM-TRF-4 Provide Electric Vehicle Charging Infrastructure and Employee Sponsored Vanpool for the Lassen Facility, Tuolumne Facility, and Port of Stockton. GSNR would be required to provide, or cause to be provided, vanpooling services consistent with CAPCOA Measure T-11 for workers traveling to the Lassen Facility, Tuolumne Facility, and the Port of Stockton facility when applicable (i.e., when 5 or more employees with similar work hours live close enough to one another for van pooling to be practicable). A Transportation Manager shall be designated to coordinate vanpooling at each facility and maintain a record of annual vanpool usage.

Additionally, GSNR would be required to install EV charging at the Lassen Facility, Tuolumne Facility, and the project facility at the Port of Stockton, consistent with CAPCOA Measure T-13. Per Table A5.106.5.3.2 of the 2019 California Green Building Standards, 10 percent of total parking spaces are required to be EV charging spaces to meet Tier 2 standards. The project proponent would be required to exceed the 10 percent EV charging space requirement, consistent with CAPCOA Measure T-13.

MM-TRF-4 is not quantified in the analysis.

3.7.4.5 Significance After Mitigation

Impact GHG-1 The project would potentially generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.

Mitigation measures as listed in Section 3.7.4.4 would reduce GHG emissions. No additional feasible GHG-specific mitigation measures have been identified. While these measures will reduce the project's direct GHG emissions, they would not mitigate those emissions to a level of insignificance. Similar to the reasons for the pre-mitigation significance determination, to meet CEQA's mandate of good faith disclosure and acknowledge potential future impacts in light of uncertainties, this EIR classifies this GHG impact as **significant and unavoidable.** Even though the long-term outcome may yet become beneficial, the "significant and unavoidable" determination alerts the public to the potential that net positive emissions may persist over time, and any more definitive conclusion would be speculative in light of the above-noted uncertainties.

Impact GHG-2 The project would potentially conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

As described in Section 3.7.4.4, and under Impact TRF-1 (see Chapter 3.14, "Transportation"), the project will implement feasible Mitigation Measures to reduce the GHG emissions generating the conflict with CARB's 2022 Scoping Plan, but those emissions cannot be mitigated to a level of insignificance. Therefore, the impact related to potential conflict with an applicable plan, policy, or regulation of an agency adopted for the purpose of reducing emissions of GHGs is deemed to be **significant and unavoidable.**

3.7.5 Additional GHG Considerations

3.7.5.1 "Lifecycle" GHG Analysis

Purpose

CEQA is intended to inform government decisionmakers and the public about the potential environmental effects of proposed activities and to prevent significant, avoidable environmental damage. An EIR should be prepared with a sufficient degree of analysis to provide decision makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among the experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure (CEQA Guidelines, § 15151).

The extent of an evaluation and analysis of environmental impacts in an EIR is guided by a rule of reason (Save Round Valley Alliance v. County of Inyo (2007) 157 Cal.App 4th 1437, 1467). The level of specificity required is likewise determined by the nature of the project and the rule of reason (Al Larson Boat Shop, Inc. v. Board of Harbor Commissioners (1993) 18 Cal.App.4th 729, 741–742). Further, an EIR is not required to engage in speculative analysis. (CEQA Guidelines, § 15145.) "Common sense" applies, and "is an important consideration at all levels of CEQA review." (*Save the Plastic Bag Coalition v. City of Manhattan Beach* 2011).

Applying these principles, there is a "distinction between local impacts and impacts in areas outside the public agency's geographical boundaries. CEQA specifies that a public agency must consider any significant effect on the environment in the area affected by the project. Although...public agencies must consider effects a project will have beyond the boundaries of the project area...CEQA does not require an exhaustive analysis of all conceivable impacts a project may have in areas outside its geographical boundaries...broader environmental impacts without direct impact on the local agency's geographical area may be evaluated at a higher level of generality (Save the Plastic Bag Coalition v. County of Marin (2014) 218 Cal.App.4th 209, 221-223). "That the effects will be felt outside of the project area is one of the factors that determines the amount of detail required in any discussion. Less detail, for example, would be required where those effects are more indirect than effects felt within the project area, or where it [would] be difficult to predict them with any accuracy" (*Save the Plastic Bag Coalition v. City of Manhattan Beach* 2011).

For these reasons, both the CNRA and the courts have been somewhat skeptical of "life cycle" studies that purport to assess the global impact of particular activities or products. CNRA has twice declined to include a requirement for lifecycle analysis in the CEQA Guidelines. In 2009, CNRA amended Appendix F of the Guidelines (pertaining to analysis of energy conservation) to remove the term "lifecycle" because "[n]o existing regulatory definition of 'lifecycle' exists. In fact, comments received...indicate a wide variety of interpretations of that term" and "[m]oreover, even if a standard definition of the term 'lifecycle' existed, requiring such an analysis may not be consistent with CEQA. As a general matter, the term could refer to emissions beyond those that could be considered "indirect effects" of a project as that term is defined in section 15358 of the State CEQA Guidelines" (CNRA 2009). Similarly, in 2018, CNRA amended Section 15126.2 of the Guidelines (also pertaining to energy impacts) to caution that such impact analysis "is subject to the rule of reason, and must focus on energy demand caused by the project. This sentence is necessary to place reasonable limits on the analysis. Specifically, it signals that a full 'lifecycle' analysis that would account for energy used in building materials and consumer products will generally not be required." (CNRA 2018) Similarly, the California Supreme Court has specifically cautioned against "overreliance on generic studies of 'life cycle' impacts associated with a particular product." (*Save the Plastic Bag Coalition v. City of Manhattan Beach* 2011)

Nonetheless, these authorities have also noted that some evaluation of a product's lifecycle "may well be a useful guide for the decision maker when a project entails substantial production or consumption of the product." (Manhattan Beach) "[P]rojects may spur the manufacture of certain materials, and in such cases, consideration of the indirect effects of a project resulting from the manufacture of its components may be appropriate" (CNRA 2009). As such, this section will provide such analysis as is reasonably feasible regarding the GHG emissions generated by those aspects of the wood pellet "life cycle" occurring outside of California, in an effort to show good-faith analysis and comply with CEQA's information disclosure requirements. (For an informational evaluation of the project's criteria air pollutant lifecycle, see Section 3.2.5.1 within Chapter 3.2, "Air Quality.")

Specifically, this section will evaluate several inter-related aspects of the larger GHG lifecycle of the wood pellets produced by the proposed project.

- First, this section will provide a conventional GHG lifecycle analysis based upon the methodologies widely accepted by regulators and industry participants, as set forth (1) Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (Official Journal of the European Union 2009), and (2) the Sustainable Biomass Program, Instruction Document 6C: Methodology for the calculation of GHG savings (Sustainable Biomass Program 2021).
- Second, because the foregoing methodologies have been criticized by some stakeholders for disregarding emissions from the combustion of biofuels, this section will also provide an alternative lifecycle analysis that includes those emissions.
- Third, given the substantial national and international incentives that exist in many countries to transition energy generation from existing fossil fuel sources (i.e., coal) to other sources such as wood pellets ([USITC 2022]), it is reasonably likely that at least some portion of the pellets produced by this project would be used to replace coal. While the amount(s) and location(s) in which this could occur are presently unknown, this section will evaluate the effects of replacement of pre-existing fossil fuel energy sources with wood pellets to the extent feasible at this time.[14]

As will appear, due to the many uncertainties and variables discussed in this section (and Section 3.2.5.1 in Chapter 3.2, Air Quality), attempting to reach any specific impact conclusion regarding any or all of this "lifecycle" would be speculative. The analysis in this section is therefore intended to provide "a useful guide" to decision-makers and the public regarding these "lifecycle" aspects, subject to the above-mentioned "common sense" limitations.

Conventional Biomass Lifecycle Analysis

The two applicable guidance documents followed to perform a conventional GHG lifecycle evaluation for the project are (1) *Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources* (Official Journal of the European Union 2009) and (2) the Sustainable Biomass Program,[15]

14 These three sections collectively address the same three interconnected aspects of the wood pellet lifecycle discussed in Section 3.2.5.1 in the Air Quality chapter, i.e., "Transport to market outside of California's geographic jurisdiction," "End-use combustion of wood pellets for energy generation," and "Replacement of pre-existing fossil fuel energy sources with wood pellets."

15 The Sustainable Biomass Program (SBP) is an independent, multi-stakeholder certification scheme designed for biomass used in large-scale energy production. Its purpose is to set standards that allow biomass sector companies to demonstrate compliance with regulatory, including sustainability requirements related to woody biomass used in energy production.

Instruction Document 6C: Methodology for the calculation of GHG savings (Sustainable Biomass Program 2021), which both include various biomass production pathway GHG emission sources *before* conversion to electricity, heating, and cooling, and are generally consistent with one another.

Earlier sections in this chapter set forth most of the pathway GHG emission sources captured by a conventional GHG lifecycle evaluation, to the extent applicable to the project. Emissions associated with wood cultivation are not present, as the feedstock is naturally occurring within the forest, and the project does not include activities related to growing trees. However, emissions from extraction of the feedstock were fully quantified in the preceding sections. “Land-use change” is discussed and quantified in the preceding sections relating to forest carbon change. Potential emissions from the pellet facilities were likewise thoroughly evaluated above. Transport and distribution activities within California, including truck trips from the feedstock activity areas to the pellet facilities, transport by train from the pellet facilities to the Port of Stockton, and marine vessel transport from the Port of Stockton to jurisdictional waters, were similarly discussed and quantified earlier in this chapter. Transport from California’s jurisdictional waters to the wood pellet destination was too speculative for inclusion within the impact analyses above (since those destination(s) are currently unknown) but are evaluated in the lifecycle analysis herein. (See Section 3.2.5.1 within Chapter 3.2, Air Quality, for further discussion of these uncertainties.)

The conventional GHG emissions equation for the production of solid and gaseous biomass fuels also includes consideration of GHG emission savings (i.e., the ways in which the project may reduce GHG emissions). The preceding sections quantified the GHG emission savings lifecycle categories associated with biological carbon capture and storage (i.e., increased carbon sequestration and reduced wildfire emissions) within the forest carbon change analysis. While the impact analyses and significance determinations above noted that there is some uncertainty regarding the predicted extent of these benefits, they are included within this lifecycle evaluation (which, as noted above, is conducted at a higher level of generality). Finally, soil carbon accumulation via improved agricultural management and carbon capture and replacement are not features of this project and thus not applicable to this analysis.

As noted above, the conventional lifecycle calculation for wood pellets does not include the conversion of those pellets to electricity, heating, and cooling. The Directive 2009/28/EC lifecycle equation explicitly assumes that emissions from the “fuel in use” (i.e., combustion of the fuel to produce energy) is zero for biofuels and bioliquids. (Official Journal of the European Union 2009, pg. 55). However, an alternative analysis that includes these emissions is provided later in this section.

Under the conventional lifecycle analysis methodology, GHG emissions from the production and use of transport fuels, biofuels and bioliquids are calculated using the following equation, with each variable in the equation and associated number detailed below:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

Where:

E = total emissions from the use of the fuel;

e_{ec} = emissions from the extraction or cultivation of raw materials;

e_l = annualized emissions from carbon stock changes caused by land-use change;

e_p = emissions from processing;

e_{td} = emissions from transport and distribution;

e_u = emissions from the fuel in use;

e_{sca} = emission saving from soil carbon accumulation via improved agricultural management;

e_{ccs} = emission saving from carbon capture and geological storage;

e_{ccr} = emission saving from carbon capture and replacement; and

e_{ee} = emission saving from excess electricity from cogeneration.

Per the above-described guidance, emissions from the manufacture of machinery and equipment shall not be taken into account. (This is also consistent with the approach taken in the CNRA FSORs noted above.)

Each individual input in the equation is discussed below along with the complete lifecycle calculation.

e_{ec} = emissions from the extraction or cultivation of raw materials

Emissions associated with wood cultivation are not present in this case, as the feedstock is naturally occurring and the project does not include activities related to growing trees. As such, the emission from cultivation is 0 MT CO_2e per year, as it is not applicable.

Regarding emissions associated with extraction of raw materials, this is evaluated above under feedstock acquisition which includes operation of off-road equipment, logging/haul trucks, and worker vehicles.

The overall annual e_{ec} value is **39,805 MT CO_2e per year**, which is the sum of the GHG emissions from feedstock acquisition in the Lassen feedstock area (See Table 3.7-6) and the Tuolumne feedstock area (see Table 3.7-7).

e_l = annualized emissions from carbon stock changes caused by land-use change

As set forth in EU Directive 2009/28/EC, this category quantifies "[a]nnualised emissions from carbon stock changes due to land-use change." In this case, the project's feedstock materials will be harvested from natural growth on forested lands that will remain living forests, without any change of land use. As set forth in Chapter 2.4, the project will not engage in activities that involve the conversion of forest land to non-forest use, and will not accept any feedstock materials derived from such activities. Therefore, the "the reference land use" and "actual land use" (see EU Directive 2009/28/EC, p. 37) are identical - i.e., forest - and the "land-use change" effect is thus zero. Moreover, as demonstrated in Tables 3.7-15 and 3.7-16 above, while the project's fuel treatments have an initial carbon impact (20.4 million tons of C over the life of the project), the biological carbon sequestration of the treated acreage, even without accounting for any beneficial effects of fuel treatments, more than recovers this initial carbon loss, whether measured on an annual, 20-year, or 60-year timescale. (The initial carbon loss associated with feedstock acquisition is discussed in greater detail below, under e_{ccr}).

For these reasons, the annual e_l value is **0 MT CO_2e per year.**

e_p = emissions from processing

Processing includes emissions from energy sources (electricity), mobile (passenger vehicles and trucks), switcher locomotive use (on-site), water and wastewater, solid waste, refrigerants, stationary sources, and off-road equipment usage at the Lassen and Tuolumne facilities. The emissions from processing also conservatively include amortized construction emissions for the Lassen, Tuolumne, and Port of Stockton facilities, although typically not included in lifecycle calculations. The emissions from processing exclude line haul rail and ship transport emissions from Tables 3.7-8 and 3.7-10, as these sources are included below in the e_{td} value. The emissions from processing also exclude logging/haul trucks emissions from Tables 3.7-8 and Table 3.7-10, as this source is included above in the e_{ec} value.

The overall annual e_p value is **45,915 MT CO_2e per year**, which is the sum of operational processing emissions at the Lassen Facility (27,041 MT CO_2e per year from Table 3.7-8), the Tuolumne Facility (18,327 MT CO_2e per year from Table 3.7-10), and the total amortized construction emissions for the Lassen, Tuolumne, and Port of Stockton facilities (548 MT CO_2e per year from Table 3.7-7, Table 3.7-9, and Table 3.7-12).

e_{td} = emissions from transport and distribution

Transport and distribution include line haul (rail) travel, operational activities at the Port of Stockton, ship travel within California, and ship travel outside of California waters. All transport and distribution associated with the project are quantified in the preceding section except for ship travel outside of California waters. The emissions from transport and distribution exclude line haul rail and ship transport emissions from Table 3.7-14 to avoid double counting.

To estimate ship travel outside of California waters, the same assumptions for ship travel within California were applied and the distance was changed to reflect travel from California to Immingham, United Kingdom (see Section 3.2.5.1).[16] It was assumed that 29 Handymax vessels would make the trip per year, approximately 8,228 nautical miles one-way. Emissions were estimated assuming 24 hours per day and 46 days per trip (23 days one-way). It was assumed the ships would travel at 15 knots.

The overall e_{td} value is **188,122 MT CO_2e per year**, which is the sum of the total line haul rail transport (See Table 3.7-11), operational Port activities (2,581 MT CO_2e per year from Table 3.7-13), ship travel within California (See Table 3.7-14), and ship travel outside of California waters (178,397 MT CO_2e per year from Appendix B2).

e_u = emissions from the fuel in use

For this project, fuel in use refers to the combustion of wood pellets. As set forth in the above-described guidance for conventional GHG lifecycle analysis, emissions from the fuel in use shall be taken to be zero for biofuels and bioliquids (Official Journal of the European Union 2009), on the basic assumption that "over the full lifecycle of the fuel, the CO_2 emitted from biomass-based fuels combustion does not increase atmospheric CO_2 concentrations, assuming the biogenic carbon emitted is offset by the uptake of CO_2 resulting from the growth of new biomass." (Renewable Fuel Standard Program (RFS2) Final Regulatory Impact Analysis; Report EPA-420-R-10-006; U.S. Environmental Protection Agency: Washington, DC, USA, February 2010.)

For purposes of the conventional lifecycle calculation, the e_u value is therefore taken to be **0 MT CO_2e per year**.

(As previously noted, an alternative analysis that quantifies and includes these emissions is provided below.)

e_{sca} = emission saving from soil carbon accumulation via improved agricultural management

The project does not include improved agricultural management or associated soil carbon accumulation.

16 As set forth in Chapter 3.2, "Air Quality," there is no certainty that any quantity of pellets will ultimately be shipped to this location (a Drax generating station), and the location is used here simply to model one potential emissions scenario. Note that some potential destinations for project wood pellets are located substantially closer than the United Kingdom (e.g., generating stations in Japan), making this location a fairly conservative basis for calculation.

The e_{sca} value is **0 MT CO_2e per year**, as it is not applicable.

e_{ccs} = emission saving from carbon capture and geological storage

Emission saving from carbon capture and geological storage are related to emissions avoided through the capture and sequestration of emitted CO_2 directly related to the extraction, transport, processing and distribution of fuel. The project does not capture GHG emissions during extraction, transport, processing or distribution of fuel and therefore, is not applicable to the project.

The e_{ccs} value is **0 MT CO_2e per year**, as it is not applicable.

e_{ccr} = emission saving from carbon capture and replacement

Under EU Directive 2009/28/EC, in conventional GHG lifecycle analysis, e_{ccr} typically consists of "emissions avoided through the capture of CO_2 of which the carbon originates from biomass and which is used to replace fossil-derived CO_2 used in commercial products and services." However, in this case, replacement of fossil-derived CO_2 is evaluated later in this chapter, and the project's fuel treatments provide unique modes of carbon capture through improved biological sequestration in the forest, and reduced wildfire emissions, exclusion of which would disserve CEQA's informational purposes.

As discussed above, the project's lifetime is 20 years, but the additional carbon sequestered as a result of GSNR Biomass Only Thinning Projects is evaluated over 60 years to account for long-term effects (i.e., an additional 40 years). For the e_{ccr} value in this lifecycle equation, only the delta between the carbon sequestered between GSNR-treated and untreated forest is considered to isolate the project's effect on forest carbon sequestration. As such, to attain an annual value, approximately 15,650,000 MT CO_2e (discussion supporting Table 3.7-16) was amortized over 60 years, which is an additional 260,833 MT CO_2e per year.[17]

It is important to note that the project's treated forest would sequester an average of 305.3 MMT CO_2e over 60 years under with fire and no fire conditions, which equates to approximately 5,088,333 MT CO_2 per year (when amortized over 60 years), which is substantially greater than the difference in carbon sequestered between GSNR treated and untreated forest (i.e., 260,833 additional MT CO_2e per year). While it may be appropriate to consider the anticipated on-the-ground forest conditions and associated full carbon sequestered by the treated forest, this conventional lifecycle analysis only takes credit for the "GHG emission savings" associated with the difference between GSNR treated and untreated forests.

When avoided GHG emissions from wildfires was considered, the e_{ccr} value would increase an additional 227,087 MT CO_2e per year which is a total of 4,654,951 MT CO_2e avoided during the project's lifetime, divided by 20 years (Table 3.7-17). As noted above, it is anticipated that the benefit of avoided wildfire may occur well beyond the 20-year life modeled, but that extended benefit is not counted in this analysis.

Adding together annualized emissions benefits from sequestered carbon and avoided wildfires would yield a combined e_{ccr} value of **487,921 MT CO_2e per year**.

As with improved biological sequestration and reduced wildfire emissions, the initial carbon loss resulting from wildfire fuel treatment activities (which, as noted above, involve no change in land use) is not a typical element of

17 Forest carbon sequestration is not linear year-to-year and instead fluctuates over time. The annualized value is provided for lifecycle analysis calculation purposes and is not intended to reflect actual values for any given year.

GHG lifecycle analysis. Since the treated area remains in forest use, and the biological carbon sequestration of the treated acreage more than recovers this initial carbon loss (in a healthier and thus more resilient and stable forest), exclusion of this carbon loss may be justifiable. As explained throughout, forest carbon loss and gain should be evaluated holistically to estimate the balance between the two as carbon loss initially occurs during forest thinning and carbon gain occurs for the project life and beyond associated with healthier forests.

Nevertheless, untreated forests would also continue to sequester additional carbon (albeit at a lower rate) and do not undergo this initial carbon loss. Given the absence of any widely-accepted guidance on this issue, and in order to function best as a "useful guide" for decision-makers, this analysis will therefore present the e_{ccr} value (and resulting calculations) both with *and* without inclusion of this initial carbon loss.

As indicated above, the initial carbon loss associated with GSNR thinning activities over 20 years is 67,913,288 MT CO_2e (Table 3.7-15). For mathematical purposes, when amortized over the project lifetime of 20 years, the annual carbon loss is estimated to be 3,395,664 MT CO_2e per year (i.e., 67,913,288 MT CO_2e ÷ 20 years). Including the initial carbon loss annualized over the project lifetime (3,395,664 MT CO_2e per year), along with the annualized emissions benefits from sequestered carbon (260,833 MT CO_2e per year) and avoided wildfires (227,087 MT CO_2e per year), would yield an overall combined e_{ccr} value of **-2,907,744 MT CO_2e per year.** In this scenario, the estimated "savings" would be a negative figure (i.e., effectively, a net increase in GHG emissions), due to the initial removal of carbon and this equation only taking credit for the delta between untreated and treated stands rather than the total carbon sequestered by treated stands.

***e_{ee}* = emission saving from excess electricity from cogeneration**

Emission saving from excess electricity from cogeneration may be taken into account when the excess electricity produced by fuel production systems use cogeneration, except where the fuel used for the cogeneration is a co-product other than an agricultural crop residue. Because the project does not include cogeneration, e_{ee} does not apply.

The e_{ee} value is **0 MT CO_2e per year**, as it is not applicable.

Complete Conventional Lifecycle Calculation

The complete conventional lifecycle calculations are as follows:

Excluding Initial Carbon Loss

-214,079 MT CO_2e/year (E) = 39,805 (e_{ec}) + 0 (e_l) + 45,915 (e_p) + 188,122 (e_{td}) + 0 (e_u) – 0 (e_{sca}) – 0 (e_{ccs}) – 487,921 (e_{ccr}) – 0 (e_{ee})

Including Initial Carbon Loss

3,181,586 MT CO_2e/year (E) = 39,805 (e_{ec}) + 0 (e_l) + 45,915 (e_p) + 188,122 (e_{td}) + 0 (e_u) – 0 (e_{sca}) – 0 (e_{ccs}) – (-2,907,744) (e_{ccr}) – 0 (e_{ee})

As shown above, lifecycle emissions, calculated in the conventional manner, would be -214,503 MT CO_2e per year (i.e., an overall reduction in GHG emissions) if the initial carbon loss is excluded, and 3,181,586MT CO_2e per year (i.e., a net increase in GHG emissions) if the initial carbon loss were included.

Alternative Biomass Lifecycle Analysis (Including "Fuel in Use"/Pellet Combustion)

As noted above, conventional GHG lifecycle analysis for biomass assumes that the GHG emissions from combustion of the biomass "is offset by the uptake of CO_2 resulting from the growth of new biomass." This assumption is the subject of controversy among some stakeholders, and several comments received during the scoping period advocated for preparation of a lifecycle analysis that accounted for these emissions. While preparation of an alternative lifecycle analysis – particularly one that deviates from internationally accepted methodology – goes well beyond CEQA's requirements for "good faith effort at full disclosure" and providing "a useful guide for the decision maker," this EIR nonetheless provides such an analysis for informational purposes.

The basic formula used for this alternative lifecycle analysis is the same as described above:

$$E = e_{ec} + e_{l} + e_{p} + e_{td} + e_{u} - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

Further, the following elements in this formula are unchanged from the conventional analysis:

- e_{ec} (emissions from the extraction or cultivation of raw materials) = 39,805 MT CO_2e per year.
- e_{l} (annualized emissions from carbon stock changes caused by land-use change) = 0 MT CO_2e per year.
- e_{p} (emissions from processing) = 45,915 MT CO_2e per year.
- e_{td} (emissions from transport and distribution) = 188,122 MT CO_2e per year.
- e_{sca} (emission saving from soil carbon accumulation via improved agricultural management) = 0 MT CO_2e per year.
- e_{ccs} (emission saving from carbon capture and geological storage) = 0 MT CO_2e per year.
- e_{ee} (emission saving from excess electricity from cogeneration) = 0 MT CO_2e per year.

The two elements in this formula that may vary from the conventional analysis are e_{u} (emissions from the fuel in use) and e_{ccr} (emission saving from carbon capture and replacement), both of which are discussed in greater detail below.

e_{u} (emissions from the fuel in use)

To estimate GHG emissions from combustion of the 1 MMT per year of wood pellets produced by the project, four different methods were applied that use project-specific data and recommended assumptions, as available and applicable. Each method is briefly discussed below along with the estimated associated annual GHG emissions.

A. The GHG emissions from the combustion of wood pellets were calculated using a combination of EPA Methodology and wood pellet heat content. This method uses the wood pellet throughput in US tons per year, wood pellet density, wood pellet heating value, and GHG emission factors from EPA to calculate the CO_2e MT per year, resulting in **1,583,822 MT CO_2e per year**.
B. The GHG emissions from the combustion of wood pellets were calculated using a combination of EPA Methodology and wood carbon content. This method uses the wood pellet throughput in US tons per year, the carbon content of pellets, and the ratio of molecular weights CO_2 to carbon to calculate the CO_2 MT per year. The CH_4 and N_2O MT per year were calculated using the same methodology with wood heat content and EPA Methodology in Method A, resulting in **1,669,291 MT CO_2e per year**.
C. The GHG emissions from the combustion of wood pellets were calculated using EPA AP-42 emission factors for wood residue combustion in boilers. This method uses the wood pellet throughput in US tons per year,

wood pellet density, wood pellet heating value, AP-42 emission factor for CO_2, and EPA emission factors for CH_4 and N_2O, resulting in **1,495,920 MT CO_2e per year.**

D. The GHG emissions from the combustion of wood pellets were calculated using the *Chatham House Report "Greenhouse gas emissions from burning US-sourced woody biomass in the EU and UK Reporting.* This method uses the wood pellet throughput in MT per year, and the Chatham House report's emission factor for metric tons of CO_2 per metric tons of wood pellets, resulting in **1,632,949 MT CO_2 per year.**

As shown above, all four methods result in estimated GHG emissions within the same magnitude. For purposes of this alternative lifecycle calculation, the e_u value is taken to be **1,595,496 MT CO_2e per year**, which is the average of all four methods.

e_{ccr} (emission saving from carbon capture and replacement)

As noted above, this alternative lifecycle analysis deliberately eschews the conventional assumption that biomass combustion emissions are offset by the uptake of CO_2 resulting from the growth of new biomass. However, this does not necessarily mean that the regrowth of harvested biomass should be entirely disregarded. The loss of carbon associated with biomass should not be double counted in the lifecycle equation. Because biomass loss of carbon is considered in the end use (combustion) stage, the initial loss of carbon from forest thinning cannot also be included when quantifying the lifecycle impact.

The conventional lifecycle analysis above modeled two scenarios, one that excluded the initial carbon loss, and one that included that initial carbon loss within the e_{ccr} value. For purposes of this alternative analysis, to avoid double-counting carbon impacts, the former e_{ccr} value, excluding initial carbon loss, is more appropriate (**487,921 MT CO_2e per year**).

Complete Alternative Lifecycle Calculation

If combustion emissions were included instead of initial carbon loss, the total lifecycle GHG emissions from project activities would result in a net increase of 1,381,417 MT CO_2e per year:

1,381,417 MT CO_2e/year (E) = 39,805 (e_{ec}) + ND (e_l) + 45,915 (e_p) + 188,122 (e_{td}) + 1,595,496 (e_u) – 0 (e_{sca}) – 0 (e_{ccs}) – 487,921 (e_{ccr}) – 0 (e_{ee})

Conclusion

As set forth in this section, lifecycle analyses of project-related GHG emissions produce results ranging from a net decrease of 214,079 MT CO_2e/year, to a net increase of 3,181,586 MT CO_2e per year, depending on the methodologies and assumptions used. The differing results highlight the speculative nature of a global lifecycle analysis performed at the CEQA stage of a project, and the extent of disagreement among stakeholders in the field, rather than an issue with methodology or calculations. Nonetheless, the full range of lifecycle calculations have been provided here in good faith to achieve meaningful disclosure.

As explained throughout this EIR, the purpose of the project is to reduce the risks of catastrophic wildfire, and to help restore California forests, watersheds, and ecosystems to a more natural and resilient condition, so GHG emissions associated with the project do not conflict with its core objectives. Further, the foregoing calculations treat all the project's GHG emissions as additive, without taking into account the likelihood that at least some portion of the pellets produced by this project would be used to replace coal, thus reducing the project's net lifecycle emissions. That baseline matter is discussed in the next section.

3.7.5.2 Replacement of Pre-Existing Fossil Fuel Energy Sources with Wood Pellets

Wood Pellets vs. Fuel Energy Sources - Lifecycle

As discussed above, biomass-derived wood pellets are often viewed as a renewable energy source with a substantially lower environmental impact when compared to coal, a non-renewable fossil fuel. Compared to fossil fuels, whose carbon contents are only replaced naturally after eons, many stakeholders treat wood pellets as a more sustainable source of fuel. The life cycle of the wood pellets is typically considered to be renewable, and has been described by many policymakers and scholars as a carbon neutral process because the amount of carbon emitted during pellet combustion is almost entirely offset by the carbon sequestered through the trees' growth. However, this has been a topic of contention among environmental groups (Brack 2017).

As a source of fuel, biomass is often criticized for its comparatively low energy density. However, wood pellets, through the process of pulverization, drying, and compression, have a higher calorific value than other forms of biomass and are therefore a more favorable source of energy (Hamzah et. al 2018).

Given the widespread view of biomass as environmentally superior to coal as a fuel source, substantial national and international incentives that exist in many countries to transition energy generation from existing fossil fuel sources (i.e., coal) to biomass, including wood pellets (USITC 2022).

Efforts to compare the lifecycle emissions of wood pellets to coal are inherently speculative, as the respective sources, destinations, and conditions under which each fuel source would be used are unknown. However, some scholars have predicted "a GHG reduction of 63.62 kg CO_2-eq for every 1-GJ heat provision" resulting from converting coal heating to wood pellets (Wang et al. 2016). (This includes emissions from combustion of both fuel types.)

Applying GSNR's wood pellet energy content (17 GJ per U.S. ton) and this study's estimate of the coal energy content (21 MJ per kg or 19 GJ per U.S. ton), Table 3.7-22 shows the total estimated GHG emissions from the lifecycle of GSNR's 100% throughput of wood pellets (1 MMT) and the coal equivalent (which includes emissions from production, transportation, and heat generation).

- If 10% of this amount (100,000 MT) replaced coal, this would indicate a total annual GHG reduction of ~74,558 MT CO_2e.
- If the replacement percentage was increased to 50%, the total annual GHG reduction would increase to ~372,789 MT CO_2e.
- If 100% replacement was assumed, the total annual GHG reduction would increase further to ~745,578 MT CO_2e.

Table 3.7-22. Estimated Greenhouse Gas Emissions – Wood Pellets vs. Coal Lifecycle (1 MMT)

Lifecycle Phase	CO_2e Metric Tons per Year
Wood Pellet Lifecycle	
Production	151,602
Transportation	17,215
Heat Generation	133,380
Total	*302,196*
Coal Lifecycle	
Production	854,118
Transportation	60,138
Heat Generation	139,065
Total	*1,053,322*
Net Change (Transitioning Coal to Wood)	**-751,125**
Percent Change (Transitioning Coal to Wood)	**-71%**

Source: Wang et al. 2016.
Notes: CO_2e = carbon dioxide equivalent.
This analysis assumes a wood pellet energy content of 17 GJ per ton and a coal energy content of 19 GJ per ton.
Totals may not sum due to rounding.

As shown in Table 3.7-22, using the methodology from the study noted above, transitioning from coal to wood pellets would result in a GHG reduction of approximately 71% when considering their entire lifecycles.

As noted, this comparative analysis is speculative, and estimates of the net GHG benefit or detriment from conversion of coal energy to project-generated wood pellets are inherently uncertain. The study noted above, like all such studies, includes many assumptions that may or may not represent actual conditions under which this conversion may occur in the future. (For example, the study noted above included assumptions regarding the relative transportation distances and combustion conditions of coal and pellets that cannot presently be either refuted or validated, since where and how any conversion will occur is unknowable at this time.) As noted above, this supports, rather than detracts from, the ultimate conclusion reached here, i.e., that analysis of the GHG lifecycle of wood pellets produced by the project is too speculative to reach a useful impact conclusion.

Wood Pellets vs. Fuel Energy Sources – Combustion Only

The preceding section endeavored to compare the relative GHG impacts of wood pellets versus coal over the entire lifecycle of those fuel sources – which, as noted, involves a great many speculative variables. In order to maximize the value of this analysis as a "useful guide" for decision-makers, this section will further compare the respective GHG impacts of wood pellets and coal at one discrete point in the lifecycle – combustion by the end-user (i.e., "fuel in use").

To estimate and solely compare the GHG emissions associated with end use burning of wood pellets vs. coal, two different methodologies were used. The first method used uncontrolled AP-42 emission factors as shown in Table 3.7-23, and the second method used controlled Washington State Department of Natural Resources emission factors (WSDNR 2010). The purpose of showing both methodologies is to highlight the difficulty and speculative nature of estimating and comparing emissions of wood pellet and coal combustion.

Based on the estimated annual throughput of wood pellets (1 MMT) from GSNR and the estimated annual throughput of coal equivalent, potential GHG emissions were calculated using the uncontrolled emission factors from the EPA's AP-42 Section 1.6 Wood Residue Combustion In Boilers for wood pellets (EPA 2022), and Section 1.2 for Anthracite Coal Combustion for coal (EPA 1996). This method uses the wood pellet throughput in US tons per year, a wood pellet energy content of 17 GJ per U.S. ton, wood pellet density, wood pellet heating value, and AP-42 emission factor for CO_2. Table 3.7-23 compares the GHG emissions for wood pellets and coal assuming 10% replacement, 50% replacement, and 100% replacement.

Table 3.7-23. Estimated GHG Emissions from Combustion of Wood Pellets vs. Coal – EPA AP-42

Fuel	CO_2e Metric Tons per Year
10% Replacement	
Wood Pellets	149,592
Coal	254,105
Net Change (Transitioning Coal to Wood)	**-104,513**
50% Replacement	
Wood Pellets	747,960
Coal	1,270,526
Net Change (Transitioning Coal to Wood)	**-522,566**
100% Replacement	
Wood Pellets	1,495,920
Coal	2,541,052
Net Difference (Transitioning Coal to Wood)	**-1,045,132**
Percent Change (Transitioning Coal to Wood)	***-70%***

Source: EPA 1996; EPA 2022.
Notes: CO_2e = carbon dioxide equivalent.
Totals may not sum due to rounding.

This analysis assumes a wood pellet energy content of 17 GJ per ton and a coal energy content of 19 GJ per ton. As shown in Table 3.7-23, using AP-42 methodology, transitioning from coal to wood pellets would result in a GHG reduction of approximately 70% at the combustion stage.

Based on the estimated annual throughput of wood pellets from GSNR (1 MMT) and the estimated coal equivalent, potential GHG emissions were also calculated using the controlled emission factors from the Washington State Department of Natural Resources (WSDNR 2010). Table 3.7-24 compares the criteria air pollutant emissions for wood pellets and coal assuming 10% replacement, 50% replacement, and 100% replacement.

Table 3.7-24. Estimated Greenhouse Gas Emissions – Burning Wood Pellets vs. Coal – Washington State Department of Natural Resources

Fuel	CO_2e Metric Tons per Year
10% Replacement	
Wood Pellets	159,932
Coal	215,405
Net Change (Transitioning Coal to Wood)	**-55,473**
50% Replacement	
Wood Pellets	799,661
Coal	1,077,025
Net Change (Transitioning Coal to Wood)	**-277,364**
100% Replacement	
Wood Pellets	1,599,322
Coal	2,154,049
Net Difference (Transitioning Coal to Wood)	**-544,727**
Percent Change (Transitioning Coal to Wood)	***-35%***

Source: WSDNR 2010
Notes: CO_2e = carbon dioxide equivalent.
This analysis assumes a wood pellet energy content of 17 GJ per ton and a coal energy content of 19 GJ per ton.
Totals may not sum due to rounding.

As shown in Table 3.7-24, using Washington State Department of Natural Resources methodology, transitioning from coal to wood pellets would result in a GHG reduction of approximately 35% at the combustion stage.

Conclusion

When potential baseline conditions are considered, which could include anywhere from 0%[18] to 100% replacement of coal by project-generated wood pellets, potential GHG emissions from the combustion of project wood pellets in replacement of coal may result in an annual GHG emissions reduction (benefit) of 544,727 MT CO_2e to 1,045,132 MT CO_2e (EPA AP-42 and WSDNR 2010 methods, Table 3.7-23 and 3.7-24). Similarly, when considering baseline conditions on a lifecycle basis, the project may reduce GHG emissions by 745,578 MT CO_2e assuming 100% replacement (Wang et al. 2016, Table 3.7-22). This wide variance and many uncertainties make GHG lifecycle analyses and predicting the emissions from the replacement of coal for wood pellets too speculative to support an impact conclusion, but this information is nonetheless provided here to outline the major issues and provide a useful guide for decisionmakers and the public when considering the larger GHG lifecycle.

18 As noted, some amount of coal replacement is highly likely, making 0% replacement a very conservative worst-case scenario.

3.7.6 References

AB 1757 EAC (Assembly Bill 1757 Expert Advisory Committee). 2023. 1757 Expert Advisory Committee (EAC) Recommendations for Implementation Targets for Natural and Working Lands (NWL) Sector Climate Actions. November 2023. https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Expanding-Nature-Based-Solutions/1757_EAC_Recommendations_Implementation_Targets_for_NWL.pdf.

Abatzoglou, J.T. and A.P. Williams. 2016. Impact of anthropogenic climate change on wildfire across western U.S. forests. Proceedings of the National Academy of Sciences 113(42):11770-11775

Achat, D. L., Fortin, M., Landmann, G., Ringeval, B., & Augusto, L. 2015. Forest soil carbon is threatened by intensive biomass harvesting. Scientific reports, 5(1), 15991.

Boerner, R. E. J., J. Huang, and S. C. Hart. 2008. Fire, thinning, and the carbon economy: effects of fire and fire surrogate treatments on estimated carbon storage and sequestration rate. Forest Ecology and Management 255: 3081–3097.

Brack, Duncan. 2017. Woody Biomass for Power and Heat. Published February 2017. Updated May 2023. https://www.chathamhouse.org/2017/02/woody-biomass-power-and-heat/1-biomass-carbon-neutral

Brodie, E. G., Knapp, E. E., Brooks, W. R., Drury, S. A., & Ritchie, M. W. 2024. Forest thinning and prescribed burning treatments reduce wildfire severity and buffer the impacts of severe fire weather. Fire Ecology, 20(1), 17.

CalEPA et al. 2019. Draft 2030 Natural and Working Lands Implementation Plan. April 2019. https://ww2.arb.ca.gov/sites/default/files/2020-10/draft-nwl-ip-040419.pdf

CalFIRE et al. 2018. California Forest Carbon Plan. May 2018. https://ww2.arb.ca.gov/sites/default/files/2019-01/California-Forest-Carbon-Plan-Final-Draft-for-Public-Release-May-2018.pdf

California Housing Partnership Corporation and TransForm. 2014. Why Creating and Preserving Affordable Homes Near Transit is a Highly Effective Climate Protection Strategy. Accessed January 2024. https://1p08d91kd0c03rlxhmhtydpr-wpengine.netdna-ssl.com/wp-content/uploads/2015/11/4- AffordableTODResearchUpdate070114.pdf.

Campbell, J. L., Harmon, M. E., & Mitchell, S. R. (2012). Can fuel - reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions?. *Frontiers in Ecology and the Environment*, *10*(2), 83-90.

CAPCOA (California Air Pollution Control Officers Association). 2008. *CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act*. January 2008. https://www.contracosta.ca.gov/DocumentCenter/View/34122/CAPCOA-2008-CEQA-and-Climate-Change-PDF.

CAPCOA. 2022. *California Emissions Estimator Model (CalEEMod) User's Guide Version 2022.1*. Prepared by ICF in collaboration with Sacramento Metropolitan Air Quality Management District, Fehr & Peers, STI, and

Ramboll. April 2022. Accessed June 2023. https://www.caleemod.com/documents/user-guide/CalEEMod_User_Guide_v2022.1.pdf.

CARB. 2014. *First Update to the Climate Change Scoping Plan: Building on the Framework*. May 2014. http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf.

CARB. 2017a. *The 2017 Climate Change Scoping Plan Update*. January 20, 2017. https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf.

CARB. 2017b. Short-Lived Climate Pollutant Reduction Strategy. March 2017. Accessed January 2024. https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf.

CARB. 2019. *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan*. January 2019. https://ww2.arb.ca.gov/sites/default/files/2020-10/draft-nwl-ip-040419.pdf

CARB. 2022. *2022 Scoping Plan Update*. December 2022. Last Accessed June 2023. https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents.

CARB. 2023a. "California Greenhouse Gas Emissions for 2000 to 2021—Trends of Emissions and Other Indicators." December 14, 2023. https://ww2.arb.ca.gov/sites/default/files/2023-12/2000_2021_ghg_inventory_trends.pdf

CARB. 2023b. Wildfire Emission Estimates for 2022. https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/Wildfire%20Emission%20Estimates%20for%202022%20%28ADA%29.pdf.

CARB. 2024a. "GHG Inventory Glossary." https://ww2.arb.ca.gov/ghg-inventory-glossary.

CARB. 2024b. "Frequently Asked Questions: Wildfire Emissions." https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires.

CARB. 2024c. "Advanced Clean Cars Program." https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program.

CARB. 2024d. "Advanced Clean Trucks." https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks.

Carlson, C. H., Dobrowski, S. Z., & Safford, H. D. 2012. Variation in tree mortality and regeneration affect forest carbon recovery following fuel treatments and wildfire in the Lake Tahoe Basin, California, USA. Carbon balance and management, 7, 1-17.

CEC. 2021. 2022 Building Energy Efficiency Standards Summary. August 2021. https://www.energy.ca.gov/sites/default/files/2021-08/CEC_2022_EnergyCodeUpdateSummary_ADA.pdf

Chambers, M. E., Fornwalt, P. J., Malone, S. L., & Battaglia, M. A. (2016). Patterns of conifer regeneration following high severity wildfire in ponderosa pine–dominated forests of the Colorado Front Range. *Forest Ecology and Management*, *378*, 57-67.

City of Stockton. 2014. City of Stockton Climate Action Plan. August 2014. https://cms3.revize.com/revize/stockton/Documents/Government/City%20Manager/Sustainability/Climate_Action_Plan_August_2014.pdf

City of Stockton. 2018. Envision Stockton 2040 General Plan. December 4, 2018. https://cms3.revize.com/revize/stockton/Documents/Business/Planning%20&%20Engineering/General%20Plan/Adopted_Plan.pdf.

CNRA (California Natural Resources Agency). 2009. *Final Statement of Reasons for Regulatory Action: Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of Greenhouse Gas Emissions Pursuant to SB 97*. December 2009. https://www.sandiegocounty.gov/content/dam/sdc/pds/ceqa/JVR/AdminRecord/IncorporatedByReference/Section-3-1-3---Greenhouse-Gas-Emissions-References/CNRA%202009%20Final_Statement_of_Reasons.pdf.

CNRA. 2018. California's Fourth Climate Change Assessment: Statewide Summary Report. 2018. https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf.

CNRA. 2022. Natural and Working Lands Climate Smart Strategy. resources.ca.gov/-/media/CNRAWebsite/Files/Initiatives/Expanding-Nature-Based-Solutions/CNRA-Report-2022---Final_Accessible.pdf

CNRA. 2024. California's Nature-Based Solutions Climate Targets. April 22, 2024. https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Expanding-Nature-Based-Solutions/Californias-NBS-Climate-Targets-2024.pdf.

Dore, S., D. L. Fry, B. M. Collins, R. Vargas, R. A. York, and S. L. Stephens. 2016. Management impacts on carbon dynamics in a Sierra Nevada mixed conifer forest. PLOS ONE **11**: 1–22.

EPA. 1996. US EPA AP-42 Section 1.2, *Anthracite Coal Combustion.* October 1996. https://www.epa.gov/sites/default/files/2020-09/documents/1.2_anthracite_coal_combustion.pdf

EPA. 2022. US EPA AP-42 Section 1.6, Wood Residue Combustion In Boilers. March 2022. https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s06.pdf

EPA. 2024a. "Climate Change Science." Last updated April 2024. https://www.epa.gov/climatechange-science.

EPA. 2024b. "Overview of Greenhouse Gases." Last updated April 2024. https://www.epa.gov/ghgemissions/overview-greenhouse-gases.

EPA. 2024c. "Causes of Climate Change." Last updated April 2024. https://www.epa.gov/climatechange-science/causes-climate-change.

EPA. 2024d. U.S. Greenhouse Gas Emissions and Sinks: 1990-2022. April 2024 https://www.epa.gov/system/files/documents/2024-04/us-ghg-inventory-2024-main-text_04-18-2024.pdfhttps://www.epa.gov/system/files/documents/2024-02/us-ghg-inventory-2024-main-text.pdf

EPA. 2024e. "Climate Change Indicators: Wildfires." Last updated June 2024. https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires

EPA. 2024f. "About the Greenhouse Gas Reduction Fund." Last updated April 2024. Accessed June 2023. https://www.epa.gov/greenhouse-gas-reduction-fund/about-greenhouse-gas-reduction-fund.

Haffey, C. M. 2014. *Patterns and predictors of crown fire induced type conversion in dry conifer forests* (Master's thesis, Northern Arizona University).

Hall, J., Sandor, M. E., Harvey, B. J., Parks, S. A., Trugman, A. T., Williams, A. P., & Hansen, W. D. (2024). Forest carbon storage in the western United States: Distribution, drivers, and trends. Earth's Future, 12, e2023EF004399. https://doi.org/10.1029/2023EF004399, https://www.caryinstitute.org/news-insights/press-release/forest-carbon-storage-has-declined-across-much-western-us-likely-due

Hamzah, et. Al. 2018. Wood Biomass Pellet Characterization for Solid Fuel Production in Power Generation. International Journal of Renewable Energy Sources, Volume 3. Published 2018. https://www.iaras.org/home/caijres/wood-biomass-pellet-characterization-for-solid-fuel-production-in-power-generation

Hill, A. P., Nolan, C. J., Hemes, K. S., Cambron, T. W., & Field, C. B. (2023). Low-elevation conifers in California's Sierra Nevada are out of equilibrium with climate. *PNAS nexus*, *2*(2), pgad004.

Hurteau, M. D., Koch, G. W., & Hungate, B. A. (2008). Carbon protection and fire risk reduction: toward a full accounting of forest carbon offsets. Frontiers in Ecology and the Environment, 6(9), 493-498.

IPCC (Intergovernmental Panel on Climate Change). 2007. *IPCC Fourth Assessment Synthesis of Scientific-Technical Information Relevant to Interpreting Article 2 of the U.N. Framework Convention on Climate Change*.

IPCC. 2013. *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, edited by T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midgley. Cambridge, United Kingdom and New York, New York: Cambridge University Press.

IPCC. 2014. *Climate Change 2014 Synthesis Report: A Report of the Intergovernmental Panel on Climate Change.* Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Accessed August 2016. http://www.ipcc.ch/report/ar5/syr/.

IPCC. 2023. "Summary for Policymakers." In *Climate Change 2023: Synthesis Report*. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland: IPCC. https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

Jerrett, M., Jina, A. S., & Marlier, M. E. 2022. Up in smoke: California's greenhouse gas reductions could be wiped out by 2020 wildfires. August 14, 2022. Environmental Pollution,310. https://doi.org/10.1016/j.envpol.2022.119888

Kane, V. R., Bartl-Geller, B. N., North, M. P., Kane, J. T., Lydersen, J. M., Jeronimo, S. M., ... & Moskal, L. M. (2019). First-entry wildfires can create opening and tree clump patterns characteristic of resilient forests. *Forest Ecology and Management*, *454*, 117659.

Kodero, J. M., Felzer, B. S., & Shi, Y. (2024). Future transition from forests to shrublands and grasslands in the western United States is expected to reduce carbon storage. *Communications Earth & Environment*, *5*(1), 78.

Liang, S., Hurteau, M. D., & Westerling, A. L. 2017. Potential decline in carbon carrying capacity under projected climate-wildfire interactions in the Sierra Nevada. *Scientific reports*, *7*(1), 2420.

Long, J. N., & Shaw, J. D. 2012. A density management diagram for even-aged Sierra Nevada mixed-conifer stands. Western Journal of Applied Forestry, 27(4), 187-195.

Miller, J. D., Skinner, C. N., Safford, H. D., Knapp, E. E., & Ramirez, C. M. (2012). Trends and causes of severity, size, and number of fires in northwestern California, USA. *Ecological Applications*, *22*(1), 184-203.

Moghaddas, E. E., & Stephens, S. L. 2007. Thinning, burning, and thin-burn fuel treatment effects on soil properties in a Sierra Nevada mixed-conifer forest. Forest Ecology and Management, 250(3), 156-166.

North, M., M. Hurteau, and J. Innes. 2009. Fire suppression and fuels treatment effects on mixed- conifer carbon stocks and emissions. Ecological Applications 19: 1385–1396.

North, M. P., & Hurteau, M. D. 2011. High-severity wildfire effects on carbon stocks and emissions in fuels treated and untreated forest. Forest Ecology and Management, 261(6), 1115-1120.

OEHHA (Office of Environmental Health Hazard Assessment). 2018. Report Summary: Indicators of Climate Change in California. May 2018. https://oehha.ca.gov/media/downloads/climate-change/report/2018indicatorssummary.pdf.

OEHHA. 2022. Indicators of Climate Change in California. 4th ed. November 2022. Accessed June 2023. https://oehha.ca.gov/media/downloads/climate-change/document/2022caindicatorsreport.pdf.

Official Journal of the European Union. 2009. DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF

Ontl, T. A., Janowiak, M. K., Swanston, C. W., Daley, J., Handler, S., Cornett, M., ... & Patch, N. 2020. Forest management for carbon sequestration and climate adaptation. *Journal of Forestry*, *118*(1), 86-101.

OPR (Governor's Office of Planning and Research). 2008. "CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review." June 19, 2008. https://opr.ca.gov/ceqa/docs/20210720-june08-ceqa.pdf.

OPR. 2018. "Discussion Draft CEQA and Climate Change Advisory." December 2018. Accessed March 2019. http://opr.ca.gov/docs/20181228-Discussion_Draft_Climate_Change_Adivsory.pdf.

Port of Stockton. 2023. *Port of Stockton Clean Air Plan.* April 2023. https://www.portofstockton.com/wp-content/uploads/2023/07/Port-of-Stockton-Clean-Air-Plan_FINAL.pdf.

PBL. 2022. Trends in Global CO_2 and Total Greenhouse Gas Emissions: 2021 Summary Report. August 2022. https://www.pbl.nl/uploads/default/downloads/pbl-2022-trends-in-global-co2-and_total-greenhouse-gas-emissions-2021-summary-report_4758.pdf

Poeplau et al. 2011. Temporal dynamics of soil organic carbon after land-use change in the temperate zone – carbon response functions as a model approach. Global Change Biology, 17(7), 2415-2427.

Prichard, S. J., & Kennedy, M. C. 2012. Fuel treatment effects on tree mortality following wildfire in dry mixed conifer forests, Washington State, USA. International Journal of Wildland Fire, 21(8), 1004-1013.

Save the Plastic Bag Coalition v. City of Manhattan Beach. 2011. 52 Cal.4th 155. Accessed July 2024. https://casetext.com/case/save-the-plastic-bag-coal-v-city-of-manhattan-beach

Sherlock, J. W. 2007. Integrating stand density management with fuel reduction. In Restoring fire-adapted ecosystems: proceedings of the 2005 national silviculture workshop. Gen. Tech. Rep. PSW-GTR-203. Albany, CA: US Department of Agriculture, Forest Service, Pacific Southwest Research Station (pp. 55-66).

Stancil, J.M. 2015. The Power of One Tree - The Very Air We Breathe. https://www.usda.gov/media/blog/2015/03/17/power-one-tree-very-air-we-breathe

State of California. 2021. Wildfire and Forest Resilience Action Plan. January 2021. https://wildfiretaskforce.org/wp-content/uploads/2022/04/californiawildfireandforestresilienceactionplan.pdf.

Steel, Z. L., Goodwin, M. J., Meyer, M. D., Fricker, G. A., Zald, H. S. J., Hurteau, M. D., & North, M. P. 2021. Do forest fuel reduction treatments confer resistance to beetle infestation and drought mortality?. Ecosphere, 12(1), e03344.

Stephens, S. L., & Moghaddas, J. J. 2005. Experimental fuel treatment impacts on forest structure, potential fire behavior, and predicted tree mortality in a California mixed conifer forest. *Forest Ecology and Management*, *215*(1-3), 21-36.

Stephens, S. L., Moghaddas, J. J., Hartsough, B. R., Moghaddas, E. E., & Clinton, N. E. 2009. Fuel treatment effects on stand-level carbon pools, treatment-related emissions, and fire risk in a Sierra Nevada mixed-conifer forest. *Canadian Journal of Forest Research*, *39*(8), 1538-1547.

Stephens, S. L., McIver, J. D., Boerner, R. E., Fettig, C. J., Fontaine, J. B., Hartsough, B. R., ... & Schwilk, D. W. 2012a. The effects of forest fuel-reduction treatments in the United States. *BioScience*, *62*(6), 549-560.

Stephens, S. L., R. E. J. Boerner, J. J. Moghaddas, E. E. Y. Moghaddas, B. M. Collins, C. B. Dow, C. Edminster, C. E. Fiedler, D. L. Fry, B. R. Hartsough, J. E. Keeley, E. E. Knapp, J. D. McIver, C. N. Skinner, and A. Youngblood. 2012b. Fuel treatment impacts on estimated wildfire carbon loss from forests in Montana, Oregon, California, and Arizona. Ecosphere 3(5):38. http://dx.doi.org/10.1890/ES11-00289.1

Stephenson, N. L., Das, A. J., Condit, R., Russo, S. E., Baker, P. J., Beckman, N. G., ... & Zavala, M. A. (2014). Rate of tree carbon accumulation increases continuously with tree size. *Nature*, *507*(7490), 90-93.Stevens-Rumann and Morgan 2019

Sustainable Biomass Program. 2021. Instruction Document 6C: Methodology for the calculation of GHG savings. July. https://sbp-cert.org/wp-content/uploads/2021/07/SBP-Instruction-Document-6C_Methodology-for-the-calculation-of-GHG-savings_v1.0_22Jul21-FINAL.pdf

Syphard, A. D., Radeloff, V. C., Keeley, J. E., Hawbaker, T. J., Clayton, M. K., Stewart, S. I., & Hammer, R. B. (2007). Human influence on California fire regimes. *Ecological applications*, *17*(5), 1388-1402.

Tuolumne County. 2018. General Plan Update EIR. https://www.tuolumnecounty.ca.gov/DocumentCenter/View/11308/Tuolumne-County-GPU-Recirculated-DEIR-full-report.

Tuolumne County. 2022. Tuolumne County Climate Action Plan. November 2022. https://www.tuolumnecounty.ca.gov/DocumentCenter/View/23701/Final-Clean-linked.

UC Berkeley (University of California, Berkeley). 2020. Managing for Resilience: The Fire and Carbon Ecology of the Sierra Nevada Forests.

U.S. Forest Service. 2023. Carbon management in fire-prone forests. February 28, 2023. California's Wildfire and Forest Resilience Action Plan: Recommendations of the Governor's Forest Management Task Force (wildfiretaskforce.org)

USITC (United States International Trade Commission). 2022. Working Paper: The Rise of Utility Wood Pellet Energy in the Era of Climate Change. May 2022. https://www.usitc.gov/publications/332/working_papers/wood_pellets_final_052722.pdf.

Wang, et. Al. 2016. *A Life-cycle Comparison of the Energy, Environmental and Economic Impacts of Coal Versus Wood Pellets for Generating Heat in China.* Available November 2016. https://www.sciencedirect.com/science/article/pii/S0360544216317157#sec1

Ward, D.E., and C.C. Hardy. 1991. Smoke emissions from wildland fires. Environ. Int. 17:117-134

Weber and Berger. 2020. We Lost Greenville': Dixie Fire Becomes Third-Largest Wildfire in State History, Decimates California Town. Associated Press. https://www.kqed.org/news/11883862/we-lost-greenville-wildfire-decimates-california-town

Westerling, A. L., Bryant, B. P., Preisler, H. K., Holmes, T. P., Hidalgo, H. G., Das, T., & Shrestha, S. R. (2011). Climate change and growth scenarios for California wildfire. *Climatic Change*, *109*, 445-463.

WSDNR (Washington State Department of Natural Resources). 2010. Forest Biomass and Air Emissions. https://www.dnr.wa.gov/Publications/em_forest_biomass_and_air_emissions_factsheet_7.pdf.

Yazdanpah et al. 2014. *Measurement of Off-Gases in Wood Pellet Storage*. February 26, 2014. https://www.intechopen.com/chapters/46210.