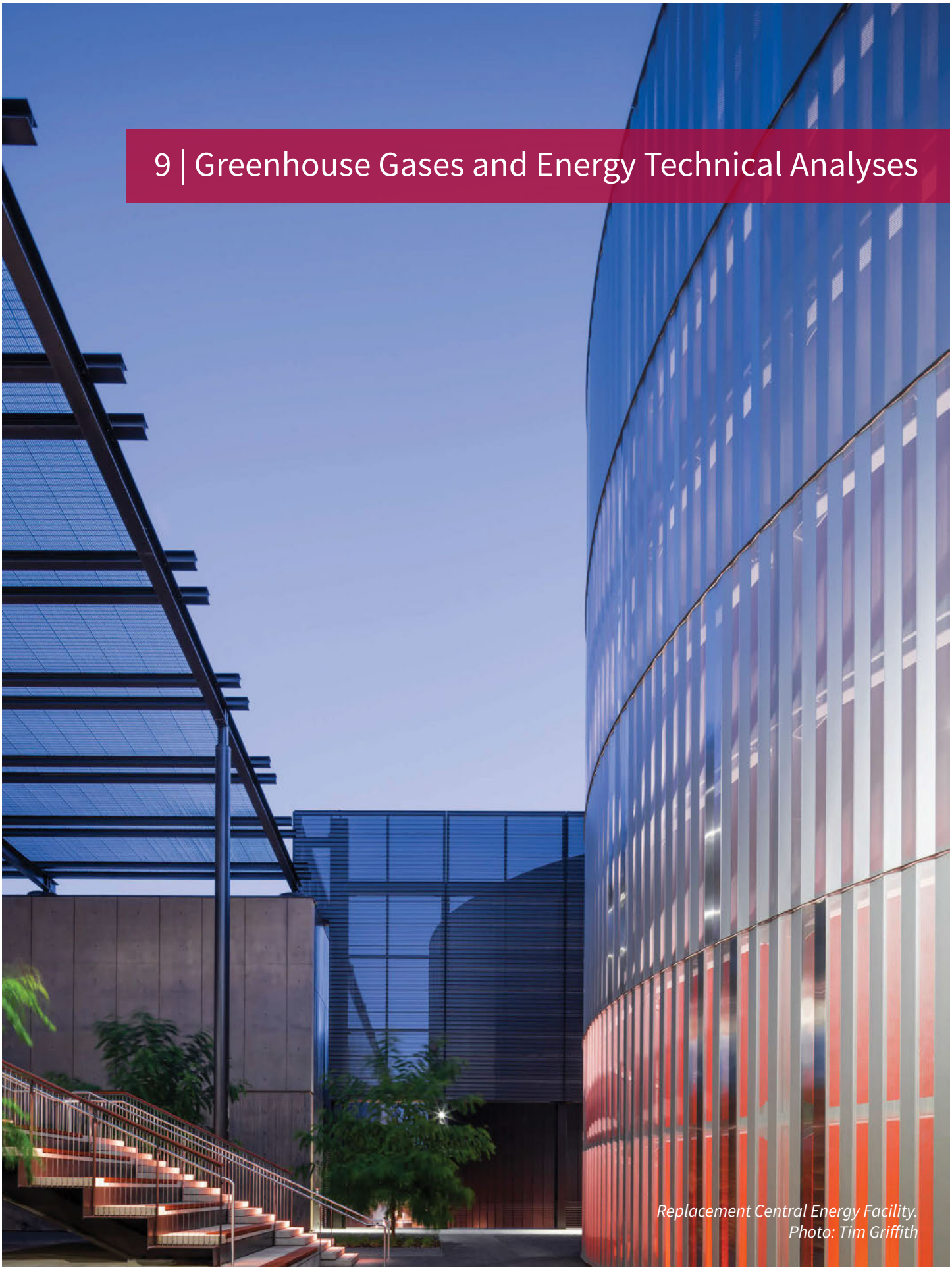
9 | Greenhouse Gases and Energy Technical Analyses



Replacement Central Energy Facility.
Photo: Tim Griffith

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STANFORD 2018 GENERAL USE PERMIT: GHG TECHNICAL REPORT

STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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ACRONYMS AND ABBREVIATIONS

°C	Degree Celsius
AB	Assembly Bill
ABAG	Association of Bay Area Governments
AEP	Association of Environmental Professionals
ARB	California Air Resources Board
ARRA	American Recovery and Reinvestment Act
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
BAU	Business-As-Usual
Bay Area Basin	San Francisco Bay Area Basin
BMP	Best Management Practice
CAFE	Corporate Average Fuel Economy
CalEEMod®	California Emission Estimator Model
CAP	Criteria Air Pollutant
CAT	Climate Action Team
CEC	California Energy Commission
CEF	Central Energy Facility
CEQA	California Environmental Quality Act
CF_4	Perfluoromethane
CFC	Chlorinated Fluorocarbon
CH_4	Methane
CNRA	California Natural Resources Agency
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPUC	California Public Utilities Commission
CY	Cubic Yards
DOT	Department of Transportation
EDGAR	Emissions Database for Global Atmospheric Research
EIR	Environmental Impact Report
EISA	Energy Independence and Security Act
EMFAC	EMission FACtor Model

GHG	Greenhouse Gas
GT	Billion Metric Tons
GUP	General Use Permit
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
Lb	Pound
LCFS	Low Carbon Fuel Standard
LFG	Landfill Gas
MMT	Million Metric Tons
mpg	Miles Per Gallon
MPO	Metropolitan Planning Organization
MRR	Mandatory Reporting Rule
MT	Metric Tons
MTC	Metropolitan Transportation Commission
MWh	Megawatt-Hour
N_2O	Nitrous Oxide
NCDC	National Clean Diesel Campaign
NHTSA	National Highway Traffic Safety Administration
OPC	California Ocean Protection Council
OFFROAD	Missions Inventory Program Model
OPR	Office of Planning and Research
PGE	Pacific Gas and Electric
ppb	Parts Per Billion
ppm	Parts Per Million
PSD	Prevention of Significant Deterioration
PSSI	Peninsula Sanitary Service, Inc.
Ramboll	Ramboll Environ US Corporation
RFS	Renewable Fuel Standard
RPS	Renewables Portfolio Standard
RTAC	Regional Targets Advisory Committee
RTP	Regional Transportation Plan
SB	Senate Bill

SCS	Sustainable Communities Strategy
SEM	Sustainability and Energy Management
SESI	Stanford Energy System Innovations
SF_6	Sulfur Hexafluoride
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
WCI	Western Regional Climate Action Initiative
WECC	Western Electricity Coordinating Council
ZEV	Zero-Emission Vehicle
ZNE	Zero Net Energy

1. INTRODUCTION

Please note that this report replaces the Greenhouse Gas Technical Report dated April 13, 2017. This updated report incorporates updates to the traffic data that result in minor changes to mobile emissions.

1.1 Project Description

Stanford University's contiguous lands occupy over 8,000 acres, with 4,017 of those acres in unincorporated Santa Clara County. The development of the Stanford land in unincorporated Santa Clara County currently is subject to conditions of approval in the 2000 General Use Permit (GUP). The 2000 GUP authorized the development of 2.035 million square feet of net new academic space and 3,018 net new housing units. In March 2016 the Santa Clara County Planning Commission authorized an additional 1,450 housing units. As of December 2015, 769,354 square feet of academic buildings remain to be built under the 2000 GUP. Stanford is proposing a 2018 GUP that would authorize 2.275 million net new academic space and 3,150 net new housing units. Stanford estimates that the new development authorized by the proposed 2018 GUP would occur between 2018 and 2035.

1.2 Emissions Inventory Years

This report evaluates the greenhouse gas (GHG) emissions inventories associated with the buildings and energy sources for existing conditions and the development proposed for the 2018 GUP (the "Project"). Inventories presented here represent calendar years 2014 and 2015, annualized emissions expected in Fall 2018, emissions expected in Fall 2020 including occupancy of the Escondido Village Graduate Residences, and the emissions inventory for the completion of the development proposed for the 2018 GUP, anticipated to occur by Fall 2035.

1.2.1 Study Area Boundaries

Stanford anticipates that the 2018 GUP will continue to cover all of its lands in unincorporated Santa Clara County. However, the GUP does not apply to land uses within those areas that are permitted as of right. The single-family and two-family residences in the faculty/staff subdivision are permitted as of right, and therefore are not included in the study area for this report. In addition, Stanford does not propose development under the 2018 GUP in areas zoned for medium-density faculty and staff housing (i.e., the Peter Coutts, Pearce Mitchell, and Olmsted Terrace housing areas). Nor does Stanford propose development outside the Academic Growth Boundary, including on the Stanford Golf Course. Therefore, these areas similarly are not included in the study area boundary for this GHG Technical Report.

The study area boundary includes all of the Academic Campus and Campus Open Space lands, including the Stanford Driving Range, which Stanford proposes to designate as Academic Campus rather than medium-density residential. Thirty-eight faculty and staff housing units are included in the study area in the Searsville and Olmsted staff rental subdivisions. The study area within which the emissions are analyzed are shown in **Figure 1-2**.

1.2.2 Existing Conditions Analysis Years

This document contains the evaluation of three analysis years to represent existing conditions. A more complete description of the existing condition years and the recent history of Stanford's emissions profile is provided in Section 3.2. The scenario years are:

1. 2014, which represents the state of the campus energy systems at the Stanford campus prior to the implementation of the Stanford Energy System Innovations (SESI), and also includes the operations of the Valero Service Station. This period uses data from 2014. A major feature of SESI was the replacement of the steam-based heating system with a hot-water based heating system, and replacement of the cogeneration plant with a new more efficient Central Energy Facility (CEF). A fuller description of the SESI and a comparison of the old and new CEF is provided in Section 3.2. The 2014 information is provided to aid in understanding the degree to which historic emissions have been reduced.
2. 2015, which represents the state of the campus energy systems after SESI. This period uses data from 2015. Natural gas and electricity usage is based on July – December 2015, after SESI is implemented. This scenario also reflects year 2015 emission factors.
3. Fall 2018, which represents the conditions that are expected to exist immediately prior to commencement of operations under the proposed 2018 GUP. This includes buildings that would be expected to be permitted and occupied during implementation of the 2000 GUP, and also reflects emission factors consistent with 2018. The Fall 2018 scenario assumes that the Escondido Village Graduate Residences Project is under construction, but not yet occupied and operational.
4. Fall 2020, which represents the conditions expected to exist after complete buildout of the 2000 GUP, including the operations from the Escondido Village Graduate Residences, and the same academic square footage as the Fall 2018 scenario. This scenario reflects emission factors consistent with 2020.

1.2.3 Project Analysis Year

This document evaluates the emissions inventory for complete buildout of the 2018 GUP (i.e., the Project). Because California has adopted a regulatory goal for reductions in GHG emissions by 2030, the Project emissions inventory is based on adopted regulatory measures (e.g., RPS) and emission factors (e.g., EMFAC2014 mobile factors), assuming the total operational activity from complete buildout and operation of the 2018 GUP in 2030. This scenario is called "Fall 2035" because it consists of the full Project operations expected by 2035; however, if 2035 emission factors were used instead of 2030 emission factors, then total GHG emissions would be even lower than reported here. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions. This report also includes an estimate of Project emissions in Fall 2035 that incorporates intensity factors for electricity generation consistent with expected implementation of renewable portfolio standards in 2035. The additional scenario is labeled "Fall 2035 With RPS Projection".

2. GHG SCIENTIFIC BACKGROUND AND REGULATORY OVERVIEW

2.1 GHG Scientific Background

There is international scientific consensus that anthropogenic emissions of greenhouse gases (GHGs)[1] have and will continue to contribute to changes in the global climate. Although there is uncertainty concerning the magnitude, rate, and ultimate effects of this change, it is generally accepted that climate change will result in a number of substantial adverse environmental impacts.

Climate change is the cumulative effect of all natural and anthropogenic sources of GHGs on a global scale. The GHG emissions from an individual project, even a very large development project, would not individually generate sufficient GHG emissions to measurably influence global climate change.[2,3] Consideration of a project's climate change impact, therefore, is essentially an analysis of a project's contribution to a cumulatively significant global impact through its emission of GHGs. While it is possible to examine the quantity of GHGs that would be emitted from individual project sources, it is not currently possible to link these GHGs emitted from a specific source or location to particular global climate changes.

The State of California, through Assembly Bill (AB) 32, Senate Bill (SB) 32, Executive Order S-3-05, and Executive Order B-30-15 has set state-wide targets for the reduction of GHG emissions. The goal of AB 32, Executive Order S-3-05, and Executive Order B-30-15 is to reduce future GHG emissions in a state that is expected to experience rapid growth in population and economic output.

2.1.1 Global Setting

This section describes the status of global science on climate change and the scientific consensus regarding the role of anthropogenic GHG emissions in contributing to climate change and global warming. This section also describes global-scale estimates of GHG trends and projected effects on climate.

2.1.1.1 Global Climate Change

Global warming and global climate change are both terms that describe changes in the earth's climate. Global climate change is a broad term used to describe any worldwide, long-term change in the earth's climate. This change could be, for example, an increase or decrease in temperatures, the start or end of an ice age, or a shift in precipitation patterns. The term global warming is more specific than global climate change and refers to a general increase in temperatures across the earth. Though global warming is characterized by rising temperatures, it can cause other climatic changes, such as a shift in the frequency and

[1] For the purposes of this analysis, the term "GHGs" refers to carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride, those gases regulated under California AB 32 and the Kyoto Protocol of the United Nations Framework Convention on Climate Change. Although the State of California also declared nitrogen trifluoride a GHG, there is no nitrogen trifluoride associated with this project. Therefore, nitrogen trifluoride will not be further considered.

[2] Alternative Approaches to Analyzing GHG Emissions and Global Climate Change in CEQA Documents. Accessed July 8, 2016. http://www.placer.ca.gov/Departments/CommunityDevelopment/EnvCoordSvcs/EIR/Homewood/drafteir/~/media/cdr/ECS/EIR/Homewood/ClimateChange/1_AEP2007.ashx

[3] Technical Advisory. CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review. June 19. Accessed July 8, 2016. http://opr.ca.gov/docs/june08-ceqa.pdf

intensity of rainfall or hurricanes. Global warming does not necessarily imply that all locations will be warmer. Some specific, unique locations may be cooler even though the world, on average, is warmer. All of these changes fit under the umbrella of global climate change.[4]

While global warming can be caused by natural processes, there is a general scientific consensus that most current global warming is the result of human activity on the planet.[5] This human-made, or anthropogenic, warming is primarily caused by increased emissions of GHGs that keep the earth's surface warm. This is called "the greenhouse effect." The greenhouse effect and the role that GHGs play in it are described below.

2.1.1.2 The Greenhouse Effect

Greenhouses allow sunlight to enter, and then they capture some of the heat generated by the sunlight. Similarly, the earth's atmosphere acts like a greenhouse by retaining some of the heat that is generated by the sun. When solar radiation from the sun reaches the earth, much of it penetrates the atmosphere to ultimately reach the earth's surface; this solar radiation is absorbed by the earth's surface and then re-emitted as heat in the form of infrared radiation.[6] The warming potential of GHGs does not come from the absorption of solar radiation but from the absorption of infrared radiation. When the infrared radiation is absorbed by the molecules of GHGs, it is re-radiated in all directions. A portion of the infrared radiation is emitted back toward the surface of the earth, in effect "trapping" the heat in the atmosphere.[7] This phenomenon is referred to as the "greenhouse effect."

The earth's greenhouse effect has existed far longer than humans have and has played a key role in the development of life. Concentrations of major GHGs, such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and water vapor, have been naturally present for millennia at relatively stable levels in the atmosphere, maintaining hospitable temperatures on the surface of the earth. Without these GHGs, the earth's temperature would be too cold for life to exist.

In the absence of major industrial human activity, natural processes have maintained atmospheric concentrations of GHGs, and, therefore, global temperatures at constant levels over the last several centuries.[8] As human industrial activity has increased, atmospheric concentrations of certain GHGs have grown dramatically. Concentrations of CO_2 and CH_4 over the past 10,000 years has increased, particularly dramatically since the Industrial Revolution. As the concentrations of GHGs increase due to human activity, more infrared

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[4] Other definitions of "greenhouse effect" and "global warming" can be found on Merriam-Webster online at http://www.m-w.com/. A definition for "climate change" can be found at http://dictionary.reference.com, which uses Webster's New Millennium™ Dictionary of English, Preview Edition (v 0.9.6). (Websites accessed July 8, 2016.)

[5] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

[6] All light, be it visible, ultraviolet, or infrared, carries energy.

[7] Infrared radiation is characterized by longer wavelengths than solar radiation. GHGs reflect radiation with longer wavelengths. As a result, instead of escaping back into space, GHGs reflect much infrared radiation (i.e., heat) back to the earth.

[8] Examples of natural processes include the addition of GHGs to the atmosphere from respiration, fires, and decomposition of organic matter. The removal of GHGs is mainly from plant and algae growth and absorption by the ocean.

radiation is reflected back toward the earth, subsequently heating the surface of the earth to higher temperatures. This is the process that is described as human-induced global warming.

In 2013, the Intergovernmental Panel on Climate Change (IPCC) began releasing components of its Fifth Assessment Report,[9] providing a comprehensive assessment of climate change science. The Fifth Assessment Report states that there is a scientific consensus that the global increases in GHGs since 1750 are mainly due to human activities such as fossil fuel use, land use change (e.g., deforestation), and agriculture. In addition, the report states that it is likely that these changes in GHG concentrations have contributed to global warming. Confidence levels of claims in this report have increased since the release of the Third and Fourth Assessment Reports due to the large number of simulations run and the broad range of available climate models.[10]

2.1.1.3 GHGs and GHG Emission Sources

The term "greenhouse gases" includes gases that are emitted from natural processes, such as forest fires, and anaerobic degradation, as well as man-made fossil fuel combustion, such as CO_2, CH_4, N_2O, and water vapor, as well as gases that are only human-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs), chlorinated fluorocarbons (CFCs), and sulfur hexafluoride (SF_6). These last three families of gases, while not naturally present in the atmosphere, have properties similar to the naturally occurring GHGs that also cause them to trap infrared radiation when they are present in the atmosphere, thus making them GHGs. These six gases comprise the major GHGs that are recognized by the Kyoto Protocol (water is not included).[11] A seventh gas, nitrogen trifluoride, was also recognized by the California Air Resources Board (ARB) as a GHG.[12] There are other GHGs that are not recognized by the Kyoto Protocol or ARB, due to either the smaller role that they play in climate change or the uncertainties surrounding their effects. Atmospheric water vapor is not recognized by the Kyoto Protocol or ARB because there is not an obvious correlation between atmospheric water vapor concentrations and specific human activities. Atmospheric water vapor appears to act in a positive feedback manner; higher temperatures lead to higher atmospheric water vapor concentrations, which in turn cause more global warming.[13]

The effect each GHG has on global warming is a combination of the volume of its emissions and its global warming potential (GWP). GWP indicates, on a pound (lb)-for-pound basis, how much a gas will contribute to global warming relative to how much warming would be caused by the same mass of CO_2. CH_4 and N_2O are substantially more potent than CO_2, with GWPs of 25 and 298,[14] respectively. However, these GHGs are nowhere near as potent as

[9] IPCC Fifth Assessment Report. Climate Change 2014: Working Groups I, II, and III Reports. Accessed July 14, 2016. http://www.ipcc.ch/report/ar5/syr/

[10] IPCC Third Assessment Report. Accessed July 14, 2016. https://www.ipcc.ch/ipccreports/tar/

[11] The Kyoto Protocol sets legally binding targets and timetables for cutting the GHG emissions of industrialized countries. The U.S. has not approved the Kyoto Protocol.

[12] Senate Bill 104, which directs ARB to regulate nitrogen trifluoride and possibly other gases found to be at least as harmful as CO_2 was signed into law by Governor Schwarzenegger in October 2009.

[13] Third Assessment Report. Accessed July 9, 2016. https://www.ipcc.ch/ipccreports/tar/

[14] These GWPs are from the IPCC's Fourth Assessment Report.

synthetic chemicals such as SF_6 and perfluoromethane (CF_4), which have GWPs of 22,800 and 7,390, respectively, compared to a GWP of 1 for CO_2.[15]

GHG emissions are typically measured in terms of mass of carbon dioxide equivalent (CO_2e). CO_2e is calculated as the product of the mass of a given GHG and its specific GWP.

The most important GHG in human-induced global warming is CO_2. While many gases have much higher GWPs than the simple GHGs, CO_2 is emitted in such vastly higher quantities that it accounts for 85% of the GWP of all GHGs emitted by the United States (US).[16] Fossil fuel combustion, especially for the generation of electricity and powering of motor vehicles, has led to substantial increases in CO_2 emissions and thus substantial increases in atmospheric CO_2 concentrations. In 2005, atmospheric CO_2 concentrations were about 379 parts per million (ppm), over 35% higher than the pre-industrial concentrations of about 280 ppm.[17]. In addition to the sheer increase in the volume of its emissions, CO_2 is a major factor in human-induced global warming because of its lifespan in the atmosphere of 50 to 200 years.

Concentrations of the second most prominent GHG, CH_4, have also increased due to human activities such as rice production, degradation of waste in landfills, cattle farming, and natural gas mining. In 2005, atmospheric levels of CH_4 were more than double pre-industrial levels, up to 1,774 parts per billion (ppb) as compared to 715 ppb.[18] CH_4 has a relatively short atmospheric lifespan of only 12 years but has a higher GWP than CO_2.

N_2O concentrations increased from about 270 ppb in pre-industrial times to about 319 ppb by 2005.[19] Most of this increase can be attributed to agricultural practices (such as soil and manure management), as well as fossil-fuel combustion and the production of some acids. N_2O's 120-year atmospheric lifespan increases its role in global warming.

Besides CO_2, CH_4, and N_2O, there are several gases and categories of gases that were not present in the atmosphere in pre-industrial times but now exist and contribute to warming. These include CFCs, used often as refrigerants, and their more stratospheric-ozone-friendly replacements, HFCs. Fully fluorinated species, such as SF_6 and CF_4, are present in the atmosphere in relatively small concentrations but have extremely long life spans of 50,000 and 3,200 years each, making them potent GHGs.

2.1.1.4 Current and Projected Climatic Impacts of Global Warming

A strong indication that anthropogenic global warming is currently taking place is the fact that the top ten warmest years since 1880 occurred after 1998, with 2014 as the hottest year on record. Furthermore, a warming of about 0.2 degree Celsius (°C) per decade is projected by currently accepted models.

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[15] Fourth Assessment Report.

[16] USEPA. 2016. Inventory of U.S. GHG Emissions and Sinks: 1990-2014. Accessed July 8, 2016. https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html

[17] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

[18] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

[19] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

There is scientific consensus that global climate change will increase the frequency of heat extremes, heat waves, and heavy precipitation events. Other likely direct effects include an increase in the areas affected by drought and by floods, an increase in tropical cyclone activity, a rise in sea level, and recession of polar ice caps. The impacts of global warming have already been demonstrated by substantial ice loss in the Arctic.[20,21] Scenarios for 2100 modeled in the IPCC's Fifth Assessment Report include the following:[22]

Temperature Increase by 2100

- Low Emissions Scenario: 1.1°C to 2.6°C
- High Emissions Scenario: 2.5°C to 7.8°C

Sea Level Rise by 2100

- Low Emissions Scenario: 0.26 to 0.55 meters (range)
- High Emissions Scenario: 0.45 to 0.82 meters (range)

2.1.2 United States Setting

Total US GHG emissions were approximately 6.9 billion metric tons (GT) CO_2e in 2014, 6.8 GT CO_2e in 2013, and 6.6 GT CO_2e in 2012.[23] Dividing this value by the 2014 U.S. population yields per capita emissions of approximately 21.6 metric tons (MT) CO_2e per person.[24] US emissions have increased by an annual average rate of 0.4% since 1990. Approximately 77% of the CO_2e emissions in the US are comprised of CO_2 emissions from energy-related fossil fuel combustion.[25]

According to the Emissions Database for Global Atmospheric Research (EDGAR), global GHG emission totaled approximately 53.9 GT CO_2e in 2012.[26] The top 10 emitting countries in 2012 were as follows:

- China – 12.5 GT CO_2e
- United States – 6.3 GT CO_2e[27]

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[20] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

[21] IPCC. 2007c. Summary for Policymakers. In: Climate Change 2007: Impacts, Adaption and Vulnerability. Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4_wg2_full_report.pdf

[22] Future GHG emissions are the product of very complex dynamic systems, determined by driving forces such as demographic development, socio-economic development, and technological change. Their future evolution is highly uncertain. Scenarios are alternative images of how the future might unfold and are an appropriate tool with which to analyze how driving forces may influence future emission outcomes and to assess the associated uncertainties. They assist in climate change analysis, including climate modeling and the assessment of impacts, adaptation, and mitigation. The possibility that any single emissions path will occur as described in scenarios is highly uncertain. More information on the IPCC's selection of scenarios is available at, http://www.ipcc.ch/ipccreports/sres/emission/index.htm accessed July 8, 2016.

[23] USEPA. 2016. Inventory of US GHG Emissions and Sinks 1990-2014. Accessed June 30, 2016. https://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2016-Main-Text.pdf.

[24] US Census Population. Accessed June 30, 2016.http://www.census.gov/topics/population.html .

[25] State Energy CO_2 Emissions. Access July 1, 2016. https://www.epa.gov/statelocalclimate/state-energy-co2-emissions.

[26] GHG (CO_2, CH_4, N_2O, F gases) emission time series 1990-2012 per region/country. Emission Database for Global Atmospheric Research. Accessed June 30, 2016. http://edgar.jrc.ec.europa.eu/overview.php?v=GHGts1990-2012&sort=des9.

- India – 3.0 GT CO_2e
- Brazil – 3.0 GT CO_2e
- Russian Federation – 2.8 GT CO_2e
- Japan – 1.5 GT CO_2e
- Canada – 1.0 GT CO_2e
- Germany – 0.95 GT CO_2e
- The Democratic Republic of Congo – 0.80 GT CO_2e
- Indonesia – 0.78 GT CO_2e

In 2012, CO_2e emissions from industrialized countries reporting their inventories to the United Nations Framework Convention on Climate Change (UNFCCC) were as follows:[28]

- United States – 6.5 GT CO_2e
- European Union (27 members) – 4.5 GT CO_2e
- Russian Federation – 2.3 GT CO_2e
- Japan – 1.3 GT CO_2e
- Canada – 0.70 GT CO_2e

2.1.3 California Setting

In 2014, California emitted approximately 442 million metric tons (MMT) CO_2e, or about 7% of the total US emissions, whereas California represents over 12% of the US population.

In 2013, the largest source of GHG emissions in California (approximately 38%) was the transportation sector.[29] High GWP gases[30] accounted for approximately 4% of the CO_2e emissions in 2011.[31] California's 2014 per-capita GHG emissions were 11.4 MT CO_2e per person[32]. Since 2001, California's per-capita GHG emissions have trended downward despite an increase in population. An overall decrease in gross GHG emissions since 2008 has also contributed to the decrease in per-capita GHG emissions.[33]

In 2012, emissions from facilities required to report their GHG inventories to ARB under the California Mandatory Reporting Rule (MRR) rose following a three-year decline. Emissions from these facilities remained constant the following year. Emissions were 110.0, 123.3, and 123.2 MMT CO_2e for 2011, 2012, and 2013, respectively.[34] ARB forecasts that California's

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[27] Slight difference between USEPA value and EDGAR value may be due to differences in sources and methodology used by the two organizations.

[28] *Time Series Annex I: GHG Total Excluding Land Use, Land-Use Change and Forestry.* Accessed June 30, 2016. http://unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3841.php

[29] Emissions Trends: Mandatory GHG Emissions Reporting. January. Accessed July 1, 2016. http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/2008-2013-ghg-summary-2015-06-30.pdf.

[30] Such as HFCs and PFCs.

[31] California GHG Emission Inventory. Accessed July 1, 2016. http://www.arb.ca.gov/cc/inventory/data/data.htm.

[32] US Census QuickFacts. Accessed July 1, 2016. http://www.census.gov/quickfacts/

[33] Emissions Trends: Mandatory GHG Emissions Reporting. January. Accessed July 1, 2016..http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/2008-2013-ghg-summary-2015-06-30.pdf

[34] California GHG Emission Inventory. Accessed July 1, 2016. http://www.arb.ca.gov/cc/inventory/data/data.htm

GHG emissions will reach approximately 509 MMT CO_2e by 2020 if no further measures are taken to mitigate or decrease emissions.[35]

2.1.4 Bay Area Setting

The Bay Area Air Quality Management District (BAAQMD) published an updated inventory of GHG emissions in the San Francisco Bay Area Air Basin (Bay Area Basin) in January 2015 based on a 2011 inventory year. Total GHG emissions within the Bay Area Basin in 2011 were estimated as 86.6 MMT CO_2e. Fossil fuel consumption in the transportation sector and the industrial/commercial sector were the two largest sources of the Bay Area Basin's GHG emissions in 2011, contributing, respectively, 39.7% and 35.7% of GHG emissions in the Bay Area Basin. These sectors were followed by electricity/co-generation (14.0%), residential fuel usage (7.7%), off-road equipment (1.5%), and agriculture/farming (1.5%).

To reduce future GHG emissions, BAAQMD published the California Environmental Quality Act (CEQA) Guidelines, which were updated in May of 2012.[36] BAAQMD CEQA Guidelines suggest adopting a climate action plan that includes both a GHG emission inventory and a forecast of future emissions. In accordance with the 2010 BAAQMD CEQA Guidelines, the BAAQMD has created a forecast of GHG emissions through 2020 by applying sector-specific growth factors to the baseline year emissions. The BAAQMD GHG Plan Level Guidance document identifies specific growth metrics and data sources for the various sectors including residential, commercial, industrial, transportation, waste, water treatment, and agriculture. The BAAQMD projects that GHG emissions will increase to approximately 94.8 MMT CO_2e per year by 2029 if current trends continue without mitigation.[37]

2.1.5 Santa Clara County Setting

In 2015, BAAQMD prepared GHG inventories for each of the nine Bay Area Counties.[38] In this report, annual GHG emissions of Santa Clara County for basis year 2011 were listed as 16.0 MMT CO_2e.

2.1.6 Stanford University Setting

In 2007, Stanford University formed its Sustainability and Energy Management (SEM) program. Stanford reported that in 2014, campus operations produced approximately 209,000 $MTCO_2e$.[39] On-site power generation accounts for 58% of these emissions. 12% of the total is attributable to vehicles used to commute to campus. 11% of GHG emissions are attributable to power generation for Stanford Hospital. Stanford aims to increase

[35] GHG Inventory. Accessed July 1, 2016. 2020 Emissions Forecast. Accessed July 8, 2016. http://www.arb.ca.gov/cc/inventory/data/forecast.htm.

[36] BAAQMD GHG Plan Level Guidance. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/baaqmd-ceqa-guidelines_final_may-2012.pdf?la=en.

[37] Source Inventory of Bay Area GHG Emissions: Base Year 2011. Accessed July 1, 2016. http://www.baaqmd.gov/~/media/files/planning-and-research/emission-inventory/by2011_ghgsummary.pdf

[38] Source Inventory of Bay Area GHG Emissions: Base Year 2011. Accessed July 1, 2016. http://www.baaqmd.gov/~/media/files/planning-and-research/emission-inventory/by2011_ghgsummary.pdf

[39] The primary differences between the Stanford SEM's 2014 inventory and the inventory presented in this GHG Technical Report are different boundaries accounted for in the two inventories and that Stanford SEM's inventory does not account for GHG emissions from vehicular activity from workers and visitors.

sustainability by conserving energy in existing buildings, incorporating efficiency in new building designs, and seeking out more sustainable sources of energy.[40]

2.1.7 Climate Change Effects

The California Natural Resources Agency (CNRA) prepared the Climate Adaptation Strategy in 2009, which discusses the impacts of climate change on California.[41] The Climate Adaptation Strategy identifies different areas of focus for decision makers, listed below, and aims to safeguard California by reducing climate risks. This document was updated in July 2014 as Safeguarding California: Reducing Climate Risk, which discusses examples of progress made since 2009.[42] Notable advances in the 2014 update include the creation of the Cal-Adapt tool for visualization of local climate impacts, the publication of the 2012 California Climate Adaptation Planning Guide for local and regional governments, and the 2013 Climate Change Consortium for Specialty Crops for agricultural resilience.

The Climate Adaptation Strategy was developed as a result of the November 2008 Executive Order S-13-08, which called for State agencies to plan for sea level rise and other climate impacts, and coordinated these plans in California's first strategy.

2.1.7.1 Changing Temperatures

The CNRA described new projections by Massachusetts Institute of Technology modelers predicting a median probability of surface warming of 5.2°C by the year 2100, which is much higher than previous modeling completed in 2003.[43] Researchers modeled temperature changes specifically related to California.[44] The model predicted greater temperature increases in summer than in winter and larger increases inland than in coastal areas.

2.1.7.2 Tipping Elements

The CNRA emphasized "tipping elements," which bring about "abrupt changes that could push natural systems past thresholds beyond which they could not recover." According to the CNRA, there are five main events (see Table 2-1-1) that could bring about abrupt environmental changes. Each of these five has a particular tipping temperature at which the event is likely to occur. The consequence of crossing each threshold could cause a 7- to 12-meter rise in sea level over the course of several centuries.

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[40] Stanford Sustainability and Energy Management. Accessed July 1, 2016. https://sustainable.stanford.edu/sites/default/files/resource-attachments/E_C_Plan_2015.pdf

[41] 2009 California Climate Adaptation Strategy. Accessed July 1, 2016. http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf

[42] 2014 Safeguarding California: Reducing Climate Risk. An update to the 2009 California Climate Adaptation Strategy. Final Version. Accessed July 1, 2016. http://resources.ca.gov/docs/climate/Final_Safeguarding_CA_Plan_July_31_2014.pdf

[43] Chandler, David, 2009. Climate Change Odds Much Worse Than Thought: New Analysis Shows Warming Could Be Double Previous Estimates. MIT News Office, May 19. Accessed July 8, 2016. http://news.mit.edu/2009/roulette-0519

[44] Moser, S., G. Franco, S. Pittiglio, W. Chou, W. and D. Cayan. 2008. The Future is Now: An Update on Climate Change Science Impacts and Response Options for California. 2008 Climate Change Impacts Assessment Project - Second Biennial Science Report to the California Climate Action Team, CEC-500-2008-071, Sacramento, CA.

Table 2-1-1 Tipping Elements That Could Trigger Abrupt Environmental Changes

Additional Warming (°F)	Environmental Change	Length of Time for Change to Complete
1-3	Rapid Arctic sea ice melt	10 years
2-4	Irreversible melting of the Greenland Ice Sheet	300 years or more
5-9	Irreversible melting of the West Antarctic Ice Sheet	300 years or more
5-7	Amazon forest die-back	None given
6-11	Intensification of El Niño Southern Oscillation cycles	None given

Notes:

°F = degrees Fahrenheit

Source:

CNRA. 2009. California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008. http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf

2.1.7.3 Extreme Natural Events

In addition, the CNRA listed extreme natural events are likely to occur, including higher nighttime temperatures and longer, more frequent heat waves overall; a 12–35% decrease in precipitation levels by mid- to late-21st century; increased evaporation and faster incidences of snowmelt that will increase drought conditions; and more precipitation in the form of rain as compared to snow that will decrease water storage in California during the dry season and increase flood events during the wet season.[45]

2.1.7.4 Precipitation Changes

The CNRA also stated that climate change will intensify California's "Mediterranean climate pattern," with the majority of annual precipitation occurring between November and March and drier conditions during the summer.[46] This will increase droughts and floods and will affect river systems. One of the ways to quantify potential impacts related to river systems was by calculating a rise in water temperature and its effects on fisheries resources.[47]

2.1.7.5 Sea Level Rise

The CNRA stated that sea level rise can cause damage to coastal communities and loss of land, which according to a study published by the University of California-Berkeley Department of Agricultural and Resource Economics, could reach tens of billions of dollars

[45] Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment. PIER Research Report, CEC-500-2009-014, Sacramento, CA, California Energy Commission.

[46] Scenarios of Climate Change in California: An Overview (White Paper, CEC-500-2005-203-SF). Sacramento, CA: CCCC, February. http://www.energy.ca.gov/2005publications/CEC-500-2005-186/CEC-500-2005-186-SF.PDF.

[47] Exposure to High Temperature Influences the Behavior, Physiology, and Survival of Sockeye Salmon During Spawning Migration. Canadian Journal of Zoology. 86(2): pp. 127-140.

per year in direct costs and trillions of dollars of assets in collateral risk.[48] Current calculations of sea level rise from 1900 to 2000 estimate approximately 7 inches along the California coast.[49] Further, up to 55 inches of sea level rise globally by the end of the 21st century is predicted under the "business as usual" model.[50]

2.1.7.6 Water Supply Issues

California Health and Safety Code Section 38501(a) recognizes that climate change "poses a serious threat to the economic well-being, public health, natural resources, and the environment of California," and notes that "the potential adverse impacts of [climate change] include…reduction in the quality and supply of water to the state from the Sierra snowpack." As most of the state, including the San Francisco Peninsula, depends on surface water supplies originating in the Sierra Nevada, this water supply reduction is a concern.

Most of the scientific models addressing climate change show that the primary effect on California's climate would be a reduced snow pack and a shift in stream-flow seasonality. A higher percentage of the winter precipitation in the mountains would likely fall as rain rather than as snow in some locations, reducing the overall snowpack. Further, as temperatures rise, snowmelt is expected to occur earlier in the year, resulting in peak runoff that would likely come a month or so earlier. The end result would be that the state may not have sufficient surface storage to capture the resulting early runoff, and so, absent construction of additional water storage projects, a portion of the current supplies would be lost to the oceans, rather than be available for use in the state's water delivery systems.

2.1.7.7 Low Sea Ice Levels

The CNRA stated that substantial sea ice melting from Greenland and the West Antarctic Ice Sheet has the potential to further raise sea levels. The sea ice extent in the Western Nordic Seas (i.e., Greenland, Norway, and Iceland Seas) is at the lowest level observed in the last 800 years. The implication is that a substantial reduction in sea ice in the Arctic sea promotes alterations in atmospheric circulation and precipitation patterns that extend to the mid-latitudes (e.g., the California coast). Additionally, it was reported that the variations in sea ice extent are correlated with changes in sea surface temperatures and atmospheric and ocean heat transport from the North Atlantic.[51]

The West Antarctic Ice Sheet is a marine-based ice sheet with edges that flow into floating ice shelves. Both the main sheet and the surrounding shelves have been showing signs of shrinking and collapsing due to global warming. Researchers have tracked the fate of at least

[48] California Climate Risk and Response. Berkeley, CA: University of California-Berkeley, Department of Agricultural and Resource Economics. http://next10.org/sites/next10.huang.radicaldesigns.org/files/California_Climate_Risk_and_Response.pdf

[49] The Future is Now: An Update on Climate Change Science Impacts and Response Options for California. 2008 Climate Change Impacts Assessment Project - Second Biennial Science Report to the California Climate Action Team, CEC-500-2008-071, Sacramento, CA.

[50] Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment. PIER Research Report, CEC-500-2009-014, Sacramento, CA, California Energy Commission. http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf

[51] Fauria, M., A. Grinsted, S. Helama, J. Moore, M. Timonen, T. Martma, E. Isaksson, and E. Eronen. 2009. Unprecedented Low Twentieth Century Winter Sea Ice Extent in the Western Nordic Seas Since A.D. 1200. Climate Dynamics, June 12.

nine shelves that have receded or collapsed around the Antarctic Peninsula in the past 50 years.[52]

2.1.7.8 Ocean Chemistry

The CNRA also noted that an emerging effect from climate change may be acidification of the ocean. Acidification will affect the ability of hard-shelled invertebrates to create their skeletal structures.[53] The implications of this change are major losses to shellfish industries and shifts in food resources for ocean fisheries. The primary contributing factors were cited as the increasing level of CO_2 and weather pattern shifts. Increases in atmospheric CO_2 levels result in increased uptake of CO_2 by the oceans, which result in decreased pH (acidification). Weather pattern shifts change the amount of calcium carbonate being delivered by rivers from sources stored in rocks, which further exacerbates the ability of invertebrates to form calcified shells.[54]

One of the main contributing factors to CO_2, outside of human influences, is melting permafrost. When permafrost thaws, it releases CO_2 and CH_4 trapped in the soil or beneath lakes into the atmosphere. Scientists are now estimating that there is more than twice the total amount of carbon stored in permafrost as there is in atmospheric CO_2, and that microbial decomposition of organic carbon in permafrost "could amount to roughly half [of the CO_2 emissions] resulting from global land-use change during this century".[55,56]

2.1.7.9 Socio-Economic Issues

Global temperature increases may have significant negative impacts on ecosystems, natural resources, and human health. Ecosystem structure and biodiversity will be compromised by temperature increases and associated climatic and hydrological disturbances.[57] The availability and quality of potable water resources may be compromised by increased salinization of ground water due to sea level rise, decreased supply in semi-arid and arid locations, and poorer water quality arising from increased water temperatures and more frequent floods and droughts.[58] These impacts on freshwater systems, in addition to the effects of increased drought and flood frequencies, may reduce crop productivity and food supply.

In addition to compromising food and water resources, climatic changes associated with global warming can affect human health and welfare through other means. Warmer

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[52] Doyle, A. 2009. Antarctic Ice Shelf Set To Collapse Due To Warming. Roche, A. (ed) In Reuters UK.Thomas Reuters. http://uk.reuters.com/articlePrint?articleId=UKTRE50I4G520090119.

[53] Risien, J. (ed.). 2009. West Coast Regional Marine Research and Information Needs. Corvallis, Oregon: Oregon Sea Grant. ORESU-Q-09-001.

[54] Griffith, E.M., A. Paytan, K. Caldeira, T. D. Bullen, and E. Thomas. 2008. A Dynamic Marine Calcium Cycle During the Past 28 Million Years. Science. December 12.

[55] Schuur, E.A.G., J. Bockheim, J.G. Canadell, E. Euskirchen, C.B. Field, S.V. Goryachkin, S. Hagemann, P. Kuhry, P.M. Lafleur, H. Lee, G. Mazhitova, F.E. Nelson, A. Rinke, V.E. Romanovshy, N. Shiklomanov, C. Tarnocai, S. Venevsky, J.G. Vogel, and S.A. Zomov. 2008. Vulnerability of Permafrost Carbon to Climate Change: Implications for the Global Carbon Cycle. BioScience. 58(8), pp. 701-714.

[56] ScienceDaily. 2008. Thawing Permafrost Likely To Boost Global Warming, New Assessment Concludes, September 2. http://www.sciencedaily.com/releases/2008/09/080901084854.htm.

[57] IPCC. 2007. *IPCC Fourth Assessment Report: Climate Change 2007: Working Groups I, II, and III Reports*. http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

[58] IPCC. 2008. Technical Paper VI: Climate Change and Water. http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf.

temperatures can lead to more ground-level ozone, a pollutant that causes eye irritation and respiratory problems. Ranges of infectious diseases will likely increase, and some areas will face greater incidences of illness and mortality associated with increased flooding and drought events.

In its 2014 Working Group II Report, the IPCC provided an assessment of the impacts of climate change on natural, managed, and human systems, as well as the capacity of these systems to adapt to these impacts. The IPCC states that, although some people will gain and some will lose because of global climate change, the "magnitude and severity of negative impacts are projected to increasingly outweigh the positive impacts" globally over the 21st century.[59]

California in particular is an area that could be negatively affected by global warming. Global warming could alter the seasonal pattern of snow accumulation and snowmelt that serve as primary sources for California's drinking water and irrigation water supplies. The scientific community projects extensions in the periods of high forest fire risk. Climatic changes would also affect agriculture, a major California industry, which could result in economic losses. For example, the heat wave in July 2006 is estimated to have cost the California dairy industry in excess of $1 billion.[60]

2.2 Regulatory Overview

2.2.1 International Provisions

The Kyoto Protocol, adopted on December 11, 1997, is an international agreement that is linked to the UNFCCC.[61] It sets targets and timetables for 36 industrialized countries and the European community for reducing GHG emissions. The targets amount to an average of 5% reduction against 1990 levels over the 5-year period from 2008 to 2012.

Negotiations after Kyoto have continued in an attempt to address the period after the first "commitment period" of the Kyoto Protocol concluded at the end of 2012. In Durban, South Africa, in 2011, parties to the protocol agreed in principle to negotiate a new comprehensive and legally binding climate agreement by 2015 and to enter it into force for all parties from 2020. In 2012, the Doha Amendment to the Kyoto Protocol was adopted for a second commitment period from 2013 to 2020. However, the Doha Amendment has not yet entered into force.

The Paris Agreement, developed at COP21 in December 2015, is an international agreement among parties in the UNFCCC. The central aim of the Paris Agreement is to maintain the global temperature rise in the 21st century below 2 degrees Celsius above pre-industrial levels. Furthermore, the Paris Agreement provides for increased transparency, requires all Parties to maintain and communicate "nationally determined contributions" that they intend to achieve, and aims to erect financial and technology frameworks for reaching the climate goals it puts forth. The agreement addresses a range of areas necessary to combat climate

[59] IPCC. 2014. *IPCC Fifth Assessment Report: Climate Change 2014: Impacts, Adaptation and Vulnerability*. http://ipcc.ch/pdf/assessment-report/ar5/wg2/ar5_wgII_spm_en.pdf.

[60] Environment News Service. 2006. California Heat Wave Costs Agriculture Industry Billions. August 4. http://www.ens-newswire.com/ens/aug2006/2006-08-04-09.html#anchor4.

[61] UNFCCC. 2013. Time Series Annex I: GHG Total Excluding Land Use, Land-Use Change and Forestry. http://unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3841.php.

change, including a long-term temperature goal, global peaking of GHG emissions, mitigation, and a "global stocktake" every five years.

2.2.2 Federal Provisions

Although the US is not a party to the Kyoto Protocol, in 2002, President George W. Bush set a national policy goal of reducing the GHG emission intensity (tons of GHG emissions per million dollars of gross domestic product) of the US economy by 18% by 2012.[62] The goal did not establish binding reduction mandates. Rather, the US Environmental Protection Agency (USEPA) began to administer a variety of voluntary programs and partnerships with industries that produce and use synthetic gases to reduce emissions of particularly potent GHGs.

In 2015, the US State Department submitted the nation's GHG emissions reduction target to the UNFCCC. The submission, referred to as Intended Nationally Determined Contribution, is a formal statement of the US target to reduce the nation's emissions by 26 to 28 percent below 2005 levels by 2025.

The emissions reduction target is the culmination of a process that examined opportunities under existing regulatory authorities to reduce GHG emissions in 2025 from all sources in all economic sectors. Several US laws, as well as existing and proposed regulations, are relevant to the implementation of the US target, including the Clean Air Act (42 U.S.C. § 7401 et seq.), the Energy Policy Act (42 U.S.C. § 13201 et seq.), and the Energy Independence and Security Act (42 U.S.C. § 17001 et seq).[63]

2.2.2.1 US Supreme Court Ruling in Massachusetts et al. v. Environmental Protection Agency

The Bush Administration's approach to addressing climate change was challenged in *Massachusetts et al. v. Environmental Protection Agency*, 549 US 497.[64] In this decision, the U.S. Supreme Court held that the USEPA was authorized by the Clean Air Act to regulate CO_2 emissions from new motor vehicles. The court did not mandate that the USEPA enact regulations to reduce GHG emissions, but found that the only instances in which the USEPA could avoid taking action were if it found that GHGs do not contribute to climate change or if it offered a "reasonable explanation" for not determining that GHGs contribute to climate change.

2.2.2.2 Endangerment Finding

On December 7, 2009, the USEPA Administrator issued an "endangerment finding" and a "cause or contribute finding" under Section 202(a) of the Clean Air Act, concluding that GHGs threaten the public health and welfare of current and future generations and that motor vehicles contribute to GHG pollution.

These findings do not impose any requirements on industry or other entities. However, this action was a prerequisite to finalizing the USEPA's proposed GHG emissions standards for

[62] NOAA. 2002. President Announces Clear Skies and Global Climate Change Initiative, February. http://georgewbush-whitehouse.archives.gov/news/releases/2002/02/20020214-5.html.

[63] The White House, FACT SHEET: U.S. Reports its 2025 Emissions Target to the UNFCCC (May 2015). https://www.whitehouse.gov/the-press-office/2015/03/31/fact-sheet-us-reports-its-2025-emissions-target-unfccc

[64] Massachusetts et al. vs. Environmental Protection Agency. 2007. 549 U.S. 497

light-duty vehicles[65,66] and providing the basis for adopting new national regulations to mandate GHG emission reductions under the federal Clean Air Act.

2.2.2.3 USEPA Rulemaking

The following sections summarize the USEPA's recent regulatory activities with respect to various types of GHG sources.

Stationary Sources

This section describes USEPA's recent regulatory activities with respect to stationary sources, which are sources of pollutants that do not move from one location. Boilers and emergency generators at Stanford University are stationary sources. Other examples of stationary sources include power plants, gas stations, and incinerators.

Mandatory Reporting Rule

Congress passed "The Consolidated Appropriations Act of 2008" (HR 2764) in December 2007, requiring reporting of GHG data and other relevant information from large emission sources and suppliers in the United States. The rule is referred to as 40 CFR Part 98 – GHG Reporting Program. The stated purpose of the rule is to collect accurate and timely GHG data to inform future policy decisions. Facilities that emit 25,000 MT of GHGs or more per year are required to submit annual reports to the USEPA. Suppliers of certain products that result in GHG emissions if released and facilities that inject CO_2 underground for geologic sequestration are also subject to the rule.

This program is expected to cover approximately 85% of the nation's GHG emissions and applies to roughly 10,000 facilities. The USEPA's new reporting system will provide a better understanding of GHG sources and will assist the development of policies and programs to reduce emissions. The data will also allow the reporters to track their own emissions, compare themselves to similar facilities, and aid in identifying cost-effective methods to reduce GHG emissions in the future.

Tailoring Rule

In May 2010, the USEPA issued the "Tailoring Rule" establishing permitting requirements for GHG emissions under the Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs. A determination of the Best Available Control Technology (BACT) for GHGs is a requirement established by the program in the same manner as it is done for any other PSD regulated pollutant. The Tailoring Rule sets thresholds for GHG emissions that define when permits under the PSD and Title V Operating Permit programs are required for new and existing industrial facilities. This rule generally establishes that first-time new construction projects that emit GHG emissions of at least 100,000 tons per year and modifications at existing facilities that increase GHG emissions by at least 75,000 tons per year are subject to PSD. The rule also establishes that facilities that emit or have the potential to emit at least 100,000 tons per year CO_2e will be subject to Title V permitting requirements. Each new source or modified emission unit subject to PSD is required to undergo a BACT review.

[65] USEPA. 2009. Recovery: EPA Gets Involved. Accessed July 8, 2016. http://www.epa.gov/recovery

[66] USEPA and DOT. 2010. *Light-Duty Vehicle GHG Emission Standards and Corporate Average Fuel Economy Standards*. Final Rule. 75 Fed. Reg. 25324-25728.

Climate Action Plan

In June 2013, President Barack Obama issued a Climate Action Plan to reduce carbon pollution. The Climate Action Plan established a multi-faceted approach to reduce carbon pollution, ranging from calling for carbon pollution standards for new and existing power plants, to new federal funding for renewables, to directing the development of new efficiency standards for appliances and federal buildings, among other measures.

Mobile Sources

This section describes the USEPA's recent regulatory activities with respect to mobile sources, which include vehicles that operate on roads and highways as well as non-road vehicles, engines, and equipment. Examples of mobile sources include cars, trucks, construction equipment, lawn mowers, railroad locomotives, ships, and airplanes.

Corporate Average Fuel Economy

First enacted by Congress in 1975 as part of the 1975 Energy Policy Conservation Act in response to the 1973-1974 oil crises, Corporate Average Fuel Economy (CAFE) standards seek to reduce energy consumption by increasing the fuel economy of passenger cars and light-duty trucks. The CAFE regulation requires each car manufacturer to meet a standard for the sales-weighted fuel economy for the entire fleet of vehicles sold in the US in each model year. Fuel economy, expressed in miles per gallon (mpg), is defined as the average distance traveled by an automobile (in miles) per gallon of gasoline or equivalent amount of other fuel. The National Highway Traffic Safety Administration (NHTSA) of the US Department of Transportation (DOT) administers the CAFE program, and the USEPA provides the fuel economy data. NHTSA sets fuel economy standards for passenger cars and light-duty trucks sold in the US while the USEPA calculates the average fuel economy for each manufacturer.

USEPA and NHTSA Joint Rulemaking for Vehicle Standards

In response to a *U.S. Presidential Memorandum Regarding Fuel Efficiency Standards* dated May 21, 2010, the USEPA and NHTSA are taking coordinated steps to enable the production of a new generation of clean vehicles, through reduced GHG emissions and improved fuel efficiency from on-road vehicles and engines. In April 2010, the USEPA and NHTSA issued a Final Rulemaking establishing new federal GHG and fuel economy standards for model years 2012 to 2016 passenger cars, light-duty trucks, and medium-duty passenger vehicles. The agencies extended the national program of harmonized GHG and fuel economy standards to model years 2017 through 2025 in a joint Final Rulemaking issued on August 28, 2012. These standards are projected to achieve a fleet-wide average CO_2 emission level of 163 grams per mile in model year 2025. (This would be equivalent, on a mpg-equivalent basis, to 54.5 mpg if all of the CO_2 emissions reductions were achieved with fuel economy technology.)

In addition, on August 9, 2011, the USEPA and NHTSA finalized regulations to reduce GHG emissions and improve fuel efficiency of medium- and heavy-duty vehicles, including large pickup trucks and vans, semi-trucks, and all types and sizes of work trucks and buses. The regulations incorporate all on-road vehicles rated at a gross vehicle weight at or above 8,500 lbs, and the engines that power them. Under the regulations, fuel economy will be improved and GHG emissions will be reduced in model years 2014-2018.

In August 2016, the USEPA and NHTSA adopted the next phase (Phase 2) of the fuel economy and GHG standards for medium- and heavy-duty trucks, which apply to vehicles

with model year 2018 and later. [67] In response to the USEPA's adoption of the Phase 2 standards, ARB staff plan to bring a proposed California Phase 2 program before its Board in 2017.[68]

2.2.2.4 Additional Federal GHG Rules and Policies

In addition to the rules and regulations developed with respect to stationary and mobile sources, discussed above, various other federal developments have occurred that aim to reduce GHGs from other sources, including land use activities.

Energy Independence and Security Act

On December 19, 2007, President Bush signed the Energy Independence and Security Act (EISA) of 2007. Among other key measures, the EISA would do the following, which would aid in the reduction of national GHG emissions:

1. Increase the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard (RFS) requiring fuel producers to use at least 36 billion gallons of biofuel in 2022.

1. Set a target of 35 mpg for the combined fleet of cars and light trucks by model year 2020, and direct NHTSA to establish a fuel economy program for medium- and heavy-duty trucks and create a separate fuel economy standard for work trucks.

2. Prescribe or revise standards affecting regional efficiency for heating and cooling products, procedures for new or amended standards, energy conservation, energy efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances.

Additional provisions of the EISA address energy savings in government and public institutions, promotion of research for alternative energy, additional research in carbon capture, international energy programs, and the creation of "green jobs."

American Recovery and Reinvestment Act

On February 17, 2009, President Obama signed the American Recovery and Reinvestment Act (ARRA) of 2009. ARRA was passed in response to the economic crisis of the late 2000s, with the primary purpose of maintaining existing jobs and creating new jobs. Among the secondary objectives of ARRA was investment in "green" energy programs, including funding the following through grants, loans, or other means: private companies developing renewable energy technologies; local and state governments implementing energy efficiency and clean energy programs; research in renewable energy, biofuels, and carbon capture; and development of high efficiency or electric vehicles.[69,70]

Renewable Fuel Standards (RFS1 and RFS2)

Created under the Energy Policy Act of 2005, the RFS program established the first renewable fuel volume mandate in the United States. The original RFS program (RFS1) required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012. Under the

[67] USEPA. Available at: https://www3.epa.gov/otaq/climate/documents/420f16044.pdf.

[68] CARB, CA Phase 2 GHG webpage: http://www.arb.ca.gov/msprog/onroad/caphase2ghg/caphase2ghg.htm. Accessed: September 2016.

[69] The Recovery Act. 2009. Accessed July 9, 2016. https://www.whitehouse.gov/recovery/about

[70] USEPA. 2009. Recovery: EPA Gets Involved. Accessed July 8, 2016. https://archive.epa.gov/recovery/web/html/

EISA of 2007, the RFS program was expanded to include diesel and to increase the volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022. In addition, the updated version of EISA required the USEPA to apply lifecycle GHG performance threshold standards to ensure that each category of renewable fuel emits fewer GHGs than the petroleum fuel it replaces.

In January 2011, the USEPA established the volume requirements and associated percentage standards that applied in calendar year 2011 for cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel (RFS2). The final percentage standard sets 8% of renewable fuel per total volume. The rule also announced the 2011 price for cellulosic biofuel waiver credits ($1.13 per credit) and the USEPA's assessment of the aggregate compliance provision for domestic feedstocks. The regulation increased the volume of fuel required to be blended into transportation fuel from 12.2 billion gallons in 2009 to 74 billion gallons by 2022; this includes 16.0 billion gallons for cellulosic biofuel, at least 1 billion gallons for biomass-based diesel fuel, 21.0 billion gallons for advanced biofuel, and 36.0 billion gallons for renewable fuel.

2.2.2.5 Voluntary Programs

The following voluntary programs developed by the USEPA provide opportunities for industry, the USEPA, and other organizations in both the public and private sectors to work together to reduce GHG emissions.[71]

Center for Corporate Climate Leadership

The USEPA's Center for Corporate Climate Leadership serves as a resource center for all companies looking to expand their work in the area of GHG measurement and management.

Green Power Partnership

The Green Power Partnership is a voluntary partnership between the USEPA and organizations that are interested in using green power, which is electricity produced from a subset of renewable resources, such as solar, wind, geothermal, biomass, and low-impact hydropower.

National Clean Diesel Campaign

The USEPAs National Clean Diesel Campaign (NCDC) promotes diesel emission reduction strategies. The NCDC works to reduce the pollution emitted from diesel engines across the country through the implementation of varied control strategies by working with manufacturers, fleet operators, air quality professionals, environmental and community organizations, and state and local officials to reduce diesel emissions. NCDC activities include developing new emissions standards for locomotive and marine diesel engines; and promoting the reduction of emissions for existing diesel engines, including using cleaner fuels, retrofitting and repairing existing fleets, and reducing idling, among others.

State and Local Climate and Energy Program

The USEPA also administers the State and Local Climate and Energy Program, which provides technical assistance, analytic tools, and outreach support to state, local, and tribal governments.[72]

[71] USEPA. Voluntary Energy and Climate Programs. Accessed July 8, 2016. http://www.epa.gov/climatechange/EPAactivities/voluntaryprograms.html.

2.2.3 Multi-State Area Provisions

The Western Regional Climate Action Initiative (WCI) was established in 2007 by the governors of five US states (Arizona, California, New Mexico, Oregon, and Washington) as a partnership to implement a regional, economy-wide cap-and-trade system to reduce global warming pollution. By the end of 2008, the partnership had expanded to include Montana, Utah, and four Canadian provinces (British Columbia, Manitoba, Ontario, and Quebec).

The WCI partners set a goal of reducing the region's GHG emissions from the electricity, industrial, and transportation sectors to 15% below 2005 levels by 2020. By December 2011, California and Quebec had adopted cap-and-trade regulations based on WCI recommendations, while the rest of the partner states declined to actively implement a cap-and-trade program. The partnership was then streamlined to include only California and the four Canadian provinces actively implementing or considering cap-and-trade programs. In May 2013, ARB adopted a final rule linking California's and Quebec's cap-and-trade programs (as of January 1, 2014) for the purpose of allowing the two entities to mutually recognize each other's compliance instruments. In October 2013, California and Quebec entered into an agreement to integrate and harmonize their cap-and-trade programs. California is also working closely with British Colombia, Ontario, and Manitoba through the WCI to develop harmonized cap-and-trade programs.

2.2.4 California Provisions

California has adopted various administrative initiatives and also enacted a variety of legislation relating to climate change, much of which sets aggressive goals for GHG emissions reductions within the state. However, none of this legislation provides definitive direction regarding the treatment of climate change in environmental review documents prepared under CEQA. In particular, the amendments to the CEQA Guidelines do not require or suggest specific methodologies for performing an assessment of thresholds of significance, and do not specify GHG reduction mitigation measures. Instead, the CEQA Guidelines amendments continue to rely on lead agencies to choose methodologies and make significance determinations based on substantial evidence, as discussed in further detail below.[73] Consequently, no State agency has promulgated binding regulations for analyzing GHG emissions, determining their significance, or mitigating any significant effects in CEQA documents.

The discussion below provides a brief overview of ARB and Office of Planning and Research (OPR) documents and of the primary legislation that relates to climate change and that may affect the emissions associated with the Project. It begins with an overview of the primary regulatory acts that have driven GHG regulation in California, which underlie many of the GHG rules and regulations that have been developed.

2.2.4.1 Executive Order S-3-05 (State-Wide GHG Targets for 2010, 2020, and 2050)

California Executive Order S-03-05 (June 1, 2005) establishes the goal of reducing GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by

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[72] USEPA. State and Local Climate and Energy Program. November. Accessed July 8, 2016. https://www.epa.gov/statelocalclimate

[73] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/FINAL_Text_of_Proposed_Amendemts.pdf

2050. Although the 2020 target is the core of AB 32 and has effectively been incorporated into AB 32, the 2050 target remains the goal of the Executive Order only.[74]

2.2.4.2 Executive Order B-30-15 (State-Wide GHG Targets for 2030)

In April 2015, Governor Brown signed Executive Order B-30-15, which established the following GHG emission reduction goal for California: by 2030, reduce GHG emissions to 40 percent below 1990 levels. This Executive Order also directed all state agencies with jurisdiction over GHG-emitting sources to implement measures designed to achieve the new interim 2030 goal, as well as the pre-existing, long-term 2050 goal identified in Executive Order S-3-05 (see discussion above). Additionally, the Executive Order directed ARB to update its Scoping Plan (see discussion below) to address the 2030 goal. Therefore, in the coming months, ARB is expected to develop statewide inventory projection data for 2030, as well as commence its efforts to identify reduction strategies capable of securing emission reductions that allow for achievement of the Executive Order's new interim goal.

In the last legislative session, the Legislature adopted SB 32 to enact the Executive Order's 2030 goal.

2.2.4.3 Assembly Bill 32 (Statewide GHG Reductions)

The California Global Warming Solutions Act of 2006 (AB 32) was signed into law in September 2006 after considerable study and expert testimony before the Legislature.[75] The law instructed ARB to develop and enforce regulations for the reporting and verification of state-wide GHG emissions. The bill directed ARB to set a state-wide GHG emission limit based on 1990 levels, to be achieved by 2020. The bill set a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.

The heart of the bill is the requirement that state-wide GHG emissions be reduced to 1990 levels by 2020. Based on ARB's calculation of 1990 baseline emissions levels, California must reduce GHG emissions by approximately 28.5% below "business-as-usual" (BAU) predictions for 2020 to achieve this goal.

In June 2011, ARB revised its "BAU" GHG emission estimate for 2020 in order to account for the recent economic downturn in its emission projections.[76] The estimate presented in the Scoping Plan (596 MMT CO_2e) was based on pre-recession, 2007 data from the Integrated Energy Policy Report. ARB has updated the projected "BAU" 2020 GHG emissions to 545 MMT CO_2e.

AB 32 requires ARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions. Key AB 32 milestones for ARB's actions include the following:

- *June 30, 2007: Identification of discrete early action GHG emissions reduction measures.* On June 21, 2007, ARB satisfied this requirement by approving three

[74] On November 6, 2013, the BAAQMD Board passed a resolution adopting the 2050 target of 80 percent below 1990 levels. Details of this resolution are described in the "Regional Provisions" section of this "Regulatory Setting" section.

[75] ARB. Assembly Bill 32 Overview. 2006a. Accessed July 22, 2016. http://www.arb.ca.gov/cc/ab32/ab32.htm

[76] ARB. Supplement to the AB 32 Scoping Plan Functional Equivalent Document. http://www.arb.ca.gov/cc/scopingplan/document/Supplement_to_SP_FED.pdf

early action measures.[77] These were later supplemented with six other discrete early action measures.[78]

- *January 1, 2008: Identification of the 1990 baseline GHG emissions level and approval of a state-wide limit equivalent to that level and adoption of reporting and verification requirements concerning GHG emissions.* On December 6, 2007, ARB approved a state-wide limit on GHG emissions levels for the year 2020 consistent with the determined 1990 baseline.[79]
- *January 1, 2009: Adoption of a scoping plan for achieving GHG emission reductions.* On December 11, 2008, ARB adopted its *Climate Change Scoping Plan: A Framework for Change* (Scoping Plan), discussed in more detail below.[80]
- *January 1, 2010: Adoption and enforcement of regulations to implement the "discrete" actions.* Several early action measures have been adopted and became effective on January 1, 2010.[81],[82]
- *January 1, 2011: Adoption of GHG emissions limits and reduction measures by regulation.* On October 28, 2010, ARB released its proposed cap-and-trade regulations, which would cover sources of approximately 85% of California's GHG emissions.[83] ARB's Board ordered ARB's Executive Director to prepare a final regulatory package for cap-and-trade on December 16, 2010.[84]
- January 1, 2012: GHG emissions limits and reduction measures adopted in 2011 become enforceable.
- November 14, 2012: First quarterly auction of GHG emissions allowances was held, as part of the cap-and-trade program.
- January 1, 2013: Cap-and-trade program begins with a GHG emissions cap that will decline over time.
- September 17, 2013: First carbon offset credits are issued as part of the cap-and-trade program.[85]

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[77] ARB. Summary of Board Meeting: Consideration of Recommendations for Discrete Early Actions for Climate Change Mitigation in California. Sacramento, CA, June 21.

[78] ARB. Summary of Board Meeting: Public Meeting to Consider Approval of Additions to Reduce GHG Emissions under the California Global Warming Solutions Act of 2006 and to Discuss Concepts for Promoting and Recognizing Voluntary Early Actions. Sacramento, CA, October 25.

[79] ARB. California GHG Inventory (millions of metric tons of CO2 equivalent) by IPCC Category. Sacramento, CA, November. http://www.arb.ca.gov/cc/inventory/archive/tables/ghg_inventory_ipcc_90-04_all_2007-11-19.pdf

[80] ARB. 2008. Climate Change Scoping Plan. Sacramento, CA, December. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

[81] ARB. Summary of Board Meeting: Consideration of Recommendations for Discrete Early Actions for Climate Change Mitigation in California. Sacramento, CA, June 21.

[82] ARB. Summary of Board Meeting: Public Meeting to Consider Approval of Additions to Reduce GHG Emissions under the California Global Warming Solutions Act of 2006 and to Discuss Concepts for Promoting and Recognizing Voluntary Early Actions. Sacramento, CA, October 25.

[83] ARB. Proposed Regulation to Implement California Cap-and-Trade Program. Sacramento, CA, October 28.

[84] ARB. California Cap-and-Trade Program. Final Resolution. Sacramento, CA. http://www.arb.ca.gov/regact/2010/capandtrade10/res1042.pdf

[85] ARB. 2014. Assembly Bill 32 Overview. Accessed August 31, 2016. https://www.arb.ca.gov/cc/ab32/ab32.htm

- May 22, 2014: Approval of the First Update to the Climate Change Scoping Plan. The First Update to the Climate Change Scoping Plan defines the ARB's climate change priorities for the next five years.
- April 29, 2015: AB 32 Scoping Plan updated to reflect the GHG emissions reduction target for 2030, which was established with Executive Order B-30-15.[86]

2008 Scoping Plan

As noted above, on December 11, 2008, ARB adopted the 2008 Scoping Plan to establish an overall framework for the measures that will be adopted to reduce California's GHG emissions. ARB determined that achieving the 1990 emission level would require a reduction of GHG emissions of approximately 28.5% below what would otherwise occur in 2020 in the absence of new laws and regulations (referred to as "BAU"). The Scoping Plan evaluates opportunities for sector-specific reductions, integrates all ARB and Climate Action Team early actions and additional GHG reduction measures by both entities, identifies additional measures to be pursued as regulations, and outlines the role of a cap-and-trade program. Many of these measures and regulations became effective on January 1, 2012. The key elements of the Scoping Plan[87] include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a state-wide renewables energy mix of 33% by 2020;
- Developing a California cap-and-trade program that links with other WCI partner programs to create a regional market system and caps sources contributing 85% of California's GHG emissions;
- Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;
- Adopting and implementing measures pursuant to existing state laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard (LCFS); and
- Creating targeted fees, including a public goods charge on water use, fees on high GWP gases, and a fee to fund the administrative costs of the State of California's long-term commitment to AB 32 implementation.

In 2009, a coalition of environmental groups brought a challenge to the Scoping Plan alleging that it violated AB 32 and that the environmental review document (called a "Functional Equivalent Document") violated CEQA by failing to appropriately analyze alternatives to the proposed cap-and-trade program. On May 20, 2011, the San Francisco Superior Court entered a final judgment ordering that ARB take no further action with respect to cap-and-trade rulemaking until it complied with CEQA.[88] ARB appealed the decision on May 23, 2011.

[86] ARB. 2016. AB 32 Scoping Plan. Accessed August 31, 2016. https://www.arb.ca.gov/cc/scopingplan/scopingplan.htm

[87] ARB. 2009. Initial Climate Change Scoping Plan. Sacramento, CA, December. Accessed July 9, 2016. http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm

[88] ARB, et al., v. Association of Irritated Residents, et al., 2011. http://www.crpe-ej.org/crpe/images/stories/7.25.11_Petition_for_Review_FINAL_with_Exhibits_smaller_version.pdf

The portions of the Scoping Plan that do not relate to cap-and-trade remained valid during the litigation. While the appeal was pending, ARB prepared a supplement to the Functional Equivalent Document that included the analysis that the trial court had determined was inadequate under CEQA. ARB certified the supplement to the Functional Equivalent Document and readopted the Scoping Plan on August 24, 2011[89]. On June 19, 2012, the California First District Court of Appeal upheld the Scoping Plan and affirmed ARB's approval of the Scoping Plan as in compliance with AB 32.[90]

In connection with the preparation of the supplement to the Functional Equivalent Document, ARB released revised estimates of the expected 2020 emissions reductions in consideration of the economic recession and the availability of updated information from development of measure-specific regulations. Incorporation of revised estimates in consideration of the economic recession reduced the projected 2020 emissions from 596 MMT CO_2e to 545 MMT CO_2e.[91] Under this scenario, achieving the 1990 emissions level would require a reduction of GHG emissions of 118 MMT CO_2e, or 21.7% (down from 28.5%), from 2020 "BAU" emissions levels. The 2020 AB 32 baseline was also updated to account for measures incorporated into the inventory, including Pavley (vehicle model years 2009-2016) and the Renewables Portfolio Standard (RPS) (12% to 20%). Inclusion of these measures further reduced the 2020 baseline to 507 MMT CO_2e. As a result, based on both the economic recession and the availability of updated information from the development of measure-specific regulations, achieving the 1990 emission level would now require a reduction of GHG emissions of 80 MMT CO_2e, or a reduction of approximately 16% (down from 28.5%) to achieve in 2020 emissions levels in the "BAU" or "No Action Taken" condition.[92]

The Scoping Plan identifies over 70 measures for reducing GHG emissions in sectors including transportation, electricity and natural gas, water, green buildings, industry, recycling and waste, and agriculture. Many of these measures incorporate laws, policies, and measures that are not solely driven by the AB 32 directive, including ship electrification (shorepower), high speed rail, RPS, and the Goods Movement Emission Reduction Plan. Regulatory development for other measures is ongoing. Of these measures, 44 were identified as Early Action Measures, which were adopted by ARB and made enforceable in 2010. These measures included regulations affecting landfills, motor vehicle fuels, refrigerants in cars, port operations, and many other sources.

The Scoping Plan notes that local governments are "essential partners" in the effort to reduce GHG emissions, and that they have "broad influence and, in some cases, exclusive jurisdiction" over activities that contribute to GHG emissions. The Scoping Plan encourages local governments to adopt goals for reducing municipal GHG emissions and move toward adoption of a goal for reducing community emissions. These targets should parallel the State's commitment to reduce GHG emissions by approximately 15% of current levels by 2020. The Scoping Plan also observes that "[l]ocal governments have the ability to directly influence both the siting and design of new residential and commercial developments in a

[89] ARB. Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document. http://www.arb.ca.gov/cc/scopingplan/document/final_supplement_to_sp_fed.pdf .

[90] Association of Irritated Residents, et al., v. California Air Resources Board, et al, 2012. 206 Cal. App. 4th 1487.

[91] ARB. Status of Scoping Plan Recommended Measures. July. http://www.arb.ca.gov/cc/scopingplan/status_of_scoping_plan_measures.pdf.

[92] ARB. 2011. Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document. http://www.arb.ca.gov/cc/scopingplan/document/final_supplement_to_sp_fed.pdf

way that reduces GHGs associated with vehicle travel, as well as energy, water, and waste" and that "[i]ncreasing low-carbon travel choices (public transit, carpooling, walking and biking) combined with land use patterns and infrastructure that support these low-carbon modes of travel, can decrease average vehicle trip lengths by bringing more people closer to more destinations."[93] It also notes that regional targets would be set and achieved on a regional basis through the Senate Bill (SB) 375 implementation process, which "maintains regions' flexibility." SB 375 is discussed below.

2014 First Update to the Scoping Plan

In 2014, ARB adopted the *First Update to the Climate Change Scoping Plan: Building on the Framework* (2014 First Update).[94] The stated purpose of the 2014 First Update is to "highlight[…] California's success to date in reducing its GHG emissions and lay[…] the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050."[95] The First Update found that California is on track to meet the 2020 emissions reduction mandate established by AB 32, and noted that California could reduce emissions further by 2030 to levels squarely in line with those needed to stay on track to reduce emissions to 80 percent below 1990 levels by 2050 if the State realizes the expected benefits of existing policy goals.[96]

In conjunction with the 2014 First Update, ARB identified "six key focus areas comprising major components of the State's economy to evaluate and describe the larger transformative actions that will be needed to meet the State's more expansive emission reduction needs by 2050."[97] Those six areas are: (1) energy; (2) transportation (vehicles/equipment, sustainable communities, housing, fuels, and infrastructure); (3) agriculture; (4) water; (5) waste management; and (6) natural and working lands. The First Update identifies key recommended actions for each sector that will facilitate achievement of the 2050 reduction target.

Based on ARB's research efforts, it has a "strong sense of the mix of technologies needed to reduce emissions through 2050."[98] Those technologies include 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.

As part of the 2014 First Update, ARB recalculated the State's 1990 emissions level using more recent GWPs identified by the IPCC. Using the recalculated 1990 emissions level and the revised 2020 emissions level projection identified in the 2011 Final Supplement, ARB determined that achieving the 1990 emissions level by 2020 would require a reduction in

[93] ARB. Climate Change Scoping Plan. Sacramento, CA, December. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

[94] Health & Safety Code Section 38561(h) requires CARB to update the Scoping Plan every five years.

[95] ARB, 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

[96] ARB, 2013. 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

[97] ARB, 2013. 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

[98] ARB, 2013. 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

GHG emissions of approximately 15.3 percent (instead of 28.5 percent or 16 percent) from the "BAU" conditions.

The 2014 First Update included a strong recommendation from ARB for setting a mid-term statewide GHG emissions reduction target. ARB specifically recommended that the mid-term target be consistent with: (i) the United States' pledge to reduce emissions 42 percent below 2005 levels (which translates to a 35-percent reduction from 1990 levels in California); and (ii) the long-term policy goal of reducing emissions to 80 percent below 1990 levels by 2050.

The 2014 First Update discussed new residential and commercial building energy efficiency improvements, specifically identifying progress towards zero net energy buildings as an element of meeting mid-term and long-term GHG reduction goals. The First Update expressed ARB's commitment to working with the California Public Utilities Commission (CPUC) and California Energy Commission (CEC) to facilitate further achievements in building energy efficiency.

Proposed 2030 Target Scoping Plan

Currently, ARB is moving forward with the development of a second update to the 2008 Scoping Plan. This update is expected to address Executive Order B-30-15, and specifically Governor Brown's statewide GHG emissions reduction target for 2030, as discussed below. In January 2017, ARB released its proposed 2017 Climate Change Scoping Plan Update.[99] The Proposed Plan draft includes the following major elements for reaching the 2030 Target:

1. SB 350

   This concept includes enhancements to existing programs and implementation of SB 350, with a target of achieving 50 percent RPS and a doubling of energy efficiency savings in natural gas and electricity end uses statewide by 2030.

2. Mobile Source Strategy

   The proposed plan will increase the stringency of the Low Carbon Fuel Standard, target 4.2 million zero-emission vehicles on the road by 2030, promote medium-and heavy-duty vehicle GHG reductions, continue to reduce vehicle miles traveled (VMT), and implement the CA Sustainable Freight Action Plan.

3. Post 2020 Cap and Trade Program

   ARB proposes to continue the existing Cap-and-Trade Program after 2020 with declining caps.

4. Refinery Sector Measure

   This concept would reduce GHG emissions by 20 percent in the refinery sector statewide.

5. Short-Lived Climate Pollutant Reduction Strategy

   This plan will reduce emissions of methane, hydrofluorocarbons, and black carbon.

The Proposed Plan also addresses how CEQA can be used to further the statewide goals of GHG reduction. The Proposed Plan recommends GHG reduction goals that can apply to plan- or project-level analyses to be incorporated into environmental documentation in support of

[99] ARB. 2017. The 2017 Climate Change Scoping Plan Update. January 20. Available at https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf.

CEQA. The Proposed Plan states a GHG target in the form of MT CO_2e per capita is "appropriate for the plan level (city, county, subregional, or regional level), but not for specific individual projects, because ARB's metric includes all emission sectors in the State." Project-level goals may be supported by local governments or lead agencies and include potential strategies such as tiering from a geographically specific GHG reduction plan, comparing to service population emissions targets, implementing all feasible mitigation measures, achieving zero net GHG emissions, or emitting less than bright-line numerical thresholds. Service population emission targets are used to assess significance for this Project.

ARB is currently soliciting comments on the Proposed Plan and will be conducting additional workshops through mid 2017.

California Mandatory Reporting Rule

ARB adopted the California Mandatory Reporting Rule in December 2007 (CCR Title 17, Subchapter 10, Article 2). In December 2010, ARB adopted proposed revisions to support a California GHG cap-and-trade program and to harmonize with the Federal Rule. The revised rule, in effect starting January 1, 2012, eliminates many of the differences between the federal and California rules, though some remain. Additional modifications and clarifications were made to the rule in 2012, 2013, and 2014.

The California MRR requires the reporting of GHG emissions from essentially the same source categories specified in the USEPA MRR, but with some differences. Most of the differences in the rules are related to ensuring that all sources subject to the California cap-and-trade regulations will also be subject to the California rule, and that GHG emissions reporting for those sources will meet the requirements of the cap-and-trade program. Additionally, California requires that emission reports be verified by a third party, and that sources emitting less than the federal reporting threshold but more than the California reporting threshold are subject to abbreviated reporting requirements.

Cap-and-Trade Program

The California Global Warming Solutions Act of 2006 (AB 32) allowed, but did not require, ARB to include among the mechanisms intended to reduce GHG emissions a “system of market-based declining annual aggregate emission limits.” The legislation required ARB to develop a Scoping Plan to describe the various mechanisms that would be used. In turn, the Scoping Plan, approved by ARB on December 11, 2008, directed ARB staff to develop, among other programs, a cap-and-trade mechanism that would apply a declining aggregate cap on GHG emissions[100] and provide a flexible compliance system using tradable instruments.

On October 20, 2011, ARB adopted the final cap-and-trade regulation (CCR Title 17, Subchapter 10, Article 5). The program started on January 1, 2012, and will proceed in “compliance phases,” the first of which began on January 1, 2013. In the first phase, the program applies to electric utilities, importers of electricity, and specified industries, including refineries. Approximately 350 electric utilities and approximately 600 industrial facilities were included in the initial phase of the program. In 2015, importers and

[100] The cap-and-trade regulation applies to the following GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

distributors of fossil fuels were added to the program in the second phase. The program imposes a "cap" on the total GHG emissions from covered entities in the state, and the quantity of emissions allowed under the cap decreases each year, ultimately reaching the goal of returning state-wide GHG emissions to 1990 levels by 2020. (The quantity of allowed emissions actually increases between 2014 and 2015, but that is to account for the addition of the fuel importers and distributors and additional electricity importers to the program; the net effect is to reduce overall GHG emissions.)

To encourage emission sources to emit less as the cap decreases, "allowances," or permission to emit GHGs, are made available in decreasing quantities. Allowances are both freely allocated and auctioned off. The amount of freely given allowances decreases over time, and the severity of the decrease varies by industrial sector, with those thought to be less vulnerable to out-of-state competition receiving fewer allowances more quickly. Similarly, the amount of allowances available for purchase at auction decreases. The intent is to make reducing GHG emissions more financially attractive as the number of available allowances decreases, making each allowance more costly.

On May 8, 2013, ARB adopted proposed amendments to the California GHG emissions cap-and-trade program in Resolution 13-7. These amendments would add security to the market system and help staff implement the cap-and-trade program, as well as link the California cap-and-trade program with that of the Canadian province Quebec.[101] Additional minor modifications were made to the regulation in 2013 and 2014.

Co-Pollutant Benefits

Implementation of the cap-and-trade program will also reduce state-wide emissions of criteria and toxic air pollutants. Because GHG emissions are largely the result of fuel combustion, as the cap decreases and state-wide combustion decreases, criteria and toxic air pollutants associated with combustion will also decrease state-wide. ARB also evaluated the potential for localized impacts from short-term increases in construction and operational emissions at facilities modifying operations in response to cap-and-trade compliance obligations. ARB's analysis indicated that localized impacts are unlikely due to existing local and state air quality regulations; however, where there is potential for significant impact from a proposed project, it would be addressed by local permitting agencies and CEQA lead agencies through the permitting and CEQA processes in which mitigation measures are evaluated.

2.2.4.4 Senate Bill 32

Enacted in 2016, Senate Bill (SB) 32 (Pavley, 2016) codifies the 2030 emissions reduction goal of Executive Order B-30-15 by requiring CARB to ensure that statewide GHG emissions are reduced to 40 percent below 1990 levels by 2030.

SB 32 was coupled with a companion bill: AB 197 (Garcia, 2016). Designed to improve the transparency of CARB's regulatory and policy-oriented processes, AB 197 created the Joint Legislative Committee on Climate Change Policies, a committee with the responsibility to ascertain facts and make recommendations to the Legislature concerning statewide programs, policies and investments related to climate change. AB 197 also requires CARB to make certain GHG emissions inventory data publicly available on its web site; consider the

[101] State of California. 2013. Amendments to California Cap-and-Trade Program – Linkage. https://www.arb.ca.gov/regact/2012/capandtrade12/res13-7.pdf

social costs of GHG emissions when adopting rules and regulations designed to achieve GHG emission reductions; and, include specified information in all Scoping Plan updates for the emission reduction measures contained therein.

2.2.4.5 Regulation of Energy-Related Sources

Renewables Portfolio Standard (SB 1078, SB 107, SB X1-2, and SB 350)

Established in 2002 under SB 1078,[102] and accelerated in 2006 under SB 107[103] and again in 2011 under SB X1-2,[104] California's RPS requires retail sellers of electric services to increase procurement from eligible renewable energy resources to 33% of total retail sales by 2020. The 33-percent standard is consistent with the RPS goal established in the 2008 Scoping Plan.[105] As interim measures, RPS requires 20% of retail sales to be sourced from renewable energy by 2013, and 25% by 2016. Initially, the RPS provisions applied to investor-owned utilities, community choice aggregators, and electric service providers. SB X1-2 added, for the first time, publicly owned utilities to the entities subject to RPS.[106] The expected growth in RPS to meet the standards in effect in 2008 is not reflected in the "BAU" calculation in the 2008 Scoping Plan, discussed above. In other words, the 2008 Scoping Plan's BAU 2020 does not take credit for implementation of RPS that occurred after its adoption.[107] SB 350 further increases the RPS goals for 50% renewables by 2030.

GHG Emissions Standard for Baseload Generation (SB 1368)

SB 1368 (September 29, 2006) prohibits any retail seller of electricity in California from entering into a long-term financial commitment for baseload generation if the GHG emissions are higher than those from a combined-cycle natural gas power plant.[108] This performance standard applies to electricity generated out-of-state as well as in the state, and to publicly owned as well as investor-owned electric utilities.

2.2.4.6 Regulation of Mobile Sources

Senate Bill 375 (Land Use Planning)

SB 375 provides for a new planning process to coordinate land use planning, regional transportation plans, and funding priorities in order to help California meet the GHG reduction goals established in AB 32.[109] SB 375 requires Metropolitan Planning Organizations (MPOs) including the Association of Bay Area Governments (ABAG) to incorporate a "sustainable communities strategy" (SCS) in their regional transportation plans (RTPs) that will achieve GHG emission reduction targets set by ARB, primarily by reducing VMT from light-duty vehicles through development of more compact, complete, and efficient communities.

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[102] State of California. Senate Bill 1078 (2001-2002 Reg. Session) Stats. 2002, ch 516.

[103] State of California. Senate Bill 1368 (2005-2006 Reg. Session) Stats. 2006, ch. 598.

[104] State of California. Ass'n of Irritated Residents v. California Air Resources Board (Super. Ct. San Francisco County, March 18, 2011, No. CPF-09-509562).

[105] ARB. Climate Change Scoping Plan. Sacramento, CA, December. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.

[106] State of California. Ass'n of Irritated Residents v. California Air Resources Board (Super. Ct. San Francisco County, March 18, 2011, No. CPF-09-509562).

[107] ARB. Climate Change Scoping Plan. Sacramento, CA, December. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

[108] State of California. 2006b. Senate Bill 1368 (2005-2006 Reg. Session) Stats. 2006, ch. 598.

[109] State of California. 2008. Senate Bill 375. 2008, ch. 728.

SB 375 also required ARB to appoint a Regional Targets Advisory Committee (RTAC) to recommend factors for ARB to consider and methodologies for it to use in setting GHG emission reduction targets (Regional Targets) for each region. On September 29, 2009, the RTAC released its recommendations to ARB, who, on September 23, 2010, adopted Regional Targets applying to the years 2020 and 2035.[110] In 2011, ARB adopted Regional Targets of 7% for 2020 and 15% for 2035 for the area under ABAG's jurisdiction, which includes Stanford University. On July 18, 2013, the Metropolitan Transportation Commission (MTC) and ABAG approved the final Plan Bay Area, which includes the Bay Area region's first SCS as well as a new 2040 RTP and establishes the strategies for meeting the Bay Area's Regional Targets.[111]

The SCS for the San Francisco Bay Area is discussed in the "Regional Provisions" section below.

Mobile Source Reductions (Pavley) (AB 1493)

AB 1493 required ARB to adopt regulations by January 1, 2005, to reduce GHG emissions from non-commercial passenger vehicles and light-duty trucks of model years 2009 through 2016[112]. The bill required the California Climate Action Registry to develop and adopt protocols for the reporting and certification of GHG emissions reductions from mobile sources for use by ARB in granting emission reduction credits. The bill authorizes ARB to grant emission reduction credits for reductions of GHG emissions prior to the date of the enforcement of regulations, using model year 2000 as the baseline for reduction.

In 2004, ARB applied to the USEPA for a waiver under the federal Clean Air Act to authorize implementation of these regulations. The waiver request was formally denied by the USEPA in December 2007 after California filed suit to prompt federal action. In January 2008, the State Attorney General filed a new lawsuit against the USEPA for denying California's request for a waiver to regulate and limit GHG emissions from these vehicles. In January 2009, President Obama issued a directive to the USEPA to reconsider California's request for a waiver. On June 30, 2009, the USEPA granted the waiver to California for its GHG emission standards for motor vehicles. As part of this waiver, the USEPA specified the following provision: ARB may not hold a manufacturer liable or responsible for any non-compliance caused by emission debits generated by a manufacturer for the 2009 model year. ARB has adopted a new approach to passenger vehicles – cars and light trucks – by combining the control of smog-causing pollutants and GHG emissions into a single coordinated package of standards. The new approach also includes efforts to support and accelerate the numbers of plug-in hybrids and zero-emission vehicles in California.

Low Carbon Fuel Standard

Executive Order S-1-07, as issued by former Governor Schwarzenegger, called for a 10 percent or greater reduction in the average fuel carbon intensity for transportation fuels in California regulated by CARB by 2020.[113] In response, ARB approved the LCFS regulations

[110] ARB. Sustainable Communities. 2010. Accessed July 22, 2016. http://www.arb.ca.gov/cc/sb375/sb375.htm

[111] Metropolitan Transportation Commission. 2013. Plan Bay Area. Accessed October 14, 2013. http://www.mtc.ca.gov/planning/plant_bay_area/

[112] State of California. 2002a. Assembly Bill 1493 (2001-2002 Reg. Session) Stats. 2002, ch. 200.

[113] Carbon intensity is a measure of the GHG emissions associated with the various production, distribution and use steps in the "lifecycle" of a transportation fuel.

in 2009, which became fully effective in April 2010. Thereafter, a lawsuit was filed challenging ARB's adoption of the regulations; and, in 2013, a court order was issued compelling ARB to remedy substantive and procedural defects of the LCFS adoption process under CEQA.[114] However, the court allowed implementation of the LCFS to continue pending correction of the identified defects. In September 2015, CARB re-adopted the LCFS regulations.

Clean Cars

In January 2012, ARB approved the Advanced Clean Cars Program, which established an emissions control program for cars and light-duty trucks (such as SUVs, pickup trucks, and minivans) of model years 2017-2025. When the program is fully implemented, new vehicles will emit 75% less smog-forming pollutants than the average new car sold today, and GHG emissions will be reduced by nearly 35%. The program also requires car manufacturers to offer for sale an increasing number of zero-emission vehicles (ZEVs) each year, including battery electric, fuel cell, and plug-in hybrid electric vehicles.

In December 2012, ARB adopted regulations allowing car manufacturers to comply with California's GHG emissions requirements for model years 2017-2025 through compliance with the USEPA GHG requirements for those same model years.[115]

2.2.4.7 CEQA Guidelines Amendments (SB 97)

The 2009 CEQA Guidelines amendments adopted pursuant to SB 97 state in Section 15064.4(a) that lead agencies should "make a good faith effort, to the extent possible on scientific and factual data, to describe, calculate or estimate" GHG emissions. The CEQA Guidelines amendments note that an agency may identify emissions either by selecting a "model or methodology" to quantify the emissions or by relying on "qualitative analysis or other performance based standards." [116] Section 15064.4(b) provides that the lead agency should consider the following when assessing the significance of impacts from GHG emissions on the environment:

- The extent a project may increase or reduce GHG emissions as compared to the environmental setting.
- Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.
- The extent to which the project complies with regulations or requirements adopted to implement a state-wide, regional, or local plan for the reduction or mitigation of GHG emissions[117].

In addition, Section 15064.7(c) of the CEQA Guidelines amendments specifies "[w]hen adopting thresholds of significance, a lead agency may consider thresholds of significance

[114] *POET, LLC v. CARB* (2013) 217 Cal.App.4th 1214.

[115] ARB. Lev III and ZEV Regulation Amendments For Federal Compliance Option, December 31. Accessed July 8, 2016. http://www.arb.ca.gov/regact/2012/leviiidtc12/leviiidtc12.htm

[116] CNRA. Final Statement of Reasons for Regulatory Action: Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of GHG Emissions Pursuant to SB97. http://resources.ca.gov/ceqa/docs/Final_Statement_of_Reasons.pdf

[117] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

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"[118]. Similarly, the revision to Appendix G, Environmental Checklist Form, which is often used as a basis for lead agencies' selection of significance thresholds, does not prescribe specific thresholds. Rather, Appendix G asks whether the project would:

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

This indicates that the determination of what is a significant effect on the environment should be left to the lead agency.

Accordingly, the CEQA Guidelines amendments do not prescribe specific methodologies for performing an assessment, do not establish specific thresholds of significance, and do not mandate specific mitigation measures. Rather, the CEQA Amendments emphasize the lead agency's discretion to determine the appropriate methodologies and thresholds of significance consistent with the manner in which other impact areas are handled in CEQA.[119]

The CEQA Guidelines amendments indicate that lead agencies should consider all feasible means, supported by substantial evidence and subject to monitoring and reporting, of mitigating the significant effects of GHG emissions. These potential mitigation measures, set forth in Section 15126.4(c), may include (1) measures in an existing plan or mitigation program for the reduction of GHG emissions that are required as part of the lead agency's decision; (2) reductions in GHG emissions resulting from a project through implementation of project design features; (3) off-site measures, including offsets, to mitigate a project's emissions; and (4) carbon sequestration measures.[120]

Among other things, the California Natural Resources Agency (CNRA) noted in its Public Notice for these changes that impacts of GHG emissions should focus on the cumulative impact on climate change. The Public Notice states:

> While the Proposed Amendments do not foreclose the possibility that a single project may result in GHG emissions with a direct impact on the environment, the evidence before [CNRA] indicates that in most cases, the impact will be cumulative. Therefore, the Proposed Amendments emphasize that the analysis of GHG emissions should center on whether a project's incremental contribution of GHG emissions is cumulatively considerable.[121]

Thus the CEQA Guidelines amendments continue to make clear that the significance of GHG emissions is most appropriately considered on a cumulative level.

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[118] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

[119] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

[120] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

[121] CNRA. Notice of Public Hearings and Notice of Proposed Amendment of Regulations Implementing the California Environmental Quality Act.. http://resources.ca.gov/ceqa/docs/Notice_of_Proposed_Action.pdf

As described in the Final Statement of Reasoning[122] for the 2009 CEQA Guidelines amendments, the CEQA Guidelines specifically do not address lifecycle emission for two reasons. First, there are different interpretations of the meaning of "lifecycle" amongst lead agencies, which could lead to confusion on how to evaluate the contribution of lifecycle emissions to a project. Furthermore, requiring an analysis of lifecycle emissions may be inconsistent with CEQA, as the emissions may be outside the scope of the "indirect emissions" that are evaluated with a project

2.2.4.8 Senate Bill 743 (Updates to CEQA Guidelines)

Public Resources Code Section 21099(c)(1), as codified through enactment of SB 743, was enacted with the intent to change the focus of transportation analyses conducted under CEQA. SB 743 reflects a legislative policy to balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of GHG emissions. SB 743 requires the OPR to establish "alternative metrics to the metrics used for traffic levels of service for transportation impacts outside transit priority areas." [123] Under SB 743, the new metrics- or significance criteria- must promote the reduction of GHG emissions, the development of multimodal transportation networks, and a diversity of land uses. SB 743 dictates that once the CEQA Guidelines are amended to include new thresholds, automobile delay, as described by level of service or similar measures of vehicular capacity or congestion, shall no longer be considered a significant impact under CEQA in all locations in which the new thresholds are applied. The Legislature gave OPR the option of applying the new thresholds only to transit priority areas, or more broadly to areas throughout the State. OPR has proposed to apply the new thresholds throughout the State.

In January 2016, OPR issued its *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA* (Revised SB 743 Proposal). Included in the Revised SB 743 Proposal is proposed new CEQA Guidelines Section 15064.3 and related revisions to Appendix G. Under the proposed new Guidelines, the analysis of transportation impacts in the CEQA context would shift from a levels of service metric to a vehicle miles traveled (VMT) metric. In proposing the new approach, OPR noted the relationship between VMT and GHG emissions. If adopted as issued by OPR in January 2016, application of the new CEQA Guidelines would be mandatory when assessing CEQA transportation impacts two years after adoption, which is anticipated in late 2016/2017.

2.2.4.9 Building Energy Efficiency Standards

Title 24, Part 6 of the California Code of Regulations regulates the design of building shells and building components. The standards are updated periodically to allow for consideration and possible incorporation of new energy efficiency technologies and methods. Through SB 350, also known as the Clean Energy and Pollution Reduction Act of 2015, Section 25943 of the Public Resources Code was amended to implement a comprehensive program that will achieve energy efficiency in existing residential and nonresidential structures that will fall

[122] CNRA. 2009a. Final Statement of Reasons for Regulatory Action: Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of GHG Emissions Pursuant to SB97. http://resources.ca.gov/ceqa/docs/Final_Statement_of_Reasons.pdf

[123] California Legislative Information. 2013. SB-743 Environmental quality: transit oriented infill projects, judicial review streamlining for environmental leadership development projects, and entertainment and sports center in the City of Sacramento. Accessed July 14, 2016 http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB743

significantly below the standards described in Title 24 of the California Code of Regulations. The comprehensive program includes energy efficiency improvements, a broad range of energy assessments, energy ratings, financing options, and other measures.

The CEC adopted the 2013 Building Energy Efficiency Standards (2013 Building Standards), effective July 1, 2014. The 2013 Building Standards are 25 percent more efficient than previous standards for residential construction and 30 percent more efficient for nonresidential construction, and require better windows, insulation, lighting, ventilation systems, and other features that further reduce energy consumption in homes and businesses.

The CEC also has adopted the 2016 Building Energy Efficiency Standards (2016 Building Standards), effective January 1, 2017. For purposes of single-family residences, the 2016 Building Standards result in about 19 percent less electricity use and 27 percent less natural gas use for heating, cooling, ventilation, and water heating than the 2013 Building Standards. For multi-family residences, the 2016 Building Standards result in about 12 percent less electricity use and 48 percent less natural gas use for heating, cooling, ventilation, and water heating than the 2013 Building Standards. The electricity and natural gas use is expected to be less than five percent different between the 2016 Building Standards and the 2013 Building Standards for non-residential building types, such as office, light industrial, and suburban retail buildings.

In addition to the 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) is commonly referred to as CALGreen, and establishes voluntary and mandatory standards pertaining to the planning and design of sustainable site development, energy efficiency, water conservation, material conservation, and interior air quality. CALGreen is periodically amended, and was most recently amended in 2013 and became effective on January 1, 2014, with a supplement thereto recently becoming effective on July 1, 2015.

The California Public Utilities Commission, CEC, and CARB also have a shared, established goal of achieving zero net energy (ZNE) for new construction in California. The key policy timelines include: (1) all new residential construction in California will be ZNE by 2020, and (2) all new commercial construction in California will be ZNE by 2030. The ZNE goal generally means that new buildings must use a combination of improved efficiency and distributed renewable energy generation to meet 100 percent of their annual energy need; as specifically defined by the CEC:

> "A ZNE Code Building is one where the net of the amount of energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building, at the level of a single 'project' seeking development entitlements and building code permits, measured using the [CEC]'s Time Dependent Valuation metric. A ZNE Code Building meets an Energy Use Intensity value designated in the Building Energy Efficiency Standards by building type and climate zone that reflect best practices for highly efficient buildings."[124]

[124] CEC. 2013 Integrated Energy Policy Report (2013), p. 36.

Through Executive Order B-18-12, passed in April 2012, all State agencies and departments were required to reduce GHG emissions by 10% by 2015 and 20% by 2020, compared to 2010 levels. The key policy timelines include: (1) 50% of new State buildings and major renovations are required to be ZNE by 2020, with all new buildings and major renovations required to be ZNE by 2025, (2) grid-based energy purchases for State-owned buildings must be reduced by at least 20% by 2018, compared to 2003 levels, (3) new or renovated State buildings larger than 10,000 square feet will obtain a LEED certification of silver or higher, (4) State agencies must reduce overall water usage at their facilities by 10% by 2015 and 20% by 2020, compared to 2010 levels, and a number of other measures to promote green building practices and increase energy and water efficiency.

2.2.4.10 Executive Order B-16-12 (Transportation GHG Reduction Target)

On March 23, 2012, Governor Edmund Brown signed Executive Order B-16-12, which ordered State agencies to support and promote the rapid commercialization of ZEVs. Executive Order B-16-12 called upon ARB, CEC, Public Utilities Commission, and other relevant agencies to cooperate with the Plug-In Vehicle Collaborative and the California Fuel Cell Partnership to increase State manufacturing, private sector investment, and State research of zero-emission vehicles.

Furthermore, Executive Order B-16-12 set targets for State ZEV infrastructure to be able to support one million vehicles by 2020; 1.5 million zero-emission vehicles to be on the road, displacing 1.5 billion gallons of petroleum fuels, by 2025; and an 80% reduction of GHG emissions from the transportation sector by 2050, compared to 1990 levels. At least 10 percent of California state fleet purchases of light-duty vehicles must by zero-emission by 2015, and at least 25 percent of fleet purchases of light-duty vehicles must be zero-emission by 2020.

2.2.4.11 Senate Bill 391 (California Transportation Plan)

Also known as the California Transportation Plan, SB 391 denoted that the DOT will take into account a wide variety of measures, including the use of alternative fuels, new vehicle technology, tailpipe emissions reductions, and the expansion of public transit, bicycling, and walking. Finally, SB 391 requires that the DOT update the California Transportation Plan by December 31, 2015, and every five years thereafter. The California Transportation Plan was updated in 2015.[125]

2.2.4.12 Other State GHG Regulatory Activities

ARB Executive Order S-13-08

On November 14, 2008, Governor Arnold Schwarzenegger signed Executive Order S-13-08, which called on State agencies to develop a strategy for identification of and preparation for expected climate change impacts in California. The resulting *2009 California Climate Adaptation Strategy* report was developed by the CNRA in coordination with the (CAT). The report presents the best available science relevant to climate impacts in California and proposes a set of recommendations for California decision-makers to assess vulnerability and promote resiliency in order to reduce California's vulnerability to climate change. Guidance regarding adaptation strategies is general in nature and emphasizes incorporation of

[125] California Department of Transportation. California Transportation Plan 2040. Accessed August 31, 2016. http://www.dot.ca.gov/hq/tpp/californiatransportationplan2040/index.shtml

strategies into existing planning policies and processes. An update to the CAS report is planned for release as a draft for public comment by the end of 2013.[126]

In addition to requiring the CAT to create a Climate Adaptation Strategy, Executive Order S-13-08 ordered the creation of a comprehensive Sea Level Rise Assessment Report. The report, published in June 2012, indicates that the sea level along most of California's coast is expected to rise about 1 meter over the next century and is likely to increase the risk of damage in the form of flooding, coastal erosion, and wetland loss due to storm surges and high waves. The sea level increase is slightly higher than projected for global sea levels.[127], [128]

Executive Order S-13-08 also called for the California Ocean Protection Council (OPC) to work with the other CAT State agencies to develop interim guidance for assessing the potential impacts of sea level rise due to climate change in California. In coordination with National Academy of Sciences efforts, the OPC drafted interim guidance recommending that State agencies consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess project vulnerability, reduce expected risks, and increase resiliency to sea level rise. The draft resolution and interim guidance document is consistent with the Ocean Protection Act (Division 26.5, Public Resource Code Section 35615(a)(1)), which specifically directs the OPC to coordinate activities of State agencies to improve the effectiveness of State efforts to protect ocean resources.[129]

Other Potentially Applicable Regulations or Policies

Senate Bill X7 7 (Water Conservation Act of 2009)

The Water Conservation Act of 2009 sets an overall goal of reducing per-capita urban water use by 20% by December 31, 2020. The state is required to make incremental progress toward this goal by reducing per-capita water use by at least 10% by December 31, 2015. Reduction in water consumption directly reduces the necessary energy and the associated emissions to convene, treat, and distribute the water; it also reduces emissions from wastewater treatment.

The Department of Water Resources adopted a regulation on February 16, 2011 that sets forth criteria and methods for exclusion of industrial process water from the calculation of gross water use for purposes of urban water management planning. The regulation would apply to all urban retail water suppliers required to submit an Urban Water Management Plan, as set forth in the Water Code, Division 6, Part 2.6, Sections 10617 and 10620.

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[126] State of California. Climate Change Portal: California Climate Adaptation Strategy. Accessed July 8, 2016. http://www.climatechange.ca.gov/adaptation/strategy/index.html

[127] NRC. 2016. National Research Council of the National Academies: Committee on Sea Level Rise in California, Oregon, and Washington; Board on Earth Sciences and Resources and Ocean Studies Board; Division of Earth and Life Studies. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, June. http://www.nap.edu/read/13389/chapter/1

[128] Office of News and Public Information (ONPI). Office of News and Public Information of the National Academies. California Sea Level Projected to Rise a Higher Rate than Global Average; Slower Rate for Oregon, Washington, But Major Earthquake Could Cause Sudden Rise, June 22. http://www8.nationalacademies.org/onpinews/newsitem.aspx?recordid=13389

[129] Sea-Level Rise Task Force of the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT). 2010. State of California Sea-Level Rise Interim Guidance Document, October. http://www.opc.ca.gov/webmaster/ftp/project_pages/Climate/SLR_Guidance_Document.pdf

Senate Bill 471 Water, Energy, and Reduction of GHG Emissions: Planning

AB 32 designated the ARB as the agency that would manage the GHG Reduction Fund. Senate Bill 471, introduced in February 2015 and amended in August 2015, denotes that GHG emissions reductions associated with water treatment are eligible for funding from the GHG Reduction Fund. SB 471 requires the State Energy Resources Conservation and Development Commission, State Water Resources Control Board, State Air Resources Board, Public Utilities Commission, and Department of Water Resources to cooperate in conducting a study on water-related energy use in California.

2.2.5 Regional Provisions

2.2.5.1 BAAQMD Regional Climate Protection Strategy Resolution

On November 6, 2013, the BAAQMD Board passed a resolution adopting a regional target of achieving 80% below 1990 levels of GHG emissions by 2050. This reduction goal matches that of Executive Order S-3-05, described earlier. In addition, the resolution commits the BAAQMD to develop a regional climate protection strategy, including a Bay Area climate protection work program that will be included as an element of the BAAQMD's 2016 Clean Air Plan.[130] A draft of the 2016 Clean Air Plan, including the regional climate protection strategy, was released in July 2016, and a proposed final draft is scheduled to be released in November 2016.

2.2.5.2 ABAG/MTC Sustainable Communities Strategy (SB 375)

As discussed above, SB 375 is intended to help achieve AB 32's goals by coordinating land use and transportation planning, along with funding priorities. SB 375 requires each MPO in California to develop a SCS as part of its RTP that will achieve the GHG reduction targets required by AB 32. As described above, the MTC and the ABAG developed an SCS for the San Francisco Bay Area and incorporated it and a new RTP into a "Plan Bay Area." Plan Bay Area included Stanford as an employment center in its employment analysis.

[130] BAAQMD. Air District Board passes climate protection resolution. November 6. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/Files/Communications%20and%20Outreach/Publications/News%20Releases/2013/climateres_131106.ashx?la=en

3. GHG EMISSIONS INVENTORIES

This section describes the methodology that Ramboll Environ US Corporation (Ramboll Environ) used to develop the existing conditions GHG emission inventories, which include construction and operational emissions. GHG operational emissions sources within the study area at Stanford University include: electricity use, natural gas use, mobile sources, emergency generator use, solid waste, and water supply and wastewater. Full details on the calculation methodology for the existing conditions and project inventories are provided in **Appendix A**.

3.1 Units of measurement: Tonnes of CO_2 and CO_2e

As discussed in Section 2.1, the term "GHGs" includes gases from fossil fuel use that contribute to the global greenhouse effect, such as CO_2, CH_4, and N_2O, as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as HFCs and CFCs. Water, although a GHG, is not typically evaluated, as water vapor is ubiquitous and typically considered in the context of global feedback loops rather than as an emission from a single project. GHG emissions are typically measured in terms of mass of CO_2e. CO_2e are calculated as the product of the mass of a given GHG and its specific GWP, as described in Section 2.1.[131] 100-year GWPs of 25 and 298, corresponding to the Forth Assessment Report, were used for CH_4 and N_2O, respectively, for this analysis. In many sections of this report, including the final summary sections, emissions are presented in units of CO_2e either because the GWPs of CH_4 and N_2O were accounted for explicitly, or the CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from that particular emissions category.

CalEEMod® 2013.2.2 uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. However, the GWPs in the IPCC Fourth Assessment Report of 298 for N_2O and 25 for CH_4 have been incorporated in these calculations instead, as the Fourth Assessment Report is the basis of the GWPs in the 2016 California GHG inventory.[132] The IPCC also released a Fifth Assessment Report in 2014, which updates the GWPs to 265 and 28 for N_2O and CH_4, respectively.[133] The vast majority of emissions from this Project are CO_2. As a result, small changes in global warming potential for methane and nitrous oxide between the various scientific updates provided by the IPCC have a minimal impact on the overall GHG emissions from the Project.

In this report, a tonne refers to MT (1,000 kilograms). Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

3.2 Existing Conditions Inventories Description

There are four existing conditions scenario years presented in this report:

[131] CalEEMod® 2013.2.2, the primary tool used to develop the emissions inventory uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. The GWPs in the IPCC Fourth Assessment Report have of 298 for N_2O and 25 for CH_4 have been manually incorporated to CalEEMod® output.

[132] CARB. 2016. California Greenhouse Gas Emission Inventory – 2016 Edition. Available at: https://www.arb.ca.gov/cc/inventory/data/data.htm. Accessed: September 2016.

[133] IPCC. 2014. Climate Change 2014 – Synthesis Report. Available at: https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf.

- 2014
- 2015
- Fall 2018
- Fall 2020

The Fall 2018 scenario year presented in this technical report represents the conditions expected to exist at commencement of the proposed 2018 GUP. This includes additional buildings that would be expected to be permitted under the 2000 GUP, but does not include the occupancy of the new Escondido Village Graduate Residences. This scenario also takes into account changes in the motor vehicle fleet anticipated in 2018. For example, mobile sources are expected to have lower emissions in 2018 based on existing regulatory standards. Also importantly, Fall 2018 reflects Stanford's existing commitment to acquire electricity from a solar farm in Kern County and to build new solar systems on Stanford's campus. The Kern County solar farm will be a 68-megawatt peak solar plant generating 159,000 megawatt-hours per year (MWh/year). In addition, several Stanford building complexes feature solar panels, including the Science and Engineering Quad and the Knight Management Center. Installation began in May 2016 on rooftop panels for an additional 16 campus buildings to provide an additional 5 MW, which will generate up to 7,300 MWh/year. These two solar systems are expected to provide up to 53 percent of Stanford's total electricity use.

The 2014 and 2015 scenarios demonstrate the effects of the recently completed changes at Stanford that have significantly changed its emissions profile. Previously, in 2014, Stanford produced electricity, steam and chilled water at its on-campus Cardinal cogeneration plant and its prior Central Energy Facility (old CEF). These facilities employed what was previously considered a state-of-the-art process of generating electricity through a gas-fired plant, and using the steam (a by-product of electricity generation) to heat campus buildings. Stanford used onsite chillers to create cold water to cool the buildings. In addition, the old CEF provided process steam for use in kitchens and laboratories. Excess electricity produced by the old CEF that was not used by Stanford was sold back to Pacific Gas & Electric Company (PG&E). Emitting equipment for the old CEF was comprised of four boilers, a gas turbine, duct burners, and three emergency generators. The old CEF (including the Cardinal Cogeneration plant) was decommissioned in April 2015.

In 2015, Stanford completed a groundbreaking overhaul of it campus heating and cooling system. This overhaul is called the Stanford Energy System Innovations-- or SESI. SESI relies on a heat-recovery process that is 70 percent more efficient than the prior cogeneration process for heating and cooling. The new system will meet more than 90 percent of the campus heating demands by capturing almost two-thirds of the waste heat generated by the campus cooling system. To make that exchange possible, Stanford replaced 22 miles of underground pipes and retrofitted 155 buildings to convert the campus from a steam- to hot water-based system. In addition, Stanford now purchases its electricity through a Direct Access program that enables purchase from Electric Service Providers that include renewable resources within their portfolios.

The new CEF includes the following equipment:

- three hot water generators,
- two emergency generators,

- electric-powered chillers (non-emitting), and
- thermal energy storage tanks (non-emitting).

The hot water generators supply hot water for building heating and primarily run on natural gas, with the additional capability to run on diesel fuel in emergencies. The emergency generators run on diesel fuel.

Unlike the old CEF, the new CEF does not provide electricity to the campus. Instead, Stanford currently procures electricity via Direct Access from the grid through an Electricity Service Provider.

In addition to the change in emissions profiles due to the SESI, there are also changes in 2015 due to two other types of emissions sources:

- Stanford installed a steam processing plant that provides process steam for sterilization purposes (e.g., for laboratory autoclaves). This is referred to as "Replacement Process Steam."[134]
- Stanford installed individual boilers in a few campus locations to provide steam for heating at a few campus buildings that will not be converted from steam to hot water within a reasonably foreseeable timeframe. This category of sources is referred to as the "Individual Replacement Boilers."

Both pre-SESI (2014) and post-SESI (2015) inventories are provided here to provide context for the Fall 2018 inventory. 2014 represents the historic campus emissions prior to SESI. 2015 represents the current campus emissions after SESI. The 2015 emissions inventory was used to develop the Fall 2018 inventory by incorporating assumptions on additional campus growth under the existing 2000 GUP in certain categories, such as an increase in academic square footage and residential beds. The Fall 2020 emissions inventory represents the same conditions as Fall 2018 but with the addition of 2,020 net new beds for Escondido Village Graduate Residences, and reflects year 2020 emission factors. A comparison of the 2014, 2015, Fall 2018, and Fall 2020 inventories is provided in Table 3-2-1, illustrating the effect of SESI (between 2014 and 2015), the remaining growth of the campus under the 2000 GUP with the exception of the Escondido Village Graduate Residences, and the impact of increased electricity generation from the solar farm (Fall 2018), and the impact of the additional Escondido Village Graduate Residences (Fall 2020).

3.3 Project Inventory Description

This GHG Technical Report evaluates the emissions inventory for the Project - the complete buildout of the 2018 GUP. The Fall 2020 emissions inventory was scaled up to develop the Project inventory by incorporating assumptions on growth in certain categories, such as an increase in academic square footage and residential beds. Because California has adopted goals for reducing GHGs by 2030, the Project emissions inventory is based on adopted regulatory measures (e.g., RPS) and emission factors (e.g., EMFAC2014 mobile factors), assuming the total operational activity from complete buildout and operation of the 2018

[134] Stanford implemented an energy-efficiency program to convert campus buildings from steam to hot water for building heating. As part of this program, the steam produced at the old CEF was converted to hot water at regional heat exchange stations. While the new CEF replaces the heating and cooling functions served by the old CEF, it does not produce steam. Accordingly, other sources were needed to meet the remaining campus demands for steam (i.e., process steam for sterilization, steam for use in kitchens).

GUP in 2030. This scenario is called "Fall 2035" because it consists of the full Project operations which are expected by 2035; however, if 2035 emission factors were used instead of 2030, the total GHG emissions would be lower than reported here. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions. This report also includes an estimate of Project emissions in Fall 2035 that incorporates intensity factors for electricity generation consistent with expected implementation of renewable portfolio standards in 2035. The additional scenario is labeled “Fall 2035 With RPS Projection”. A comparison of the Project inventory, and the additional Fall 2035 scenario, to the existing conditions inventories is presented in **Table 3-2-1.**

3.4 Construction Emissions: Existing Conditions and 2035 Project

This section describes the estimation of GHG emissions from construction activities within the study area. Average annual construction and demolition square footage from fiscal year 2001 through fiscal year 2015 were used to estimate the annual construction and demolition for all existing conditions and Project inventory years. Detailed information on the construction emissions calculations is provided in **Appendix A**, and the detailed emission inventory from the CalEEMod® output files is included in **Appendix B**. The major construction phases included in this analysis are:

- Demolition: involves demolishing/removing existing buildings.
- Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- Paving: involves the laying of concrete or asphalt such as in parking lots or roads.
- Building Construction: involves the construction of structures and buildings.
- Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

GHG emissions from these construction phases are largely attributable to fuel use from off-road construction equipment and vendor vehicles. GHG emissions from construction worker, vendor, and hauling vehicles are already included separately in the mobile emissions section. VMT, trips, and emissions for the construction on-road vehicles are shown for informational purposes as separate line items in the operational mobile emissions tables.

Ramboll Environ used California Emissions Estimate Model (CalEEMod®) version 2013.2.2 to quantify the construction emissions. The construction schedule, off-road equipment lists and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 sqft,demolition of 50,306 sqft of buildings, and excavation of 62,062 cubic yards (CY) of soil per year, with the default start and end dates of the phases moved such that all construction occurs within one year while maintaining total default number of equipment-hours. Emissions are shown in **Table 3-2-1**.

3.4.1 Vegetation Changes

Permanent vegetation changes that occur as a result of land use development constitute a one-time change in the carbon sequestration capacity of a project site. In this case, no construction is proposed in open space areas, and redevelopment will primarily occur in the core campus and parking lots and will be landscaped with trees. This will result in an overall

negligible change in carbon sequestration once the vegetation reaches a steady state (i.e., new vegetation replaces dying vegetation). Consequently, vegetation change results in a negligible change in GHG emissions for this GUP.

3.5 Indirect GHG Emissions from Electricity Use

Indirect GHG emissions, which occur when electricity is used, are typically due to electricity generation from offsite power plant locations. Electrical power is supplied to the study area by PGE, through the direct access program, and from the on-site Cardinal Cogen Plant (for the 2014 inventory only).

To estimate emissions, the electricity usage is multiplied by the emission intensity factors for the GHGs. Emission intensity factors are GHG emission rates from a given source in terms of the amount of GHG released (lbs) per MWh of energy produced.

Stanford purchases "direct access" electricity for a portion of its operations. This program allows for a choice of energy services provider rather than solely purchasing electricity from the utility company.[135] The default intensity for the direct access electricity in the 2014 and 2015 inventories are based on the USEPA eGRID most recent (2014v2) values for the Western Electricity Coordinating Council (WECC) California electricity region for the electricity supplier mix specified by Stanford's Office of Sustainability for each inventory year.[136] A more specific electricity intensity factor was not available for Stanford's 2014 direct access provider, Constellation Energy. In addition, the Stanford Office of Sustainability provided the PGE intensity for the commercially supplied PGE electricity. Intensity factors for Fall 2018 campus electricity are adjusted based on Stanford's commitment to operate the Stanford Solar Generating Station that will provide half of campus electricity by renewable sources by 2017;[137] renewable sources are assumed to have an electricity intensity of zero. The electricity intensity factors for the Fall 2018 inventories are based on a linear interpolation to meet the State's requirement for 33 percent renewables by 2020. The 2020 electricity intensity factors are estimated incorporating the State's requirement for 33 percent renewables by 2020. The electricity intensity factors for Project emissions are based on the assumption the PGE and WECC California achieve the State's SB 350 goal of acquiring 50 percent of energy from renewable sources in 2030.[138] The electricity intensity factor for the Fall 2035 with RPS Projection inventory is derived based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050. This is consistent with the CARB Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan[139], and results in in 57.5% of electricity from renewables by 2035. The default electricity intensity for CH_4 and N_2O were obtained from CalEEMod® Appendix D value for PGE and were conservatively not adjusted for future

[135] PGE. 2016. Electricity – Direct Access. Available at: http://www.pge.com/b2b/retailenergysuppliers/espresourcecenter/directaccessfaqs/. Accessed: July 2016.

[136] USEPA. 2017. eGRID2014v2. Available at: https://www.epa.gov/energy/egrid-2014-summary-tables. Accessed: April 2017

[137] Stanford. 2015. Stanford Energy System Innovations. Available at: http://news.stanford.edu/features/2015/sesi/. Accessed: July 2016.

[138] CEC. 2016. Clean Energy & Pollution Reduction Act SB 350 Overview. Available at: http://www.energy.ca.gov/sb350/. Accessed: October 2016.

[139] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

inventory years. A summary of the electricity intensity factors used in the analysis are shown in **Table 3-5-1**.

3.6 Operational Emissions: Existing Conditions and 2035 Project

3.6.1 Electricity

Locations on campus acquire electricity from several providers. These are summarized in **Table 3-6-1** for 2014.

For the 2014 inventory, electricity usage for the 2014 calendar year was provided by Stanford for PGE Commercial customers, direct access customers, imports to campus, imports to the old CEF, and commercial non-Stanford accounts. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was estimated using CalEEMod® assumptions. GHG emissions associated with Cardinal Cogen were derived directly from a 2014 BAAQMD emissions inventory, multiplied by the percentage associated with electricity production for the Stanford Campus and CEF (35%). Cardinal Cogen emissions associated with electricity sales to PGE (18%) and chilled water and steam sold to the hospital (13%) are not accounted for in this inventory. Cardinal Cogen emissions associated with chilled water and steam sold to the campus (34%) are included in the Natural Gas subcategory described later in this report. The breakdown of Cardinal Cogen emissions was provided by the Stanford Office of Sustainability.

Similarly, for the 2015 inventory, electricity usage for July through December 2015 for PGE Commercial customers, direct access customers, campus usage, and the new CEF was provided by Stanford. The July – December usage was doubled to account for an entire year. The entire 2015 calendar year was not used because the new CEF was brought online in April 2015. Thus, doubling the July – December usage is assumed to be representative of a year's worth of electricity usage. It was assumed that the electricity usage for non-Stanford commercial customers would not change from the 2014 inventory. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was again estimated using CalEEMod® assumptions.

The Fall 2018 inventory is based on the 2015 inventory with certain subcategories of electricity usage increased. The electricity usage for the campus and new CEF was increased by 8% to account for the increase in academic square footage by Fall 2018. It was assumed that the electricity usage for PGE Commercial customers and direct access customers would not increase by 2018. Electricity usage for 2014 for non-Stanford commercial customers was provided by Stanford and was not scaled as it was assumed that electricity consumption for this category would not change significantly. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was estimated using CalEEMod® assumptions.

The Fall 2020 inventory is based on the Fall 2018 inventory with additional electricity consumption calculated for the new Escondido Village graduate residences. This annual electricity use is based on the CalEEMod® default for mid-rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017).

For the Fall 2035 and Fall 2035 with RPS Projection inventories, electricity emissions are based on Fall 2020 usage estimates scaled up to account for development by 2035. Electricity usage from 550 new faculty/staff high density homes to be constructed within the study boundary by 2035 was also added to the inventory. The annual electricity use is based

on the CalEEMod® default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24. This additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for charging electric vehicles.

For 2014, PGE emission factors from CPUC corresponding to 2014 were applied to PGE Commercial customers and the Searsville Block and Olmsted Staff Rental subdivisions. The eGRID 'current' (2014v2)[140] emission factor for WECC California was used for direct access customers, imports to Campus, and imports to the old CEF. An emission factor derived from Cardinal Cogen was used for non-Stanford commercial customers.

For 2015, PGE emission factors from the CPUC corresponding to 2014 were applied to PGE Commercial customers, the Searsville Block and Olmsted Staff Rental subdivisions, and non-Stanford commercial customers. The eGRID 'current' (2014v2)[141] emission factor for WECC California was used for direct access customers, campus usage, and imports to the new CEF.

For Fall 2018, PGE emission factors projected from 2014 to 2018 were applied to PGE Commercial customers, the Searsville Block and Olmsted Staff Rental subdivisions, and Commercial Non-Stanford electricity usage. The eGRID 'current' (2014v2)[142] emission factor for WECC California was adjusted toward RPS goals and used for direct access customers. Then, the direct access emission factor was modified to take into account Stanford's commitment to procure approximately 159,000 MWh/year of electricity from its Kern County solar farm and an additional 7,300 MWh/year from on-campus rooftop solar installations. This modified emission factor was applied to the campus and new CEF consumption category.

For Fall 2020, the electricity intensity factors for Project emissions are based on the assumption that PGE and WECC California achieve the State's goal of acquiring 33 percent of energy from renewable sources and that the Stanford Solar Farm and on-site solar generation continue to produce additional renewable electricity.

For Fall 2035, the electricity intensity factors for Project emissions are based on the assumption the PGE and WECC achieve the State's SB 350 goal of acquiring 50 percent of energy from renewable sources and that the Stanford Solar Farm and on-site solar generation continue to produce renewable electricity.[143]

For the Fall 2035 with RPS Projection scenario, the electricity intensity factors are based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels,

[140] https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_summarytables_v2.pdf

[141] https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_summarytables_v2.pdf

[142] https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_summarytables_v2.pdf

[143] CEC. 2016. Clean Energy & Pollution Reduction Act SB 350 Overview. Available at: http://www.energy.ca.gov/sb350/. Accessed: October 2016.

assuming the State will similarly achieve 80% RPS by 2050[144] and that the Stanford Solar Farm and on-site solar generation continue to produce renewable electricity.

Electricity consumption, intensity factors, and emissions are summarized in **Tables 3-6-2, 3-6-3, 3-6-4, 3-6-5**, **3-6-6a, and 3-6-6b.** The derivation of the Project electricity intensity factors is shown in **Table 3-5-1.**

3.6.2 Natural Gas

GHG emissions from natural gas combustion are generated from residential and commercial usage (e.g., cooking and heating) and industrial usage (i.e., powering the old CEF for the 2014 inventory and powering the new CEF and Replacement Process Steam Plant for the 2015 and Fall 2018 inventories).

For 2014 and 2015 inventories, student residential and commercial natural gas usage is provided through PGE consumption data. Natural gas usage for private faculty/staff housing is estimated based on averages for the climate zone. Natural gas usage of the old CEF (2014 inventory) and the new CEF and Replacement Process Steam Plant (2015 inventory) are provided by Stanford.

For the Fall 2018 inventory, natural gas combustion emissions are based on 2015 natural gas consumption data provided by Stanford for residential and commercial categories, scaled up to account for development by 2018; natural gas consumption estimated for the faculty/staff housing in 2018; and natural gas consumption data by Stanford for 2015 for the new CEF and Replacement Process Steam Plant scaled up to account for development under the 2000 GUP by 2018.

For the Fall 2020 inventory, natural gas combustion emissions are based on the Fall 2018 natural gas consumption data described above. Additional residential natural gas consumption is estimated for the new Escondido Village Graduate Residences.

For the 2035 inventory, natural gas combustion emissions are based on Fall 2020 natural gas consumption estimates scaled up to account for development by 2035. The majority of PGE Residential accounts are student housing so the increase in consumption is scaled up by the increase in number of beds from Fall 2020 to 2035. Commercial accounts, hot water generators that are part of the CEF, and the replacement process steam plant natural gas consumption is scaled up by the increase in academic square feet from Fall 2020 to 2035. Natural gas consumption from 550 new faculty/staff high density homes to be constructed within the study boundary by 2035 was also added to the inventory. The annual natural gas use is based on the CalEEMod® default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). Natural gas use for the other scaled categories is assumed to scale linearly, meaning efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.

GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors (on a per therm basis) from the Federal Mandatory GHG Reporting Regulation (40 CFR 98).

[144] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

Natural gas consumption, emission factors, and emissions for all scenario years are summarized in **Tables 3-6-7, 3-6-8, 3-6-9, 3-6-10, 3-6-11**, and **3-6-12.**

3.6.3 Mobile Sources

GHG emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford. Mobile source emissions include running exhaust emissions and starting exhaust tailpipe emissions. Running exhaust is dependent on VMT. Starting exhaust is dependent on the number of starts or trips that a vehicle makes. EMFAC2014 was used to calculate the emission factors for each type of fleet in the relevant operational year. Assumptions and calculations used to determine these values are described in detail in **Appendix C**.

For 2014 and 2015, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers. The on-road Campus Fleet can be categorized into the Bonair Fueling Station Fleet, the Peninsula Sanitation Services, Inc (PSSI)Fleet, the Marguerite Bus/Shuttle Fleet, and the Public Safety Fleet. Stanford provided activity data in the form of fuel usage totals for the Bonair Fueling Station Fleet and the PSSI Fleet, and VMT for the Marguerite Bus/Shuttle Fleet a portion of the PSSI fleet, and the Public Safety Fleet. Activity data (fuel consumption) for the off-road Campus Fleet and golf course fleets (Siebel Varsity Golf Training Complex and Red Barn)[145] was provided by Stanford. Activity data (number of trips and VMT) for visitors and childcare facilities were calculated by Ramboll Environ based on Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**.

For Fall 2018, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, visitors, and vendors corresponding to 2015 were scaled up based on academic square footage and number of residents. The 10 oldest vehicles from the Marguerite fleet will be assumed to be electric by Fall 2018, so only tire and brake wear particulate matter emissions will be considered from those 10 vehicles. Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, while reducing the total number of vehicles. This fleet reduction program is assumed to reduce emissions from Bonair vehicles by 5%.

For Fall 2020, the same methodology, traffic data, and assumptions are used as that for the Fall 2018 inventory, except that the worker and resident VMT have been updated per **Fehr & Peers Appendix B2** to incorporate changes due to the new Escondido Village Graduate Residences.

For 2035, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers. On-road Campus Fleet emissions incorporate the Stanford commitments that all Marguerite buses will be electric 2035 and 70% of Bonair vehicles will be replaced by electric vehicles by 2035. Activity data (number of trips and VMT) for visitors and childcare facilities was calculated by Ramboll Environ based on

[145] Although the Stanford golf course (and fuel tanks at the golf course) is located outside of the study area boundary, some of the off-road equipment that fuel at the golf course also service parts of the campus within the study area boundary. To be conservative, emissions were included from equipment activity at the Siebel Varsity Golf Training Complex and Red Barn, which are both within the study area boundary.

Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**.

The GHG emission factors for the mobile sources mentioned above were generated with the most recent approved version of ARB's EMission FACtor model (EMFAC2014), approved by the USEPA on December 14, 2015. Since EMFAC2014 does not incorporate the GHG benefits of the NHTSA Phase 2 regulation, emissions for medium- and heavy-duty vehicles are overestimated for the 2035 operational year. Full calculation details can be found in **Appendix A**.

Emissions for all scenario years are summarized in **Tables, 3-6-13, 3-6-14, 3-6-15**, **3-6-16**, and **3-6-17.**

3.6.4 Emergency Generators

Stanford currently has 90 emergency generators installed on campus. GHG emissions are from diesel combustion resulting from their operation for testing and maintenance and for emergency operation. Activity data (hours of operation, including some emergency usage) for the emergency generators is provided by Stanford for 2014 and 2015. Activity data was scaled up from the 2015 inventory based on increased academic square footage of 8% to develop the Fall 2018 inventory. The Fall 2020 inventory is assumed to be the same as the Fall 2018 inventory. For 2035, activity data from Fall 2018/2020 was scaled up based on the increase in academic square footage from full buildout of the 2000 GUP to full buildout of the 2018 GUP. A representative GHG emission factor (in grams per horsepower per hour) was derived for emergency generators based on a default fuel consumption rate. Full calculation details are provided in **Appendix A**.

Emissions for all scenario years are summarized in **Tables 3-6-18** and **3-6-19.**

3.6.5 Waste

Indirect GHG emissions associated with waste disposal include CH_4 generation from the decomposition of waste and the CO_2 emissions associated with the combustion of CH_4, if applicable. GHG emission estimates for 2014 and 2015 inventories are based on Stanford actual disposal and diversion rates for those years, with waste from faculty/staff housing outside the study area removed. GHG emission estimates for the Fall 2018 inventory are based on Stanford actual disposal and diversion rates across campus in 2015, scaled up by 8% to account for the increase in academic square footage. Stanford waste is sent to Newby Island Landfill, which contains a landfill gas (LFG) collection and destruction system. The GHG emissions were calculated using methods from CalEEMod® assuming LFG collection.

Fall 2020 is based on the Fall 2018 waste total with additional waste estimated for the new Escondido Village Graduate Residences. Waste generated by the new residents is based on the CalEEMod® default for mid-rise apartments. The diversion rate is assumed to remain the same as the 2015 rate.

For 2035, waste generation is assumed to linearly increase from Fall 2020 based on the increase in academic square footage expected from full buildout of the 2000 GUP to full buildout of the 2018 GUP. Waste associated with the new faculty/staff housing is added based on the 2015 per-house waste disposal rates. Waste disposal is assumed to scale linearly; i.e., disposal rates in new buildings is assumed equal to current buildings. The

diversion rate is assumed to remain constant from the 2015 rate, even though diversion rate statewide is expected to increase by 2035.

GHG emissions associated with non-landfill diverted waste streams are not considered, because it is generally assumed that these diversions do not result in any appreciable amounts of GHG emissions when operated effectively.[146] These waste diversion alternatives may result in differences in life-cycle emissions of GHGs, but it is not appropriate to combine life-cycle emissions for only one category of emissions.[147] Biogenic CO_2 emissions were not included when ARB analyzed the GHG emissions inventory under AB 32. Therefore, they are not included in the emissions inventory.

Emissions are summarized in **Tables 3-6-20, 3-6-21**, **3-6-22**, **3-6-23**, and **3-6-24.**

3.6.6 Water Use and Emissions

Indirect GHG emissions result from the production of electricity used to convey, treat, and distribute water and wastewater. The amount of electricity required to convey, treat, and distribute water depends on the volume of water as well as the sources of the water. Stanford potable water is sourced from the San Francisco Public Utilities Commission. Non-potable water comes from groundwater and lake water. Additional emissions from wastewater treatment include CH_4 and N_2O, which are emitted directly from the wastewater.

GHG emissions associated with water use for 2014 and 2015 are based on actual data for domestic water use and wastewater generation for the campus in 2014 and 2015, respectively. For the Fall 2018 inventory, water usage and wastewater generation values are based 2015 data, plus a 12% increase in total consumption from the April 2017 Stanford Water Supply Assessment (WSA) Report to adjust for Fall 2018. For the Fall 2020 inventory, additional water use is added on a per-bed basis for the new Escondido Village Graduate Residences based on the consumption in the WSA. Emissions from electricity from lake water pumping is already captured under campus electricity. Wastewater quantities are derived by summing monthly sewer water records. Ramboll Environ used CalEEMod® default assumptions for average embodied energy in water for Santa Clara County, which are based on a study commissioned by the CEC.[148,149] This study published recommended electricity intensities for the supply and conveyance, treatment and distribution of water, as well as treatment of wastewater, for Northern and Southern California. These factors account for the energy embodied in water use and were used to calculate emissions for the campus. Lacking more detailed information about the wastewater treatment type at the Palo Alto Water Treatment Plant, CalEEMod® defaults for Santa Clara County have been used to represent a conservative emissions calculation; if the actual wastewater treatment process does not contain anaerobic facultative lagoons or septic tanks, emissions would decrease. The PGE electricity emission factor is used to estimate GHG emissions per kilowatt-hour, since it is assumed that the electricity from the conveyance, treatment, and distribution comes from PGE.

[146] ARB. 2010. Local Government Operations Protocol. Chapter 9.4.

[147] This inventory represents scope 1 and 2 emission categories. A life-cycle analysis of waste diversion would be a scope 3 inventory. CARB's Local Government Operations Protocol Version 1.1 (May 2010) clearly states that scope 3 emissions should not be combined with scope 1 and 2 emissions.

[148] Embodied energy refers to the amount of energy that was used in delivering water to the specific land use.

[149] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF.

Fall 2035 water use rates are from the April 2017 Stanford Water Supply Assessment, which were based on pre-drought water use rates per undergraduate and graduate bed, academic building square foot, and faculty and staff residence. Consistent with the existing inventories, total water consumption is lower in the GHG Report than in the Water Supply Assessment, because the WSA includes water use from the 899 faculty and staff houses not included in the study area. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use.

Emissions are shown in **Tables 3-6-25**, **3-6-26, 3-6-27, 3-6-28, 3-6-29a,** and **3-6-29b**.

3.6.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression for 2014, 2015, Fall 2018, Fall 2020, and Fall 2035. Emissions are shown in **Table 3-2-1**.

4. GHG INVENTORIES IN CONTEXT

This section compares the three existing conditions inventories and the Project inventory.

4.1 2014 Inventory

The site emitted approximately 222,069 $MTCO_2e$ in 2014 (see **Table 3-2-1**). The dominant emissions sources were the Cardinal Cogen and transportation, which contributed 67% and 25% of the total inventory, respectively.

4.2 2015 Inventory

The site emitted approximately 166,924 $MTCO_2e$ in 2015 (see **Table 3-2-1**). The dominant emissions sources were electricity imported to campus and transportation, which contributed 45% and 33% of the total inventory, respectively. The reduction in emissions compared to 2014 primarily is due to completion of the SESI.

4.3 Fall 2018 Inventory

The site is expected to emit approximately 125,672 $MTCO_2e$ in the inventory year Fall 2018 prior to commencement of the proposed 2018 GUP (see **Table 3-2-1)**. The dominant emissions sources were transportation and electricity imported to campus, which contributed 42% and 27% of the total inventory, respectively. The reduction in emissions compared to 2015 primarily is due to operation of the Stanford Solar Generating Station.

4.4 Fall 2020 Inventory

The site is expected to emit approximately 124,525 $MTCO_2e$ in the inventory year 2020 (see **Table 3-2-1)**. The dominant emissions sources were transportation and electricity imported to campus, which contributed 43% and 27% of the total inventory, respectively. The slight decrease in emissions compared to Fall 2018 is due to the addition of the Escondido Village Graduate Residences that reduces graduate student mobile trips coupled with a decrease in electricity and mobile emission factors.

4.5 Fall 2035 Inventory

The site is expected to emit approximately 125,412 $MTCO_2e$ per year in Fall 2035 (see **Table 3-2-1)**. The dominant emissions sources are almost evenly transportation, electricity imported to campus, and natural gas which contributed 34%, 30%, and 30% of the total inventory, respectively.

4.6 Fall 2035 with RPS Projection Inventory

Emissions for a second Fall 2035 scenario ("Fall 2035 with RPS Projection") are calculated to represent a reasonable estimate of 2035 Project emissions as the electricity grid continues to incorporate additional renewables after 2030. The electricity intensity factor for the Fall 2035 with RPS Projection inventory is derived based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050.[150] This linear trajectory would require 57.5 percent of electricity to come from renewable sources in 2035. As shown in **Table 3-2-1**, the site is expected to

[150] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

emit approximately 119,875 $MTCO_2e$ per year in Fall 2035 after incorporating the 2035 RPS projection.

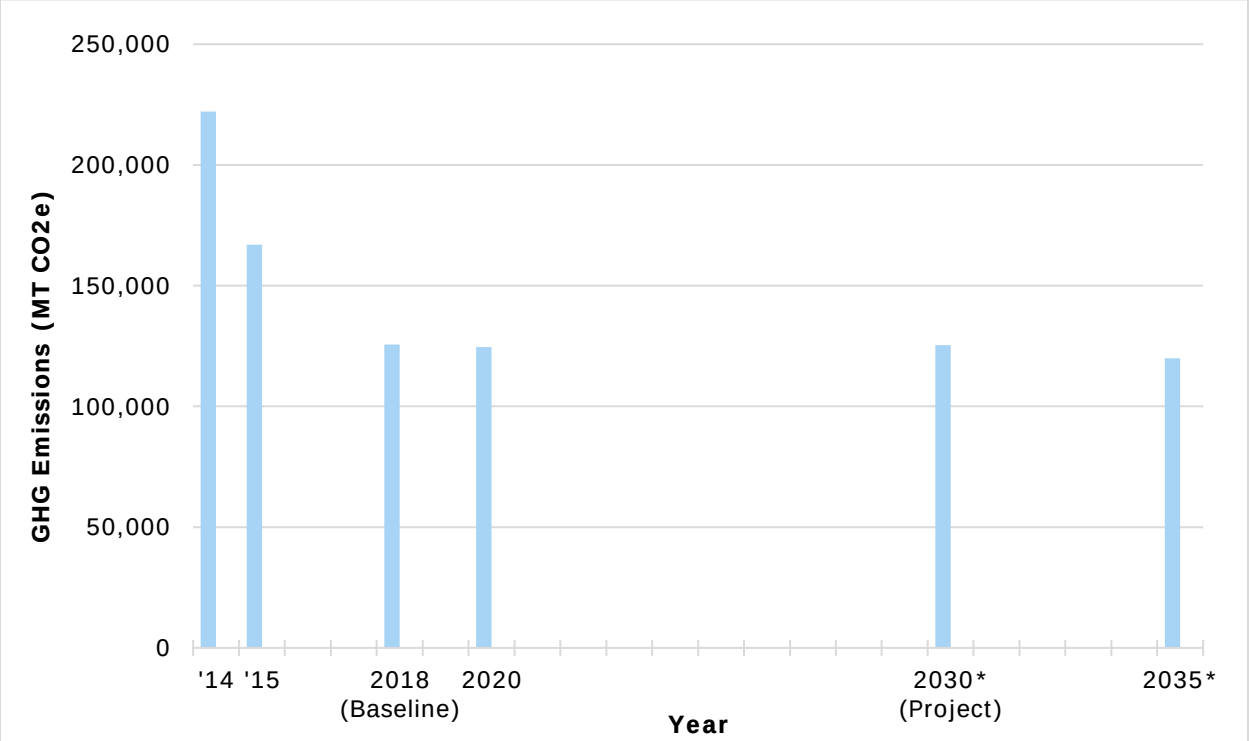
4.7 Summary

A category-by-category comparison of emissions between the three existing conditions inventories and the Project inventory is shown in **Table 3-2-1.** Even with growth in population and building square footage, total mass emissions of GHGs decrease significantly from 2014 to 2015 to Fall 2018 and remain stable from Fall 2018 to Fall 2020 and through Fall 2035. The decrease from 2014 to 2015 is due to the changes in electricity and gas consumption due to SESI, and continued decreases through Fall 2018 and Fall 2020 are due to the Stanford Solar Generating Station and the cleaner PGE electricity. The relatively stability of emissions from Fall 2020 to Fall 2035 is primarily due to a larger campus with a higher population offset by cleaner electricity and cleaner mobile vehicles. As described in Section 1.2.3, the 2035 Project inventory is the developed using 2030 emission factors. This is conservative, as the electricity intensity factor, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. As shown in the Fall 2035 with RPS Projection scenario, incorporating a reasonable estimate of the electricity intensity factor in 2035 further decreases GHG emissions. The Project would not result in a net increase in campus-wide GHG emissions from the baseline year of 2018 through full build out of the 2018 General Use Permit in 2035.

Table 4-7. Stanford GHG Emissions

Inventory Year	GHG Emissions (MT)
2014	222,069
2015	166,924
Fall 2018 (Baseline)	125,672
Fall 2020	124,525
Fall 2035 (Project)*	125,412
Fall 2035 (Project) with RPS Projection	119,875

Figure 4-5. Stanford GHG Emissions



*As described in Section 1.2.3, the Fall 2035 Project inventory assumes full development of the proposed 2018 General Use Permit, applying emission factors consistent with 2030. This is conservative, as the electricity intensity factors, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. The Fall 2035 With RPS Projection scenario incorporates anticipated renewable portfolio standards in 2035, which reduces the electricity intensity factors.

5. SIGNIFICANCE STANDARDS AND IMPACT ASSESSMENT

5.1 Standards of Significance

5.1.1 CEQA Guidelines Appendix G Thresholds

As described in Section 2.2, the 2009 amendments to the state CEQA Guidelines do not establish specific thresholds of significance for GHG impacts. Rather, Section 15064.4 of the CEQA Guidelines emphasizes the lead agency's discretion to determine the appropriate methodologies and thresholds of significance consistent with the manner in which other impact areas are handled in CEQA.[151] Appendix G of the CEQA Guidelines, the Environmental Checklist Form, is often used as a basis for lead agencies' selection of significance thresholds, but it does not prescribe specific thresholds. Rather, Appendix G suggests evaluating whether a project would:

1. Generate GHG emissions, either directly or indirectly, that may have a significant adverse impact on the environment; or

3. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Guidelines section 15064.4(b) states that in evaluating the significance of impacts from GHG emissions, the lead agency should consider the following factors, among others:

- The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting.
- Whether the project emissions exceed a thresholds of significance that the lead agency determines applies to the project.
- 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 greenhouse gas emissions. Such requirements must be adopted by the relevant public agency through a public review process and must reduce or mitigate the project's incremental contribution of GHG emissions.

Here, there is no applicable plan, policy, or regulation enacted or adopted for unincorporated Santa Clara County that meets the standards set forth in Guidelines section 15064.4(b).

Further, while this GHG Technical Report presents GHG emissions at full Project build-out compared to GHG emissions under existing conditions, the quantity of emissions standing alone does not mean that the project's GHG emissions would be cumulatively considerable. The global nature of climate change and the absence of scientific and factual information on the significance of particular amounts of GHG emissions make the change insufficient to support a significance determination. In *Center for Biological Diversity v. Department of Fish & Wildlife,* 62 Cal. 4th 204 (2015), the California Supreme recognized that an individual project's emissions will most likely not have any appreciable impact on the global problem by themselves, but they will contribute to the significant cumulative impact caused by GHG emissions from other sources around the globe. The question therefore becomes whether the

[151] CNRA. 2009. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/FINAL_Text_of_Proposed_Amendemts.pdf

project's incremental addition of GHGs is cumulatively considerable in light of the global problem, and thus significant. The Supreme Court acknowledged that the fact that emissions are global rather than local gives rise to an argument that a certain amount of GHG emissions "is as inevitable as population growth." The Court stated "Under this view, a significance criterion framed in terms of efficiency is superior to a simple numerical threshold because CEQA is not intended as a population control measure."

This GHG Technical Report uses the BAAQMD CEQA Guidelines service population metric to assess the significance of the project's contribution to cumulative global GHG emissions. The BAAQMD service population metric is an efficiency-based metric that the BAAQMD developed to assess whether a land use project would further the emission reduction goals for 2020 articulated by the State Legislature in AB 32. To extend the analysis beyond 2020, Ramboll Environ has adjusted the BAAQMD's service population metric to assess whether the Project would meet the State's newly enacted, more stringent, 2030 GHG emissions reduction goal, and Ramboll Environ has further adjusted the service population metric to identify the additional reductions that would be required by 2035 to achieve a trajectory toward the 2050 goals announced in the Governor's Executive Order.

In addition, this GHG Technical Report includes a qualitative discussion of the Project's consistency with AB 32, the ARB Scoping Plan, the region's Sustainable Communities Strategy/Regional Transportation Plan (Plan Bay Area), Executive Order S-3-05, Executive Order B-16-12, and SB 32. In *Cleveland National Forest Foundation v. San Diego Association of Governments* (Cal. Supreme Court Case S223603, Filed July 13, 2017), the California Supreme Court held that the lead agency did not abuse its discretion in declining to adopt the 2050 goal in Executive Order S-3-05 as its significance criterion for assessing greenhouse gas emissions. There, the Court explained the EIR did not obscure the existence or contextual significance of the Executive Order's 2050 emissions target; the EIR made clear that the 2050 target is part of the regulatory setting in which the plan at issue would operate; and the EIR straightforwardly mentioned the 2050 target in the course of explaining why the lead agency chose not to use the target as a measure of significance. The EIR explained that it is uncertain what role regional land use and transportation strategies can or should play in achieving the EO's 2050 emissions reductions target. Because it remains uncertain as to what plans and policies the State will adopt to achieve the 2050 goal, this analysis similarly declines to adopt the 2050 goal as a significance criterion. However, because the goal is based on sound science, this analysis discusses the goal and assesses whether the project emissions would be consistent with the trajectory needed to achieve the goal.

5.1.2 BAAQMD Significance Threshold

The BAAQMD presents its thresholds of significance along with methods for evaluating compliance in its guidance document entitled California Environmental Quality Act Air Quality Guidelines (updated May 2011).[152,153]

[152] BAAQMD. 2011. California Environmental Quality Act Air Quality Guidelines. Accessed December 1, 2013. http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20CEQA%20Guidelines_May%202011_5_3_11.ashx.

[153] On March 5, 2012 the Alameda County Superior Court issued a judgment, in California Building Industry Association v. Bay Area Air Quality Management District, finding that the BAAQMD had failed to comply with CEQA when it adopted its significance thresholds in 2010. The Court ruled that the adoption of the significance thresholds (including new significance thresholds for TACs and fine particulate matter or $PM_{2.5}$) is considered a

With respect to Project operations, BAAQMD's guidelines establish three potential analysis criteria for land use development projects:

- Compliance with a qualified Climate Action Plan, with a goal consistent with AB 32,
- A mass emissions threshold of 1,100 MT of CO2e per year, or
- A GHG efficiency threshold of 4.6 MT of CO2e per service population (project jobs + project residents).

BAAQMD thresholds are based on the AB 32 GHG reduction goals and a "gap analysis" that attributes an appropriate share of GHG emissions reductions to new land use development projects in BAAQMD's jurisdiction. The efficiency threshold (4.6 MT of CO_2e per service population) was calculated by dividing the AB 32 GHG reduction target for land use development emissions in California by the estimated 2020 population and employment level.[154] BAAQMD thresholds are tied directly to AB 32 and statewide emissions reduction goals for 2020.

SB 32 addresses GHG emissions reductions through 2030. Long-term goals for 2030 and 2050 also have been articulated in EO B-30-15 and EO S-3-05, respectively.

Achieving SB 32 and the Executive Orders' 2050 GHG emissions reduction goals will require systemic changes in how energy is produced and consumed through all sectors of the economy (as discussed in greater detail in the impact analysis below). Because the mix of technologies, strategies, and policy choices the state will ultimately choose to implement to achieve the 2030 and 2050 goals is not readily ascertainable at this time, any accounting of future GHG emissions from an individual development project cannot yet reflect the scope and scale of reductions that may occur as the state transitions toward new regulations designed to achieve the new long-term goals. Furthermore, in absence of a state plan to achieve these long-term goals, it is difficult to identify the "fair share" of reductions to be applied at the local or project level.

The Association of Environmental Professionals (AEP) Climate Change Committee recommended in a 2015 white paper that CEQA analyses for multiple-phase projects with post-2020 development not only "consider consistency with the 2020/AB 32-based framework but

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"project" under CEQA, and, thus, the BAAQMD should have prepared the required CEQA review and documentation. The court issued a writ of mandate ordering the BAAQMD to set aside the 2010 significance thresholds and cease dissemination of them until the BAAQMD had complied with CEQA. On August 13, 2013, the California First District Court of Appeal reversed the Superior Court's decision, ruling that adoption of CEQA significance thresholds does not constitute a "project" under CEQA. The CBIA then sought review of this decision in the California Supreme Court, which narrowed the scope of review to the question: under what circumstances does CEQA require an analysis of how existing environmental conditions will impact future residents or receptors of a proposed project? On December 17, 2015, the California Supreme Court held that CEQA does not generally require an agency to consider the effects of existing environmental conditions on a proposed project's future users or residents. On August 16, 2016, the California First District Court of Appeal concluded that a local agency might permissibly apply the thresholds for existing environmental conditions to an environmental review conducted for its own project under CEQA, even though the thresholds cannot be used to require an environmental impact report or the implementation of mitigating measures for a privately initiated project based solely on the impact the existing environment will have on future users or occupants of a project. Because the vacation of the proposed significance thresholds did not affect their validity from a scientific perspective and the BAAQMD's thresholds are supported by substantial evidence, and because the County of Santa Clara does not have alternative numeric thresholds for evaluating air quality impacts under CEQA, the thresholds from the BAAQMD CEQA Guidelines will be used in this analysis.

[154] BAAQMD. 2010. Proposed Thresholds of Significance. May.

also analyze the consequences of post-2020 GHG emissions in terms of their impacts on the reduction trajectory from 2020 toward 2050."[155] AEP further recommends that the "significance determination…should be based on consistency with substantial progress along a post-2020 trajectory."[156] The AEP white paper is advisory only and is not binding guidance or an adopted set of CEQA thresholds. The Project would continue to generate operational GHG emissions in future years; thus, a post-2020 discussion is warranted.

Consistent with general scientific understanding that there will be a need for deeper reductions in GHG emissions in the post-2020 period, this report evaluates operational GHG emissions by using three different metrics:

- Existing conditions emissions in Fall 2018 and Fall 2020 are compared to BAAQMD's threshold of 4.6 MT of CO_2e per service population. The detailed derivation is shown in **Table 5-1-1**. The degree to which existing emissions are below the BAAQMD threshold for 2020 and the trajectory of the Project emissions toward the 2030 threshold (identified below) can be used to assess the Project's near-term GHG emissions. Emissions in excess of BAAQMD's thresholds could impede attainment of statewide GHG reduction targets for 2020 established under AB 32. BAAQMD used the global warming potentials from the Second Assessment Report (SAR) to establish this threshold. However, if the GWPs from Assessment Report 4 were used, the metric would still be 4.6 MT of CO_2e per service population, due to negligible impacts of the GWPs on the GHG emissions inventory.
- Project emissions at full Project buildout in 2035 (Fall 2035) are compared to a 2030 threshold of 2.7 MT of CO_2e per service population. The 2030 threshold was calculated for 2030 and based on the GHG reduction goal established under SB 32 and EO B-30-15 (40 percent reduction below 1990 levels by 2030, taking into account the 1990 emissions levels adjusted for the AR4 global warming potentials for consistency with the rest of the inventory and the projected 2030 statewide population and employment levels). The detailed derivation is shown in **Table 5-1-2**. Emissions in excess of the 2030 threshold of 2.7 MT of CO_2e per service population could impede attainment of statewide GHG reduction targets for 2030 established under SB 32. The 2030 assessment conservatively assumes full Project build-out by 2030, with 2030 emission factors.
- Project emissions (Fall 2035 and Fall 2035 with RPS Projection) are also compared to a 2035 threshold of 2.1 MT of CO2e per service population. The 2035 threshold was calculated for 2035 and based on a linear projection toward 2050 reduction targets (2035 emissions would be 50% below 1990 emissions levels, and using the projected 2035 statewide population and employment levels). The detailed derivation is shown in **Table 5-1-3**.

Table 5-1-4 summarizes the operational GHG thresholds and the "substantial progress" efficiency metric considered in this GHG Technical Report.

[155] Association of Environmental Professionals. 2015. Beyond 2020: The Challenge of GHG Reduction Planning by Local Governments. Draft. March 16.

[156] Association of Environmental Professionals. 2015. Beyond 2020: The Challenge of GHG Reduction Planning by Local Governments. Draft. March 16.

Table 5-1-4: Operational GHG Thresholds / Substantial Progress Efficiency Metrics

Analysis Condition	Threshold / Metric	Basis
2018 and 2020 Existing Conditions and Trajectory Toward Fully Build-out Project Conditions	4.6 MT of CO_2e per service population	BAAQMD-adopted threshold based on AB32
Full Project Conditions	2.7 MT of CO_2e per service population	SB 32 (40 percent reduction below 1990 levels)[a]
Full Project Conditions	2.1 MT of CO_2e per service population	EO S-3-05 (linear projection towards 2050 reduction target of 80 percent reduction below 1990 levels is equivalent to 50 percent reduction below 1990 levels by 2035)[b]

Notes:
[a] Calculation of 2.7 MT of CO_2e is based on state land use sector emissions being 40 percent below 1990 levels, combined with the forecast population and employment levels at full buildout of the proposed Project. Comparison with this metric can only be done by incorporating enacted statewide reductions in electricity GHG intensity and improvements in transportation efficiency.
[b] Calculation of 2.1 MT of CO_2e is based on state land use sector emissions being 50 percent below 1990 levels by 2035, combined with the forecast population and employment levels at full buildout of the proposed Project. This is a linear interpolation of the 2030 goal (40 percent below 1990 levels) and the 2050 goal (80 percent below 1990 levels). Comparison with this metric can only be done by incorporating enacted statewide reductions in electricity GHG intensity and improvements in transportation efficiency. The Fall 2035 Project emissions inventory conservatively uses 2030 anticipated electricity GHG intensity and mobile emission factors. The Fall 2035 With RPS Project emissions inventory incorporates anticipated electricity GHG intensity in 2035.

5.2 Environmental Analysis

Impact GHG-1: The Project Would Not Generate Greenhouse Gas Emissions, either Directly or Indirectly, that Would Make A Cumulatively Considerable Contribution to Global Climate Change (Less than Significant)

As described in Section 5.1.2, Project emissions are compared to service population thresholds based on BAAQMD CEQA Guidelines and adjustments to the BAAQMD thresholds to incorporate the State's 2030 emissions reduction goals. The service population derivation for each inventory year is shown in **Table 5-2-1.**

Table 5-2-1: Service Population Derivation

Inventory	Number of People[1]			
	Workers	Residents	Workers Who Are Residents	Service Population[2]

2014	38,851	12,592	11,468	51,443
2015	38,851	12,592	11,468	51,443
Fall 2018 (Baseline)	40,240	13,028	11,928	53,268
Fall 2020	40,240	15,250	13,948	55,490
Fall 2035 (Project)	49,428	19,353	17,116	68,781
Fall 2035 (Project) with RPS Projection	49,428	19,353	17,116	68,781

Notes:
[1.] Number of people is shown in Fehr & Peers VMT Appendix.
[2.] Service population is defined as the sum of the residential population and the workers, as shown in Table 6 of May 2011 BAAQMD CEQA Guidelines [CEQA Guidelines Update - Proposed Air Quality CEQA Thresholds of Significance. BAAQMD. 2011]. If a resident works on-site, that person is counted as both a resident and a worker.

Stanford's Fall 2018 existing emissions service population efficiency metric is estimated to be 2.4 MT of CO_2e per service population. That efficiency ratio is well below the BAAQMD CEQA Guidelines' significance threshold of 4.6 MT of CO_2e per service population. Under the BAAQMD CEQA Guidelines' threshold, the Project would not result in a cumulatively considerable contribution to global climate change.

Stanford's Fall 2020 existing emissions service population efficiency metric is estimated to be 2.2 MT of CO_2e per service population. That efficiency ratio is well below the BAAQMD CEQA Guidelines' significance threshold of 4.6 MT of CO_2e per service population. Under the BAAQMD CEQA Guidelines' threshold, the Project would not result in a cumulatively considerable contribution to global climate change.

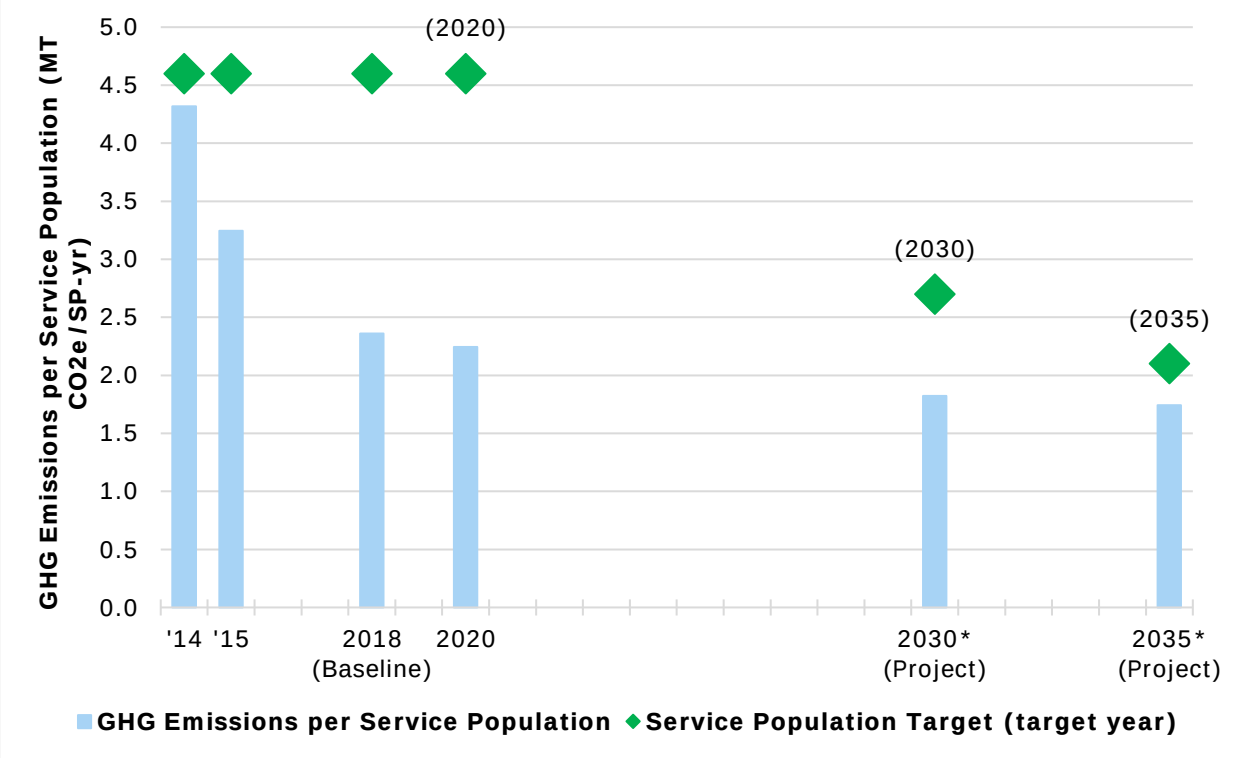
As described in Section 5.1.2, Project emissions are also compared to a 2030 threshold of 2.7 MT of CO_2e per service population and a 2035 threshold of 2.1 MT of CO_2e per service population that are derived from the BAAQMD methodology. The Project's efficiency metric is estimated to be 1.8 MT of CO_2e per service population in 2030. Under these long-term thresholds, the Project would not result in a cumulatively considerable contribution to global climate change.

The Project emissions inventory is based on adopted 2030 regulatory measures (e.g., RPS) and emission factors (e.g., EMFAC2014 mobile factors), assuming complete buildout of the 2018 GUP. If 2035 emission factors were developed, the total GHG emissions would be even lower than in 2030. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions.

As another point of comparison, the Fall 2035 with RPS Projection inventory was also prepared to represent Project emissions in Fall 2035, incorporating intensity factors for electricity generation consistent with expected implementation of renewable portfolio standards in 2035. This inventory results in an efficiency metric of 1.7 MT of CO_2e per service population, which is below the 2.1 MT of CO_2e per service population derived from the BAAQMD methodology for year 2035. This comparison is still conservative since other factors such as 2035 mobile emissions factors are not incorporated in the inventory.

Considering the downward trend of the Project's service efficiency CO_2e metric and less than significant impacts in 2018, 2020, 2030 and 2035, it can be reasoned that levels would continue to decrease into 2050. The service population efficiency metrics and Project comparisons are shown in **Figure 5-2**.

Figure 5-2. GHG Service Population Efficiency Metrics



* As described in Section 1.2.3, the Fall 2035 Project inventory assumes full development of the proposed 2018 General Use Permit, applying emission factors consistent with 2030. This is conservative, as the electricity intensity factors, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. The Fall 2035 With RPS Projection scenario incorporates anticipated renewable portfolio standards in 2035, which reduces the electricity intensity factors.

Impact GHG-2: The Project Would Be Consistent with AB 32, the ARB Scoping Plan, the Region's Sustainable Communities Strategy / Regional Transportation Plan (Plan Bay Area), Executive Order S-3-05, Executive Order B-16-12, and SB 32. (Less than Significant)

The Project has been evaluated for consistency with the following plans, policies, and regulations:

- AB 32 (California Global Warming Solutions Act of 2006), including:
  - ARB Scoping Plan

- Plan Bay Area
- Executive Order S-3-05
- Executive Order B-30-15
- SB 32

Each plan, policy, and regulation is described in detail in Section 5.1.2, above. A discussion of Project consistency with each plan, policy, and regulation is presented below.

AB 32

The heart of the California Global Warming Solutions Act of 2006 (AB 32) is the requirement for statewide GHG emissions to be reduced to 1990 levels by 2020. The Project would be consistent with this mandate based on the BAAQMD service population metric, as described in the preceding impact analysis. AB 32 also required the adoption of discrete Early Action Items[157] which resulted in the development of the Low Carbon Fuel Standard, among other things. Further, AB 32 required the development of a Scoping Plan for achieving the necessary GHG reductions in a technologically and economically feasible manner, the adoption of a mandatory GHG emissions reporting regulation, and the establishment of a market-based declining emission limit program (i.e., the cap-and-trade program). Each of these programs is discussed below.

CARB Scoping Plan

The AB 32 Scoping Plan identifies over 70 measures for reducing greenhouse gas emissions to 1990 levels by 2020. Specific measures discussed in the Scoping Plan that are relevant to the Project include the Renewables Portfolio Standard (RPS) and Advanced Clean Cars program.

The RPS requires retail sellers of electricity to achieve 33% renewable energy sources by 2020. While Stanford is not a regulated entity under the RPS, the electricity that Stanford purchases from those suppliers reflects the use of renewable sources as required to comply with the RPS.

In 2015, under the Stanford Energy Systems Innovations (SESI), Stanford transformed its campus-wide energy system, replacing a 100% fossil fuel-based cogeneration power plant with grid-sourced electricity and an advanced heat recovery system. This transformation resulted in large reductions of GHG emissions, fossil fuel use, and campus-wide water use. The new Central Energy Facility (CEF) combines conversion of the heat supply of all buildings from steam to hot water, and an innovative heat recovery loop that captures nearly two-thirds of waste heat generated by the campus cooling system to produce hot water for the heating system. By Fall 2018, Stanford will procure approximately 159,000 MWh/year of electricity from its Kern County Solar Generating Station and an additional 7,300 MWh/year from on-campus rooftop solar installations. These solar installations will be providing half of the campus's electricity demand. In combination with the renewable sources that utilities

[157] CARB. 2007. Expanded List of Early Action Measures to Reduce Greenhouse Gas Emissions in California Recommended for Board Consideration. Available online at: https://www.arb.ca.gov/cc/ccea/meetings/ea_final_report.pdf

must use to comply with the RPS, the total percentage of Stanford's electricity that will come from renewable sources will be over 65 percent.

The Advanced Clean Cars Program applies to vehicle manufacturers. While Stanford is not a regulated entity under this regulation, the vehicles used by Stanford employees, residents, and contractors will reflect the GHG emission limits required by the regulation. Implementation of these regulations, combined with the LCFS will reduce the campus's vehicular GHG emissions on a per service population basis. Additional emissions reductions will result from a fully electric vehicle of Marguerite shuttles by 2030.

Mandatory Greenhouse Gas Emissions Reporting Regulations

The State of California and federal mandatory GHG emissions reporting regulations require facilities exceeding a specified threshold of GHG emissions to report their emissions inventory. Both regulations require reporting of emissions from stationary combustion. This does not include non-stationary combustion sources such as from vehicle travel and trucking or indirect emissions from water and electricity usage. Further, the California regulation requires emissions reports to be verified by a third party if emissions exceed 25,000 MT CO_2e. Stanford submits its emissions inventory reports to ARB. Because Stanford does not directly emit more than 25,000 MT CO_2e annually, third-party verification, California Cap-and-Trade, and Federal reporting requirements do not apply.

Plan Bay Area

SB 375, the Sustainable Communities and Climate Protection Act of 2008, supports the State's climate action goals to reduce GHG emissions through coordinated transportation and land use planning. SB 375 required ARB to establish GHG emission reduction targets (Regional Targets) for each metropolitan planning region. On September 23, 2010, ARB adopted Regional Targets applying to the years 2020 and 2035.[158] In 2011, ARB adopted Regional Targets of 7% for 2020 and 15% for 2035 for the area under ABAG's jurisdiction, which includes Stanford University.

SB 375 requires Metropolitan Planning Organizations (MPO) including the Association of Bay Area Governments (ABAG) to incorporate a "sustainable communities strategy" (SCS) in their regional transportation plans (RTPs) that will achieve the GHG emission Reduction Targets set by ARB, primarily by reducing vehicle miles traveled (VMT) from light-duty vehicles through development of more compact, complete, and efficient communities.

Review of maps produced by MTC showing the 2040 growth projections under the RTP and SCS indicates increases in both residents and workers at Stanford. Therefore, the proposed Project is consistent with the SCS in terms of proposing additional residences and academic square footage in locations where the SCS specifies development. In addition, the VMT Technical Report prepared by Fehr & Peers indicates that the proposed Project would generate VMT per worker and VMT per resident rates that are more than 15% below the regional averages.

Stanford's low VMT is largely due to its close proximity to transit and its aggressive Travel Demand Management (TDM) programs. In 2003, the drive alone rate for Stanford commuters (workers and off campus students) was 72 percent. As the TDM programs have expanded, the drive alone rate of Stanford commuters has decreased to around 50 percent.

[158] ARB. Sustainable Communities. 2010. Accessed July 22, 2016. http://www.arb.ca.gov/cc/sb375/sb375.htm

This decrease in solo drivers directly reduces the number of vehicle trips to the campus and vehicle miles traveled.

Executive Order B-30-15 and SB 32

In April 2015, Governor Brown signed Executive Order B-30-15, which established the following GHG emission reduction goal for California: by 2030, reduce GHG emissions to 40 percent below 1990 levels. This Executive Order also directed all state agencies with jurisdiction over GHG-emitting sources to implement measures designed to achieve the new interim 2030 goal, as well as the pre-existing, long-term 2050 goal identified in Executive Order S-3-05 (see discussion below). Additionally, the Executive Order directed CARB to update its Scoping Plan to address the 2030 goal. SB 32 codifies the 2030 emissions reduction goal of Executive Order B-30-15 requiring CARB to ensure that statewide GHG emissions are reduced to 40 percent below 1990 levels by 2030.

The Project's 2030 emissions total represents the emissions inventory for the Project at full build-out. As explained in the preceding impact analysis, the Project emissions would be beneath the 2030 Service Population target that Ramboll Environ calculated for 2030 based on the GHG reduction goal established under SB 32 and EO B-30-15 (40 percent reduction below 1990 levels by 2030, taking into account the 1990 emissions levels and the projected 2030 statewide population and employment levels). Several regulatory requirements reduce the Project's emissions and help ensure that the State's 2030 GHG target is achieved, including the following:

- SB 350 requires retail sellers of electric services to increase procurement from eligible renewable energy resources to 50% by 2030 (from 33% by 2020).
- Under SB 375, ARB adopted Regional Targets of 15% for 2035 for the area under ABG's jurisdiction, which includes Stanford University. The MTC and ABAG approved the final Plan Bay Area, which establishes strategies for meeting the Bay Area's Regional Targets.
- The Advanced Clean Cars Program will reduce GHG emissions by nearly 35% for new cars of model years 2017-2025.
- CPUC, CEC, and ARB have a shared, established goal of achieving ZNE for new residential construction by 2020 and new commercial construction by 2030.
- Executive Order B-16-12 sets targets for State ZEV infrastructure to be able to support one million vehicles by 2020; 1.5 million zero-emission vehicles to be on the road, displacing 1.5 billion gallons of petroleum fuels, by 2025; and an 80% reduction of GHG emissions from the transportation sector by 2050, compared to 1990 levels. At least 10 percent of California state fleet purchases of light-duty vehicles must be zero-emission by 2015, and at least 25 percent of fleet purchases of light-duty vehicles must be zero-emission by 2020.

The measures above will all help ensure that the State meets the 2030 GHG target. The Project will be consistent with all of these initiatives and regulatory requirements.

Executive Order S-3-05

This report also evaluates the Project's consistency with Executive Order No. S-3-05's goal of reducing the State's GHG emissions to 80 percent below the 1990 level by the year 2050. Based on existing emissions trends, the Project's emissions are expected to decline from

2030 through at least 2050 due to continued regulatory and technological advancements. As explained in the preceding impact analysis, the Project emissions would be lower than the Service Population target that Ramboll Environ calculated for 2035 based on the trajectory needed to achieve the GHG reduction goal established under EO S-3-05 (80 percent reduction below 1990 levels by 2030, taking into account the 1990 emissions levels and the projected 2030 statewide population and employment levels). Therefore, the Project is unlikely to obstruct the attainment of the State's long-term GHG reduction goal for 2050.

As of 2004, California was emitting 12 percent more GHG emissions than in 1990.[159] For California to emit 80 percent less than it emitted in 1990, the statewide GHG emissions would be only 18 percent of the 2004 statewide GHG emissions. Accounting for a population growth from 35,840,000 people in 2004 to approximately 55,000,000 people in 2050, the emissions per capita would have to be only 12 percent of what they were in 2004. This means 88 percent reductions in per capita GHG emissions from 2004 emissions intensities must be realized in order to achieve California's 2050 GHG goals. Clearly, energy efficiency and reduced vehicle miles traveled will play important roles in achieving this aggressive goal, but the decarbonization of fuel will also be necessary.

The extent to which GHG emissions from mobile sources indirectly attributed to the Project will change in the future depends on the quantity (e.g., number of vehicles, average daily mileage) and quality (i.e., carbon content) of fuel that will be available and required to meet both regulatory standards and residents' and workers' needs. In addition, renewable power requirements, low carbon fuel standards, and vehicle emissions standards discussed above will all decrease GHG emissions per unit of energy delivered or per vehicle mile traveled. Due to the technological shifts required and the unknown parameters of the regulatory framework in 2050, quantitatively analyzing a Project's impacts further relative to the 2050 target are speculative for purposes of CEQA.

That being said, studies have shown that, in order to meet the 2050 target, aggressive technology changes in the transportation and energy sectors, such as electrification and maturation of technologies still in development (e.g., advanced batteries and more efficient biofuels), will be required.[160] One recent study indicated that, even with these emerging technologies, the 2050 goal will not be met, due to the population growth to 55 million by 2050.[161] A more recent study, however, shows that the existing and proposed regulatory framework will allow the State to reduce GHG emissions to 40 percent below 1990 levels by 2030, and to 60 percent below 1990 by 2050.[162] Even though this study did not provide a regulatory and technology roadmap to achieve the Governor's 2050 goal, it demonstrated that various combinations of policies could allow Statewide emissions to remain very low

[159] CEC. 2006. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. October. Available at: http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-D.PDF.

[160] Lawrence Berkeley National Laboratory (LBL). 2011. California's Energy Future – The View to 2050. May. Available at: http://ccst.us/publications/2011/2011energy.php.

[161] LBL. 2013. Estimating Policy-Driven Greenhouse Gas Emissions Trajectories in California: The California Greenhouse Gas Inventory Spreadsheet (GHGIS) Model. Available at: http://eetd.lbl.gov/publications/estimating-policy-driven-greenhouse-g.

[162] Jeffery Greenblatt. 2015. Modeling California Impacts on Greenhouse Gas Emissions. Energy Policy. Volume 78, March 2015, pages 158-172. Abstract available at: http://www.sciencedirect.com/science/article/pii/S0301421514006892.

through 2050, suggesting that the combination of new technologies and other regulations not analyzed in the study could allow the State to meet the Governor's 2050 goal.

While it would be speculative to quantitatively estimate the Project's emissions level in 2050 and to assess the impacts to the Executive Order's horizon-year goal, statewide efforts are underway to facilitate the State's achievement of that goal and it is reasonable to expect the Project's emissions level (approximately 125,038 metric tons of CO_2e per year in 2035) to decline as the regulatory initiatives identified by CARB in the First Update to the Climate Change Scoping Plan are implemented, and other technological innovations occur. Many of these initiatives include reducing the carbon content of motor fuels and fuels for electricity generation.[163] Reducing the carbon content of motor fuels and fuels for electricity generation will reduce CO_2e emissions from this Project over time. Stated differently, the Project's emissions total at build-out (2035) represents the maximum emissions inventory for the Project as California's emissions sources are being regulated (and foreseeably expected to continue to be regulated in the future) in furtherance of the State's environmental policy objectives. Given the reasonably anticipated decline in Project emissions once fully constructed and operational, the Project is consistent with the Executive Order's horizon-year goal.

For example, CARB's First Update "lays the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050." And many of the emission reduction strategies recommended by CARB would serve to reduce the Project's post-2020 emissions level to the extent applicable by law:

- Energy Sector: Continued improvements in California's appliance and building energy efficiency programs and initiatives would serve to reduce the Project's emissions level. Additionally, further additions to California's renewable resource portfolio would favorably influence the Project's emissions level.
- Transportation Sector: Anticipated deployment of improved vehicle efficiency, zero emission technologies, lower carbon fuels, and improvement of existing transportation systems all will serve to reduce the Project's emissions level.
- Water Sector: The Project's emissions level will be reduced as a result of further desired enhancements to water conservation technologies.
- Waste Management Sector: Plans to further improve recycling, reuse and reduction of solid waste will beneficially reduce the Project's emissions level.

In addition to CARB's First Update, in January 2015, during his inaugural address, Governor Jerry Brown expressed a commitment to achieve "three ambitious goals" that he would like to see accomplished by 2030 to reduce the State's GHG emissions: (1) increasing the State's Renewable Portfolio Standard from 33 percent in 2020 to 50 percent in 2030; (2) cutting the petroleum use in cars and trucks in half; and, (3) doubling the efficiency of existing buildings and making heating fuels cleaner. Two of these expressions of Executive Branch policy – (1) and (3) – already have been manifested in adopted legislative action (i.e., SB 350).

In summary, because the Project meets and exceeds the emissions reduction targets presented in this report for 2020, 2030, and 2035, and because many aspects of the

[163] California Energy Commission. 2007. State Alternative Fuels Plan. December. CEC-600-2007-011-CMF. Available at: http://www.energy.ca.gov/2007publications/CEC-600-2007-011/CEC-600-2007-011-CMF.PDF.

Project's emissions inventory will benefit from further regulatory and technological advancements, the Project is not expected to obstruct the attainment of the Governor's long-term GHG reduction goal for 2050. Therefore, the Project's impacts are **less than significant** under this methodology.

TABLES

Table 3-2-1
2014, 2015, Fall 2018, Fall 2020, and Project GHG Emissions - Summary
Stanford University
Stanford, CA

Sources	GHG Emissions					
	2014 Inventory	2015 Inventory	Fall 2018 (Baseline) Inventory	Fall 2020 Inventory	Fall 2035 (Project) Inventory[1]	Fall 2035 (Project) with RPS Projection Inventory[1]
	[MT CO_2e/yr]					
Electricity						
PGE Commercial	11	39	37	36	27	23
PGE Searsville/Olmstead	53	53	50	49	37	31
PGE New Faculty/Staff Housing	-	-	-	-	279	238
Direct Access	509	737	650	607	454	386
Cardinal Cogen	77,440	-	-	-	-	-
Imported to Campus and CEF	2,743	75,336	34,021	32,602	35,628	30,338
Commercial Non-Stanford	941	611	577	561	419	357
Subtotal	**81,698**	**76,776**	**35,336**	**33,854**	**36,844**	**31,372**
Natural Gas						
PGE Residential	3,359	3,006	3,112	3,623	4,281	4,281
PGE Commercial	4,325	15,718	16,942	16,942	20,559	20,559
PGE Searsville/Olmstead	71	71	71	71	71	71
PGE New Faculty/Staff Housing	-	-	-	-	347	347
Hot Water Generators	-	5,382	5,817	5,817	7,104	7,104
Replacement Process Steam Plant	-	4,371	4,725	4,725	5,770	5,770
Cardinal Cogen	71,012	-	-	-	-	-
Subtotal	**78,768**	**28,549**	**30,667**	**31,178**	**38,131**	**38,131**
Mobile Sources						
Worker Trips	21,528	21,528	20,377	18,307	15,524	15,524
Resident Trips	13,390	13,390	12,738	15,492	14,222	14,222
Campus Vehicles - On Road	5,859	5,859	5,678	5,573	1,170	1,170
Campus Vehicles - Off Road	235	235	235	235	235	235
Other Trips	14,901	14,901	14,609	13,728	11,767	11,767
Subtotal	**55,914**	**55,914**	**53,637**	**53,336**	**42,919**	**42,919**
Emergency Generators						
All Generators	279	336	363	363	444	444
Subtotal	**279**	**336**	**363**	**363**	**444**	**444**
Waste						
All waste	3,655	3,770	4,075	4,169	5,286	5,286
Subtotal	**3,655**	**3,770**	**4,075**	**4,169**	**5,286**	**5,286**
Water						
Domestic Water Use	435	327	327	336	320	272
Wastewater Treatment	138	124	124	127	121	103
Direct Wastewater Emissions	494	445	470	498	633	633
Subtotal	**1,066**	**896**	**920**	**962**	**1,074**	**1,009**
Miscellaneous Sources						
Propane, CO_2, Acetylene, Fire Suppression[2]	294	294	294	294	294	294
Construction Off-Road Equipment[3]	394	389	379	368	420	420
Subtotal	**688**	**683**	**674**	**662**	**714**	**714**
Total (MT)	**222,069**	**166,924**	**125,672**	**124,525**	**125,412**	**119,875**
Service Population (residents + workers)	51,443	51,443	53,268	55,490	68,781	68,781
Emissions per Service Population (MT/SP-yr)	4.3	3.2	2.4	2.2	1.8	1.7

Notes:

1. As described in the GHG Report, the Fall 2035 inventory assumes full development of the proposed 2018 General Use Permit, applying emission factors consistent with 2030. This is conservative, as the electricity intensity factors, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. The Fall 2035 With RPS Projection scenario incorporates anticipated renewable portfolio standards in 2035, which reduces the electricity intensity factors.

2. Data from Stanford. Propane, solid & gaseous CO_2, and acetylene are all used in on-campus research, with emissions based on purchase records from Stanford suppliers for calendar year 2015. The fire suppression system category includes both handheld fire extinguishers and larger fire suppression systems. Data from the campus Fire Marshall on the testing and discharge of fire suppression systems. In 2015, Stanford did not have any events that caused GHG leakage from the larger fire suppression systems (and only fans are activated during testing so there is no associated GHG leakage), so the number used simply captures the CO_2 released from the 40 fire extinguishers that were discharged throughout the course of the year.

3. Construction emissions are estimated using CalEEMod® 2013.2.2 using the average annual square footage of construction and demolition and estimated excavation from fiscal year 2001 through fiscal year 2015 with default construction schedules and equipment lists. Construction equipment is all assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment. Construction on-road emissions are included in the mobile sources.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
MT - metric tons
PGE - Pacific Gas & Electric
yr - year

Table 3-5-1
Electricity Intensity Factor Derivations
Stanford University
Stanford, CA

	PGE 2014[1,2]	CAMX 2014[3]	Units
CO_2 Intensity Factor per Total Energy Delivered	434.9	568.6	lbs CO_2/MWh delivered
% of Total Energy From Renewables	27%	18.6%	
CO_2 Intensity Factor per Total Non-Renewable Energy[4]	596	699	lbs CO_2/MWh delivered
Estimated Intensity Factor for Total Energy Delivered[5,6]			
2018	411.1	501.6	lbs CO_2/MWh delivered
	413.7	503.6	lbs CO_2e/MWh delivered
2020 RPS (33%)	399.2	468.0	lbs CO_2/MWh delivered
	401.7	470.1	lbs CO_2e/MWh delivered
2030 RPS (50%)[7]	297.9	349.3	lbs CO_2/MWh delivered
	300.5	351.3	lbs CO_2e/MWh delivered
2035 RPS (57.5%)[8]	253.2	296.9	lbs CO_2/MWh delivered
	255.8	298.9	lbs CO_2e/MWh delivered

Notes:

[1] Total CO_2 emission factor from The Climate Registry. Available at: https://www.theclimateregistry.org/our-members/cris-public-reports/. Accessed: February 2017.

[2] Percent of total energy from eligible renewables is from the PGE 2015 Corporate Responsibility Report. Available at: http://www.pgecorp.com/corp_responsibility/reports/2015/PGE_CRSR_2015.pdf.

[3] Total CO_2 emission factor and percentage of electricity from non-hydropower renewables (wind, solar, geothermal, and biomass) from the USEPA for the WECC California (CAMx) subregion. This is used for 'Direct Access' electricity unless the specific provider is otherwise known. Available at: https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_summarytables_v2.pdf. Accessed: April 2017. RPS-eligible technologies are defined at: http://docketpublic.energy.ca.gov/PublicDocuments/16-RPS-01/TN215573_20170125T160830_Renewables_Portfolio_Standard_Eligibility_Guidebook_Ninth_Editi.pdf.

[4] The emissions metric presented here is calculated based on the total CO_2 intensity factor divided by the percent of energy delivered from non-renewable sources.

[5] The intensity factor for total energy delivered is estimated by multiplying the percentage of energy delivered from non-renewable energy by the CO_2 emissions per total non-renewable energy metric calculated above. The estimate provided here and the energy reports issued by PGE assume that renewable energy sources do not result in any CO_2 emissions.

[6] Global Warming Potentials (GWP) are based on the IPCC Fourth Assessment Report. CH_4 and N_2O emission factors are from the CalEEMod version 2013.2.2 and eGRID 2014v2 defaults for PGE and CAMX, respectively, and are conservatively assumed not to change from these estimates. As more renewable energy is integrated into the electricity grid, these intensity factors will also decrease.

[7] Emission factor presented here is 50% projected RPS for 2030 consistent with SB 32 and SB 350. Available at: http://www.energy.ca.gov/sb350/. Accessed: April 2017.

[8] The projected 2035 RPS target is derived based on a linear trajectory for electricity to reach 80% RPS in 2050, consistent with the CARB Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1, 2016). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

Abbreviations:

CARB - California Air Resources Board
CAMX - California-Mexico Power Area
CO_2 - carbon dioxide
GHG - greenhouse gases
lbs - pounds
MWh - megawatt-hour
RPS - Renewable Portfolio Standards
PGE - Pacific Gas & Electric
SB - Senate Bill
USEPA - US Environmental Protection Agency
WECC - Western Electricity Coordinating Council

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Table 3-6-1
2014 Electricity Providers
Stanford University
Stanford, CA

Provider	Proportion of Total Annual Electricity Use	Service Areas
PGE Commercial	**0.02%**	Several addresses on campus (research laboratory, dormitory)
PGE Searsville/Olmstead	**0.10%**	Faculty/staff housing in Searsville Block and Olmstead (38 units)
Direct Access	**0.73%**	Residences, living communities, street lights, pump
Cardinal Cogen	**94%**	Majority of campus - academic buildings, dormitories, graduate student residences
Imported to Campus	**3.3%**	Cardinal Cogen service areas when Cardinal Cogen was down.
Imported to CEF	**0.67%**	The CEF while Cardinal Cogen was down.
Commercial Non-Stanford	**1.1%**	Commercial leases within the study area served by Cogen, not included in Cardinal Cogen to campus electricity

Abbreviations:

CEF - Central Energy Facility
GUP - General Use Permit
PGE - Pacific Gas & Electric

Table 3-6-2
2014 GHG Emissions - Electricity
Stanford University
Stanford, CA

Provider	Annual Electricity Use	Emission Factors[1]			GWP[6]			Emissions			
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[MWh/yr]	[lb/MWh]						[MT/yr]			[MT/yr]
PGE Commercial[2]	57	435	0.029	0.0062				11	0	0	11
PGE Searsville/Olmstead[3]	269	435	0.029	0.0062				53	0	0	53
Direct Access	1,966	569	0.033	0.0040				507	1	1	509
Cardinal Cogen[4]	253,134	672	0.029	0.0062	1	25	298	77,145	83	211	77,440
Imported to Campus	8,797	569	0.033	0.0040				2,269	3	5	2,277
Imported to CEF	1,801	569	0.033	0.0040				465	1	1	466
Commercial Non-Stanford[5]	3,077	672	0.029	0.0062				938	1	3	941
Total	**269,100**							**81,388**	**89**	**221**	**81,698**

Notes:

1. Electricity intensity factor sources are shown in Table **3-5-1.**
2. PGE data provided by Stanford. Includes commercial accounts only, geocoded to contain only addresses within the Stanford boundary in the A1 zoned areas.
3. Areas on campus for which Stanford did not provide detailed electricity data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod(R) default for single family homes built to 2008 Title 24 standards in climate zone 4.
4. This includes Cogen electrical sales to Stanford Campus and to Stanford CEF but excludes electrical sales to PGE. Data provided by Stanford.
5. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. 2014 electricity came from the Cardinal Cogen. Electricity use data was provided by Stanford.
6. Global Warming Potentials from the IPCC Fourth Assessment Report.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CEF - Central Energy Facility
CO_2 - carbon dioxide
CH_4 - methane
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GWP - Global Warming Potential
lb - pound
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
MWh - megawatt hour
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-3
2015 GHG Emissions - Electricity
Stanford University
Stanford, CA

		Emission Factors[1]			GWP[2]			Emissions			
Provider	Annual Electricity Use	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[MWh/yr]	[lb/MWh]						[MT/yr]			[MT/yr]
PGE[3]	199	435	0.029	0.0062	1	25	298	39	0.003	0.001	39
PGE Searsville/Olmstead[4]	269	435	0.029	0.0062				53	0.004	0.001	53
Direct Access	2,846	569	0.033	0.0040				734	0.043	0.005	737
Campus and CEF Consumption[5]	291,036	569	0.033	0.0040				75,068	4.4	0.5	75,336
Commercial Non-Stanford[6]	3,077	435	0.029	0.0062				607	0.040	0.009	611
Total	**294,349**							**76,501**	**4.5**	**0.55**	**76,776**

Notes:

1. Electricity intensity factor sources are shown in Table **3-5-1.**
2. Global warming potentials are based on the IPCC Fourth Assessment Report.
3. PGE data provided by Stanford. Electricity data from July through December 2015 was doubled to approximate a full year of post-SESI operations.
4. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
5. Electricity data from July through December 2015 was doubled to approximate a full year of post-SESI operations. Stanford purchases this electricity through the direct access program, so the eGRID WECC California (2014v2) factor is used. This electricity is used to heat and cool water and to power campus buildings.
6. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. Use was provided by Stanford.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
SESI - Stanford Energy System Innovations
yr - year

Table 3-6-4
Fall 2018 GHG Emissions - Electricity
Stanford University
Stanford, CA

Electricity Use				Emission Factors[3]			Emissions[4]			
Provider	2015 Annual Electricity Use[1] [MWh/yr]	Scaling for Fall 2018[2] [%]	Fall 2018 Annual Electricity Use [MWh/yr]	CO_2 [lb/MWh]	CH_4 [lb/MWh]	N_2O [lb/MWh]	CO_2 [MT/yr]	CH_4 [MT/yr]	N_2O [MT/yr]	CO_2e [MT/yr]
PGE[5]	199	0%	199	411	0.029	0.0062	37	0.0026	5.6E-04	37
Direct Access[6]	2,846	0%	2,846	502	0.033	0.0040	648	0.043	0.0052	650
Campus and CEF Consumption[7]	291,036	8%	314,562	236	0.033	0.0040	33,731	4.7	0.58	34,021
PGE Searsville/Olmstead Housing[5,8]	269	0%	269	411	0.029	0.0062	50	0.0035	7.5E-04	50
Commercial Non-Stanford[5,9]	3,077	0%	3,077	411	0.029	0.0062	574	0.040	0.0086	577
Total	**294,349**		**320,952**	**-**	**-**	**-**	**35,040**	**4.8**	**0.59**	**35,336**

Notes

1. 2015 annual electricity use details are shown in **Table 3-6-3.**
2. Scaling for fall 2018 is primarily based on the increase in academic square footage and student housing expected from December 2015 to full buildout of the 2000 GUP. Since the majority of electricity consumption within the study area is within the Campus and CEF Consumption category, all increases are assigned to this category, with no expected changes in electricity use for the other providers. Electricity use is assumed to scale linearly; e.g., efficiency of new buildings is assumed equal to current buildings. This is conservative, since newer buildings should be more energy efficient than older buildings.
3. CO_2 emission factors are described in the footnotes for each electricity provider. CH_4 and N_2O emission factors are assumed not to change from estimates for earlier years.
4. Global warming potentials are based on the IPCC Fourth Assessment Report.
5. The PGE emission factor is based on the projection from 2014 to 2018 as shown in **Table 3-5-1.**
6. The Direct Access emission factor is based on the WECC California projection from 2014 to 2018 as shown in **Table 3-5-1.** A portion of Stanford's Direct Access electricity will actually be net metered with on-campus solar generation, but for simplicity this adjustment has been reflected in the Campus and CEF Consumption category.
7. The campus and CEF consumption emission factor is a weighted average between electricity from direct access electricity service providers and electricity from Stanford's solar panels. According to Stanford's Office of Sustainability, on-campus solar panels are expected to generate approximately 7,300 MWh/year, while the Stanford Solar Generation Farm is expected to generate 159,000 MWh/year. The 166,300 MWh/year are given an emission factor of 0 lb/MWh, while the remaining electricity use is assigned the projected 2018 WECC California emission factor as shown in **Table 3-5-1.**
8. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod® v2013.2.2 default for single family homes built to 2008 Title 24 standards in climate zone 4.
9. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. In 2014, the electricity source for this category was Cardinal Cogen. The electricity use data was provided by Stanford. Ramboll Environ assumes no changes in electricity consumption for 2018 and that PGE is the default electricity provider.

Abbreviations

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
CPUC - California Public Utilities Commission
GHG - greenhouse gas
GUP - general use permit
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-5
Fall 2020 GHG Emissions - Electricity
Stanford University
Stanford, CA

Electricity Use				Emission Factors[3]			Emissions[4]			
Provider	Fall 2018 Annual Electricity Use[1] [MWh/yr]	Increase for 2020[2] [MWh/yr]	Fall 2020 Annual Electricity Use [MWh/yr]	CO_2 [lb/MWh]	CH_4 [lb/MWh]	N_2O [lb/MWh]	CO_2 [MT/yr]	CH_4 [MT/yr]	N_2O [MT/yr]	CO_2e [MT/yr]
PGE	199	0	199	399	0.029	0.0062	36	0.0026	5.6E-04	36
Direct Access	2,846	0	2,846	468	0.033	0.0040	604	0.043	0.0052	607
Campus and CEF Consumption[5]	314,562	3,918	318,480	224	0.033	0.0040	32,308	4.8	0.58	32,602
PGE Searsville/Olmstead Housing[6]	269	0	269	399	0.029	0.0062	49	0.0035	7.5E-04	49
Commercial Non-Stanford[7]	3,077	0	3,077	399	0.029	0.0062	557	0.040	0.0086	561
Total	**320,952**		**324,870**	**-**	**-**	**-**	**33,554**	**4.9**	**0.60**	**33,854**

Notes

1. Fall 2018 annual electricity use details are shown in **Table 3-6-4.**

2. The increase from Fall 2018 to Fall 2020 is due to the occupancy of the new Escondido Village Graduate Residences. The annual electricity use is based on the CalEEMod® version 2013.2.2 default for mid rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017).

CalEEMod® Table 8.1 Energy Use for Apartments Mid Rise (kWh/DU)				Adjustment from 2008 to 2013 T24 Electricity[a]	Adjustment from 2013 to 2016 T24 Electricity[b]	Adjustment from 2008 to 2016 T24 Lighting[c]	Total Electricity for 2016 T24-Compliant Residence	Number of Dwelling Units	Total Electricity (MWh)
T24 Electricity	Non-T24 Electricity	Lighting Electricity	Total Electricity						
226.6	2,558.6	741.4	3,526.6	25%	28%	50%	3,051.6	1,284	3,918

[a] CEC, 2012. http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2013_Building_Energy_Efficiency_Standards_FAQ.pdf

[b] CEC, 2016. http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf

[c] CEC, 2015. http://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037-CMF.pdf "All installed luminaires shall be high efficacy".

3. CO_2 emission factors are shown in **Table 3-5-1**. The PGE and WECC California emission factors are based on the utility achieving the State goal of 33% RPS in 2020. CH_4 and N_2O emission factors are assumed not to change from estimates for earlier years.

4. Global warming potentials are based on the IPCC Fourth Assessment Report.

5. The campus and CEF consumption emission factor is a weighted average between electricity from direct access electricity service providers and electricity from Stanford's solar panels. According to Stanford's Office of Sustainability, on-campus solar panels are expected to generate approximately 7,300 MWh/year, while the Stanford Solar Generation Farm is expected to provide renewable generation credits for 159,000 MWh/year. The 166,300 MWh/year are given an emission factor of 0 lb/MWh, while the remaining electricity use is assigned the 2020 projection of the 2014v2 WECC California emission factor.

6. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

7. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. In 2014, the electricity source for this category was Cardinal Cogen. The electricity use data was provided by Stanford. Ramboll Environ assumes no changes in electricity consumption for 2018 and that PGE is the default electricity provider.

Abbreviations

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
CPUC - California Public Utilities Commission
GHG - greenhouse gas
GUP - general use permit
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
RPS - Renewables Portfolio Standard
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-6a
Fall 2035 GHG Emissions - Electricity
Stanford University
Stanford, CA

Electricity Use				Emission Factors[3]			Emissions[4]			
Provider	Fall 2020 Annual Electricity Use[1] [MWh/yr]	Scaling for Fall 2035[2] [%]	Fall 2035 Annual Electricity Use [MWh/yr]	CO_2 [lb/MWh]	CH_4 [lb/MWh]	N_2O [lb/MWh]	CO_2 [MT/yr]	CH_4 [MT/yr]	N_2O [MT/yr]	CO_2e [MT/yr]
PGE	199	0%	199	298	0.029	0.0062	27	0.0026	5.6E-04	27
Direct Access	2,846	0%	2,846	349	0.033	0.0040	451	0.043	0.0052	454
Campus and CEF Consumption[5]	318,480	22%	388,914	200	0.033	0.0040	35,270	5.8	0.7	35,628
PGE Searsville/Olmstead Housing[6]	269	0%	269	298	0.029	0.0062	36	0.0035	7.5E-04	37
PGE New Faculty/Staff Housing[7]	0	N/A	2,049	298	0.029	0.0062	277	0.027	0.0057	279
Commercial Non-Stanford[8]	3,077	0%	3,077	298	0.029	0.0062	416	0.040	0.0086	419
Total	**324,870**		**397,353**	**-**	**-**	**-**	**36,477**	**6.0**	**0.7**	**36,844**

Notes

1. Fall 2020 annual electricity use details are shown in **Table 3-6-5.**

2. Scaling for fall 2035 is primarily based on the increase in academic square footage and student housing expected from Fall 2020 to full buildout of the 2018 GUP. Since the majority of electricity consumption within the study area is within the Campus and CEF Consumption category, all increases are assigned to this category, with no expected changes in electricity use for the other providers, except for the additional faculty/staff housing added separately. Electricity use is assumed to scale linearly; e.g., efficiency of new buildings is assumed equal to current buildings. This is conservative, since newer buildings should be more energy efficient than older buildings.

3. CO_2 emission factors are shown in **Table 3-5-1**. The PGE and WECC California emission factors are based on the utility achieving the State goal of 50% RPS in 2030. CH_4 and N_2O emission factors are assumed not to change from estimates for earlier years.

4. Global warming potentials are based on the IPCC Fourth Assessment Report.

5. The campus and CEF consumption emission factor is a weighted average between electricity from direct access electricity service providers and electricity from Stanford's solar panels. According to Stanford's Office of Sustainability, on-campus solar panels are expected to generate approximately 7,300 MWh/year, while the Stanford Solar Generation Farm is expected to generate 159,000 MWh/year. The 166,300 MWh/year are given an emission factor of 0 lb/MWh, while the remaining electricity use is assigned the WECC California emission factor adjusted for 50% RPS.

6. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod® 2013.2.2 default for single family homes built to 2008 Title 24 standards in climate zone 4.

7. This represents the electricity consumption from the 550 new faculty/staff high density homes to be constructed within the study boundary. These houses are assumed to contract electricity with PGE. The annual electricity use is based on the CalEEMod® version 2013.2.2 default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown below. This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24.

CalEEMod® Table 8.1 Energy Use for Condo/Townhouse (kWh/DU)				Adjustment from 2008 to 2013 T24 Electricity[a]	Adjustment from 2013 to 2016 T24 Electricity[b]	Adjustment from 2008 to 2016 T24 Lighting[c]	Total Electricity for 2016 T24-Compliant Residence
T24 Electricity	Non-T24 Electricity	Lighting Electricity	Total Electricity				
184.3	3,125.9	1,001.1	4,311.2	25%	28%	50%	3,725.9

[a] CEC, 2012. http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2013_Building_Energy_Efficiency_Standards_FAQ.pdf

[b] CEC, 2016. http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf

[c] CEC, 2015. http://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037-CMF.pdf. "All installed luminaires shall be high efficacy".

8. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. In 2014, the electricity source for this category was Cardinal Cogen. The electricity use data was provided by Stanford. Ramboll Environ assumes no changes in electricity consumption for 2035 and that PGE is the default electricity provider.

Abbreviations

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
CPUC - California Public Utilities Commission
DU - Dwelling Unit
GHG - greenhouse gas
GUP - general use permit
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
RPS - Renewables Portfolio Standard
T24 - Title 24
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-6b
Fall 2035 with RPS Projection GHG Emissions - Electricity
Stanford University
Stanford, CA

Electricity Use		Emission Factors[2]			Emissions[3]			
Provider	Fall 2035 Annual Electricity Use[1] [MWh/yr]	CO_2 [lb/MWh]	CH_4 [lb/MWh]	N_2O [lb/MWh]	CO_2 [MT/yr]	CH_4 [MT/yr]	N_2O [MT/yr]	CO_2e [MT/yr]
PGE	199	253	0.029	0.0062	23	0.0026	0.00056	23
Direct Access	2,846	297	0.033	0.0040	383	0.043	0.0052	386
Campus and CEF Consumption	388,914	170	0.033	0.0040	29,979	5.8	0.7120	30,338
PGE Searsville/Olmstead Housing	269	253	0.029	0.0062	31	0.0035	0.0008	31
PGE New Faculty/Staff Housing	2,049	253	0.029	0.0062	235	0.027	0.0057	238
Commercial Non-Stanford	3,077	253	0.029	0.0062	353	0.040	0.0086	357
Total Electricity Emissions with 2035 RPS Projection	**397,353**	**-**	**-**	**-**	**31,005**	**6.0**	**0.7**	**31,372**

Notes

1. Fall 2035 annual electricity use is shown in **Table 3-6-6a.**
2. The PGE and WECC California CO_2 emission factors are based on a projection of the utility achieving 57.5% RPS in 2035, as shown in **Table 3-5-1**. CH_4 and N_2O emission factors are assumed not to change from estimates for earlier years.
3. Global warming potentials are based on the IPCC Fourth Assessment Report.

Abbreviations

CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
RPS - Renewables Portolio Standard
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-7
2014 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Annual Natural Gas Usage		GHG Emission Factors[3]			GWP[3]			Emissions			
			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[therms]	[MMBtu]	[kg/MMBtu]			[-]			[MT/yr]			[MT/yr]
PGE Residential[1]	632,937	63,294	53.02	0.001	0.0001	1	25	298	3,356	0.063	0.006	3,359
PGE Commercial[1]	814,953	81,495							4,321	0.081	0.008	4,325
PGE Searsville/Olmstead[2]	13,408	1,341							71	0.001	0.000	71
Total	**1,461,298**	**146,130**							**7,748**	**0.15**	**0.015**	**7,756**

Notes:

1. Annual Natural Gas usage provided by Stanford. Addresses were geocoded, and natural gas use from addresses outside of unincorporated Santa Clara County A1 zoned areas was removed.
2. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
therms - 100,000 British thermal units
yr - year

References:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

Table 3-6-8
2014 GHG Emissions - Cardinal Cogen
Stanford University
Stanford, CA

Facility	Emissions Sources	Average Daily Emissions [lb/day]				Annual Emissions [MT/year]			
		CO_2	CH_4	N_2O	CO_2e[1]	CO_2	CH_4	N_2O	CO_2e[1]
Cardinal Cogen	Cogen Total Emissions[2]	1,260,000	86	2.4	1,262,864	208,607	14	0.4	209,082
	Cogen to Stanford Campus - GUP Emissions[3]	427,943	29	0.8	428,916	**70,851**	**4.8**	**0.13**	**71,012**

Notes:

1. Global warming potentials are based on the IPCC Fourth Assessment Report.
2. BAAQMD 2014 Cardinal Cogen Air Pollutant Emissions (For 2014 calendar year emissions) presents annual average emissions in lbs/day. Ramboll Environ assumed 365 days/year to calculate total annual emissions.
3. Total emissions shown here are only for natural gas combustion associated with non-electricity-generation activity for steam, heating, and chilled water on campus. Emissions associated with electricity generation are calculated separately and shown in Table 3-6-2. Additionally, emissions associated with steam, heating, and chilled water sold off campus are excluded. This breakout is based on data provided by the Stanford Sustainability Office.

End Use	Percent of Total Cogen Emissions
Steam and chilled water to hospitals	13%
Electricity to PGE	18%
Electricity to campus + CEF	35%
Chilled water and steam to campus	34%

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - general use permit
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
N_2O - nitrous oxide

Table 3-6-9
2015 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Annual Natural Gas Usage		Emission Factors[3]			GWP[3]			2015 Emissions
			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	
	[therms]	[MMBtu]	[kg/MMBtu]			[-]			[MT/yr]
PGE Residential[1]	566,432	56,643	53.02	0.001	0.0001	1	25	298	3,006
PGE Commercial[1]	2,961,553	296,155							15,718
PGE Searsville/Olmstead[2]	13,408	1,341							71
Hot Water Generators[1]	1,014,080	101,408							5,382
Replacement Process Steam Plant[1]	823,632	82,363							4,371
Total	**5,379,104**	**537,910**							**28,549**

Notes:

1. Annual Natural Gas usage provided by Stanford. Natural gas use within Stanford Academic Growth Boundary within unincorporated Santa Clara County in the A1 zoning areas. Natural gas data from the last six months of 2015 was doubled to approximate a full year of post-SESI operations.
2. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
GHG - greenhouse gas
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
SESI - Stanford Energy System Innovations
therms - heat energy equal to 100,000 British thermal units
yr - year

References:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

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Table 3-6-10
Fall 2018 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	2015 Annual Natural Gas Usage[1]	Scaling for Fall 2018[2]	Fall 2018 Annual Natural Gas Usage	Emission Factors[3]			Fall 2018 Emissions[3]
				CO_2	CH_4	N_2O	
	[MMBtu]	[%]	[MMBtu]	[kg/MMBtu]			[MT/yr]
PGE Residential	56,643	4%	58,626	53.02	0.001	0.0001	3,112
PGE Commercial[4]	296,155		319,205				16,942
PGE Commercial - Individual Replacement Boilers	11,007	0%	11,007				584
PGE Commercial - Remaining	285,148	8%	308,198				16,358
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				71
Hot Water Generators (Central Energy Facility)	101,408	8%	109,605				5,817
Replacement Process Steam Plant	82,363	8%	89,021				4,725
Total	**537,910**		**577,799**				**30,667**

Notes:

1. 2015 natural gas use details are shown in **Table 3-6-9.**
2. Scaling for fall 2018 is primarily based on the increase in academic square footage and student beds expected from December 2015 to full buildout of the 2000 GUP. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the CEF, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; e.g. efficiency and use in new buildings is assumed equal to current buildings.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
GHG - greenhouse gas
GUP - General Use Permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
yr - year

References:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

RAMBOLL ENVIRON

Table 3-6-11
Fall 2020 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Fall 2018 Annual Natural Gas Usage[1]	Scaling for 2020[2]	Fall 2020 Annual Natural Gas Usage	Emission Factors[3]			Fall 2018 Emissions[3]
				CO_2	CH_4	N_2O	
	[MMBtu]	[%]	[MMBtu]	[kg/MMBtu]			[MT/yr]
PGE Residential	58,626	16%	68,256	53.02	0.001	0.0001	3,623
PGE Commercial[4]	319,205		319,205				16,942
PGE Commercial - Individual Replacement Boilers	11,007	0%	11,007				584
PGE Commercial - Remaining	308,198	0%	308,198				16,358
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				71
Hot Water Generators (Central Energy Facility)	109,605	0%	109,605				5,817
Replacement Process Steam Plant	89,021	0%	89,021				4,725
Total	**577,799**		**587,429**				**31,178**

Notes:

1. Fall 2018 natural gas use details are shown in **Table 3-6-10.**
2. The increase from Fall 2018 to Fall 2020 is due to the occupancy of the new Escondido Village Graduate Residences. Scaling is based on the number of net new beds.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
GHG - greenhouse gas
GUP - General Use Permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
yr - year

References:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

Table 3-6-12
Fall 2035 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Fall 2020 Annual Natural Gas Usage[1]	Scaling for Fall 2035[2]	Fall 2035 Annual Natural Gas Usage	Emission Factors[3]			Fall 2035 Emissions[3]
				CO_2	CH_4	N_2O	
	[MMBtu]	[%]	[MMBtu]	[kg/MMBtu]			[MT/yr]
PGE Residential	68,256	18%	80,651	53.02	0.001	1.0E-04	4,281
PGE Commercial[4]	319,205		387,365				20,559
PGE Commercial - Individual Replacement Boilers	11,007	0%	11,007				584
PGE Commercial - Remaining	308,198	22%	376,358				19,975
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				71
PGE New Faculty/Staff Housing[6]	0	N/A	6,531				347
Hot Water Generators (Central Energy Facility)	109,605	22%	133,845				7,104
Replacement Process Steam Plant	89,021	22%	108,709				5,770
Total	**587,429**		**718,441**				**38,131**

Notes:

1. Fall 2020 natural gas use details are shown in **Table 3-6-11.**
2. Scaling for fall 2035 is primarily based on the increase in academic square footage and student beds expected from Fall 2020 to full buildout of the 2018 GUP. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the CEF, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. Estimates for new faculty/staff housing are added. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; e.g. efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
6. This represents the natural gas consumption from the 550 new faculty/staff high density homes to be constructed within the study boundary. The annual natural gas use is based on the CalEEMod® version 2013.2.2 default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown below. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24.

CalEEMod® Table 8.1 Energy Use for Condo/Townhouse (kBTU/DU)			Adjustment from 2008 to 2013 T24 Natural Gas[a]	Adjustment from 2013 to 2016 T24 Natural Gas[b]	Total Natural Gas for 2016 T24-Compliant Residence
T24 Natural Gas	Non-T24 Natural Gas	Total Natural Gas			
16,523.6	2,951.0	19,474.6	25%	28%	11,873.7

[a] CEC, 2012. http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2013_Building_Energy_Efficiency_Standards_FAQ.pdf
[b] CEC, 2016. http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf

Abbreviations:

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
GHG - greenhouse gas
GUP - General Use Permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
yr - year
T24 - Title 24
DU - Dwelling Unit

Table 3-6-13
2014 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[11]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	234		70,286		512,385	340	161		185
	Graduate	1,259		523,894		4,793,631				1,712
	Post-doc	555		246,412		2,335,983				833
	Faculty/Staff	5,443		2,416,714		27,803,160				9,829
	Casual Employees	302		133,960		1,793,719				631
	Contingent Employees	294		130,354		1,596,836				563
	Temporary Employees	604		268,165		3,421,786				1,205
	Non-Employee Affiliates: 20% FTEs	169		75,118		892,407				315
	Non-Employee Affiliates: FTEs	925		410,795		4,880,239				1,723
	Third Party Contractors	244		108,178		1,537,214				539
	Janitorial Shift Workers	195		86,543		1,229,771				431
	First Mile to Transit (all Workers + Students)	2,039		903,934		3,707,596				1404
	Construction	975		432,713		6,148,856				2,157
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**				**21,528**
On-Campus (Resident) Trips[3]	Undergraduate	1,582		1,962,450		7,612,107	340	161		2,900
	Graduate	3,648		5,264,378		27,554,538				10,202
	Post-doc	28		33,580		168,975				63
	Faculty/Staff	98		109,500		616,735				227
	Sub-Total	**5,356**		**7,369,908**		**35,952,355**				**13,391**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.7	454,946	7.3	3,321,104	340	77		1,164
	Bonair on-road - diesel[8]	11	3.2	12,890	7.3	94,099	306			29
	Bonair on-road buses - diesel[8]	10	1.1	4,075	7.3	29,749	1,913		2,128	65
	Bonair Unfiltered - on-road - gas[8]	74	1.7	45,317	7.3	330,811	340	77		116
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	615		164	1,493
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	306			54
	Marguerite[10]	66				1,983,931				2,857
	Public Safety	31	2.8	31,879	7.3	232,720	340	77		82
	Sub-Total	**700**		**614,290**		**8,594,006**				**5,859**
Other Trips	General Visitors (Vendor)	2,016,204	2.0	4,032,408		25,001,480	340	161		9,137
	Worker Non-Commute Trips	already above		301,920		935,952				366
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443				1,024
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	1,913		2,128	757
	Event Visitor Traffic	149,958	2.0	299,917		6,652,357	340	161		2,307
	Deliveries - Trucks (total)	168,054	2.0	336,108		2,083,870	615		164	1,310
	Construction Vendor Trucks[12]		*2.4*	*8,510*	*7.3*	*62,123*				*39*
	Construction Haul Trucks[12]		*2.4*	*7,987*	*20.0*	*159,740*				*99*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**				**14,901**
Campus Vehicles - Off-road Equip[5]						[bhp-hr/yr][6]	[g/bhp-hr][7]			
	Siebel and Red Barn equip - gas[9]					38,837	859			33
	Siebel and Red Barn equip - diesel[9]					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**55,915**

RAMBOLL ENVIRON

Table 3-6-13
2014 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix A (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC2014 mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. EMFAC emission factors for 2015 are used for calculating on-road emissions and are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC
equip - equipment
FTE - full-time equivalent
g - gram
GHG - greenhouse gas
GUP - general use permit
hp - horsepower
hr - hour
mi - mile
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - to be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled

Table 3-6-14
2015 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[11]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	234		70,286		512,385	340	161		185
	Graduate	1,259		523,894		4,793,631				1,712
	Post-doc	555		246,412		2,335,983				833
	Faculty/Staff	5,443		2,416,714		27,803,160				9,829
	Casual Employees	302		133,960		1,793,719				631
	Contingent Employees	294		130,354		1,596,836				563
	Temporary Employees	604		268,165		3,421,786				1,205
	Non-Employee Affiliates: 20% FTEs	169		75,118		892,407				315
	Non-Employee Affiliates: FTEs	925		410,795		4,880,239				1,723
	Third Party Contractors	244		108,178		1,537,214				539
	Janitorial Shift Workers	195		86,543		1,229,771				431
	First Mile to Transit (all Workers + Students)	2,039		903,934		3,707,596				1404
	Construction	975		432,713		6,148,856				2,157
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**				**21,528**
On-Campus (Resident) Trips[3]	Undergraduate	1,582		1,962,450		7,612,107	340	161		2,900
	Graduate	3,648		5,264,378		27,554,538				10,202
	Post-doc	28		33,580		168,975				63
	Faculty/Staff	98		94,698		619,941				226
	Sub-Total	**5,356**		**7,355,106**		**35,955,561**				**13,390**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.7	454,946	7.3	3,321,104	340	77		1,164
	Bonair on-road - diesel[8]	11	3.2	12,890	7.3	94,099	306			29
	Bonair on-road buses - diesel[8]	10	1.1	4,075	7.3	29,749	1,913		2,128	65
	Bonair Unfiltered - on-road - gas[8]	74	1.7	45,317	7.3	330,811	340	77		116
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	615		164	1,493
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	306			54
	Marguerite[10]	66				1,983,931				2,857
	Public Safety	31	2.8	31,879	7.3	232,720	340	77		82
	Sub-Total	**700**		**614,290**		**8,594,006**				**5,859**
Other Trips	General Visitors (Vendor)	2,016,204	2.0	4,032,408		25,001,480	340	161		9,137
	Worker Non-Commute Trips	already above		301,920		935,952				366
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443				1,024
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	1,913		2,128	757
	Event Visitor Traffic	149,958	2.0	299,917		6,652,357	340	161		2,307
	Deliveries - Trucks (total)	168,054	2.0	336,108		2,083,870	615		164	1,310
	Construction Vendor Trucks[12]		*2.4*	*8,510*	*7.3*	*62,123*				*39*
	Construction Haul Trucks[12]		*2.4*	*7,987*	*20.0*	*159,740*				*99*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**				**14,901**
Campus Vehicles - Off-road Equip[5]						[bhp-hr/yr][6]	[g/bhp-hr][7]			
	Siebel and Red Barn equip - gas[9]					38,837	859			33
	Siebel and Red Barn equip - diesel[9]					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**55,914**

RAMBOLL ENVIRON

Table 3-6-14
2015 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix A (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC2014 mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC
equip - equipment
FTE - full-time equivalent
g - gram
GHG - greenhouse gas
GUP - general use permit
hp - horsepower
hr - hour
mi - mile
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - to be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled

Table 3-6-15
Fall 2018 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[12]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	185		55,470		404,378	312	71		134
	Graduate	1,286		534,884		4,894,189				1,603
	Post-doc	589		261,730		2,481,198				811
	Faculty/Staff	5,682		2,522,720		28,678,561				9,305
	Casual Employees	314		139,563		1,868,744				603
	Contingent Employees	306		135,808		1,663,642				538
	Temporary Employees	629		279,355		3,564,566				1,152
	Non-Employee Affiliates: 20% FTEs	176		78,281		929,974				301
	Non-Employee Affiliates: FTEs	964		428,097		5,085,797				1,647
	Third Party Contractors	263		116,833		1,660,191				535
	Janitorial Shift Workers	210		93,394		1,327,128				427
	First Mile to Transit (all Workers + Students)	2,125		941,983		3,864,416				1340
	Construction	975		432,713		6,148,856				1,980
	Sub-Total	**13,705**		**6,020,830**		**62,571,641**				**20,377**
On-Campus (Resident) Trips[3]	Undergraduate	1,654		2,028,810		7,869,489	312	71		2,745
	Graduate	3,829		5,479,152		28,680,441				9,729
	Post-doc	28		33,580		168,975				58
	Faculty/Staff	98		94,698		619,941				207
	Sub-Total	**5,609**		**7,636,240**		**37,338,845**				**12,738**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	314	72		1,023
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	281			25
	Bonair on-road buses diesel	10	1.1	3,871	7.3	28,261	1,826		2,218	60
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	314	72		102
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	602		163	1,460
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	281			50
	Marguerite[10]	66				2,144,233				2,883
	Public Safety	31	2.8	31,879	7.3	232,720	314	72		75
	Sub-Total	**700**		**588,428**		**8,565,520**				**5,678**
Other Trips[3]	General Visitors (Vendor)	2,177,501	2.0	4,355,001		27,001,599	312	71		9,044
	Worker Non-Commute Trips			326,074		1,010,828				339
	Non-event Visitor Trips - Passenger	61,835	2.0	147,705		3,130,985				987
	Non-event Visitor Trips - Buses	5,250	2.0	11,074		390,000	1,826		2,218	725
	Event Visitor Traffic	67,085	2.0	301,862		6,695,507	312	71		2,131
	Deliveries - Trucks	181,499	2.0	362,997		2,250,579	602		163	1,383
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*				*38*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20.0*	*159,740*				*97*
	Sub-Total	**2,493,169**		**5,504,713**		**40,479,498**				**14,609**
Campus Vehicles - Off-road Equip[5]						**[bhp-hr/yr][9]**	**[g/bhp-hr][7]**			
	Siebel and Red Barn equip - gas					38,837	859			33
	Siebel and Red Barn equip - diesel					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**53,637**

RAMBOLL ENVIRON

Table 3-6-15
Fall 2018 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix B1. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B1 (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix B1. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2018 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix B1.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C. By fall 2018, Ramboll Environ assumed that the 10 oldest buses in the Marguerite fleet were converted from diesel-powered to electric-powered. These calculations are shown in Appendix C.
11. By fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles.
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC - Emissions Factors
FTE - Full time equivalent
g - gram
GHG - greenhouse gas
hp - horsepower
hr - hour
mi - miles
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - To be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-6-16
Fall 2020 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[12]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	185		55,470		404,378	291	67		125
	Graduate	679		282,616		2,585,933				791
	Post-doc	589		261,730		2,481,198				757
	Faculty/Staff	5,682		2,522,720		28,678,561				8,687
	Casual Employees	314		139,563		1,868,744				563
	Contingent Employees	306		135,808		1,663,642				502
	Temporary Employees	629		279,355		3,564,566				1,075
	Non-Employee Affiliates: 20% FTEs	176		78,281		929,974				281
	Non-Employee Affiliates: FTEs	964		428,097		5,085,797				1,538
	Third Party Contractors	263		116,833		1,660,191				499
	Janitorial Shift Workers	210		93,394		1,327,128				399
	First Mile to Transit (all Workers + Students)	2,099		931,213		3,837,094				1242
	Construction	975		432,713		6,148,856				1,848
	Sub-Total	**13,073**		**5,757,792**		**60,236,063**				**18,307**
On-Campus (Resident) Trips[3]	Undergraduate	1,654		2,028,810		7,869,489	291	67		2,564
	Graduate	5,303		7,647,500		40,031,490				12,682
	Post-doc	28		33,580		168,975				54
	Faculty/Staff	98		94,698		619,941				193
	Sub-Total	**7,084**		**9,804,588**		**48,689,895**				**15,492**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	296	69		965
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	266			24
	Bonair on-road buses diesel	10	1.1	3,871	7.3	28,261	1,769		2,249	58
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	296	69		96
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	588		161	1428
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	266			47
	Marguerite[10]	66				2,144,233				2,883
	Public Safety	31	2.8	31,879	7.3	232,720	296	69		71
	Sub-Total	**700**		**588,428**		**8,565,520**				**5,573**
Other Trips[3]	General Visitors (Vendor)	2,177,501	2.0	4,355,001		27,001,599	291	67		8,446
	Worker Non-Commute Trips			326,074		1,010,828				316
	Non-event Visitor Trips - Passenger	61,835	2.0	147,705		3,130,985				921
	Non-event Visitor Trips - Buses	5,250	2.0	11,074		390,000	1,769		2,249	702
	Event Visitor Traffic	67,085	2.0	301,862		6,695,507	291	67		1,989
	Deliveries - Trucks	181,499	2.0	362,997		2,250,579	588		161	1,354
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*				*37*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20*	*159,740*				*95*
	Sub-Total	**2,493,169**		**5,504,713**		**40,479,498**				**13,728**
Campus Vehicles - Off-road Equip[5]						[bhp-hr/yr][9]	[g/bhp-hr][7]			
	Siebel and Red Barn equip - gas					38,837	859			33
	Siebel and Red Barn equip - diesel					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**53,336**

RAMBOLL ENVIRON

Table 3-6-16
Fall 2020 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix B2. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B2 (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix B2. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2020 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix B2.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites is adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C. By fall 2018, Ramboll Environ assumed that the 10 oldest buses in the Marguerite fleet were converted from diesel-powered to electric-powered. These calculations are shown in Appendix C.
11. By fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles compared to 2015.
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC - Emissions Factors
FTE - Full time equivalent
g - gram
GHG - greenhouse gas
hp - horsepower
hr - hour
mi - miles
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - To be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-6-17
Fall 2035 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[12]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	185		55,470		404,378	201	47		87
	Graduate	764		317,833		2,908,174				615
	Post-doc	828		367,634		3,485,170				736
	Faculty/Staff	7,220		3,205,524		35,698,523				7,489
	Casual Employees	398		176,826		2,367,699				493
	Contingent Employees	388		172,068		2,107,835				441
	Temporary Employees	797		353,942		4,516,305				943
	Non-Employee Affiliates: 20% FTEs	223		99,182		1,178,277				247
	Non-Employee Affiliates: FTEs	1,222		542,399		6,443,705				1,348
	Third Party Contractors	321		142,671		2,027,352				422
	Janitorial Shift Workers	257		114,049		1,620,630				337
	First Mile to Transit (all Workers + Students)	2,654		1,177,343		4,853,984				1088
	Construction	975		432,713		6,148,856				1,279
	Sub-Total	**16,231**		**7,157,654**		**73,760,888**				**15,524**
On-Campus (Resident) Trips[3]	Undergraduate	2,079		2,550,030		9,891,078	201	47		2,231
	Graduate	5,974		8,613,822		45,087,773				9,888
	Post-doc	28		33,580		168,975				37
	Faculty/Staff	1,511		1,463,463		9,574,762				2,065
	Sub-Total	**9,592**		**12,660,895**		**64,722,587**				**14,222**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	221	52		360
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	204			9
	Bonair on-road buses diesel[11]	10	1.1	3,871	7.3	28,261	1,600		2,231	27
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	221	52		36
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	550		152	668
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	204			18
	Marguerite[10]	66				2,618,108				0
	Public Safety	31	2.8	31,879	7.3	232,720	221	52		53
	Sub-Total	**700**		**588,428**		**9,039,395**				**1,170**
Other Trips[3]	General Visitors (Vendor)	2,656,551	2.0	5,313,101		32,968,952	201	47		7,138
	Worker Non-Commute Trips			397,810		1,234,221				267
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		3,675,599				747
	Non-event Visitor Trips - Buses[11]	5,250	2.0	10,500		390,000	1,600		2,231	636
	Event Visitor Traffic	67,085	2.0	299,917		6,980,045	201	47		1,433
	Deliveries - Trucks[11]	221,428	2.0	442,856		2,747,957	550		152	1,546
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*				*35*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20*	*159,740*				*88*
	Sub-Total	**3,012,148**		**6,604,231**		**47,996,774**				**11,767**
Campus Vehicles - Off-road Equip[5]						**[bhp-hr/yr][6,9]**	**[g/bhp-hr][7]**			
	Siebel and Red Barn equip - gas					38,837	859			33
	Siebel and Red Barn equip - diesel					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**42,919**

RAMBOLL ENVIRON

Table 3-6-17
Fall 2035 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix C. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix C (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix C. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2035 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix C.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the Fall 2020 inventory was estimated to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2020 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are scaled down assuming only 30% non-electric vehicles contribute to emissions in 2035 versus 60% in 2020. Additionally, Stanford expects the entire Marguerite fleet to be electric by 2035. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford and is assumed to remain constant from 2015 to 2035. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption. Emission factors are shown in Mobile Appendix C.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite buses are assumed to all be electric by 2035. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles. By 2035, 70% of the Bonair fleet is assumed to be electric, in comparison to a 40% electric fleet in 2018.
11. Since EMFAC2014 does not incorporate the GHG benefits of the NHTSA Phase 2 regulation (adopted in August 2016), emissions for medium- and heavy-duty vehicles are overestimated for the 2035 operational year. USEPA. Available at: https://www3.epa.gov/otaq/climate/documents/420f16044.pdf
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC - Emissions Factors
FTE - Full time equivalent
g - gram
GHG - greenhouse gas
hp - horsepower
hr - hour
mi - miles
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - To be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-6-18
2014 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2014 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-14	755	8.3	470.7	2.9
S-15	1,490	8	470.7	5.6
S-16	73	7.2	470.7	0.25
S-17	300	20.5	470.7	2.9
S-18	135	7.2	470.7	0.46
S-21	465	21.7	470.7	4.7
S-23	465	11.1	470.7	2.4
S-25	587	0	470.7	0
S-28	900	7.1	470.7	3.0
S-30	166	7.2	470.7	0.56
S-31	166	9.1	470.7	0.71
S-32	390	7.6	470.7	1.4
S-33	1,008	16.2	470.7	7.7
S-34	605	10	470.7	2.8
S-35	170	13.2	470.7	1.1
S-37	207	11	470.7	1.1
S-38	380	7.9	470.7	1.4
S-39	210	6.9	470.7	0.68
S-46	79	8.4	470.7	0.31
S-47	207	6.6	470.7	0.64
S-52	102	2	470.7	0.10
S-56	60	5.6	470.7	0.16
S-57	218	5.1	470.7	0.52
S-58	504	6.1	470.7	1.4
S-59	135	6.1	470.7	0.39
S-60	317	6	470.7	0.90
S-61	300	70.2	470.7	9.9
S-62	300	6	470.7	0.85
S-63	300	8.7	470.7	1.2
S-65	672	7.4	470.7	2.3
S-67	1,008	7.3	470.7	3.5
S-68	1,848	7.8	470.7	6.8
S-71	270	23.8	470.7	3.0
S-72	380	6.7	470.7	1.2
S-73	900	7.8	470.7	3.3
S-74	102	7.9	470.7	0.38
S-75	102	6.7	470.7	0.32
S-76	317	15.3	470.7	2.3
S-77	755	8.8	470.7	3.1
S-78	2,220	5.5	470.7	5.7
S-79	470	6.8	470.7	1.5
S-80	2,220	7.8	470.7	8.2
S-81	230	10.6	470.7	1.1

Table 3-6-18
2014 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2014 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-82	317	6.9	470.7	1.0
S-83	755	9.3	470.7	3.3
S-84	317	8.1	470.7	1.2
S-88	395	6.7	470.7	1.2
S-89	317	7.2	470.7	1.1
S-91	395	6.2	470.7	1.2
S-92	750	8.2	470.7	2.9
S-93	325	8.2	470.7	1.3
S-94	277	15.1	470.7	2.0
S-95	750	6.3	470.7	2.2
S-96	325	10.1	470.7	1.5
S-97	1,175	9.5	470.7	5.3
S-98	1,523	8.5	470.7	6.1
S-99	1,523	8	470.7	5.7
S-100	2,220	15.8	470.7	16.5
S-102	207	8.3	470.7	0.81
S-105	1,490	9.3	470.7	6.5
S-106	755	9.2	470.7	3.3
S-110	364	9.4	470.7	1.6
S-111	145	28.3	470.7	1.9
S-112	2,220	10.2	470.7	10.7
S-113	398	8.5	470.7	1.6
S-115	130	7.8	470.7	0.48
S-116	364	11	470.7	1.9
S-44	170	6.7	470.7	0.54
S-66	166	6.5	470.7	0.51
S-70	102	6.8	470.7	0.33
S-107	755	7.8	470.7	2.8
S-108	755	7.4	470.7	2.6
S-109	755	6.9	470.7	2.5
None	100	5.9	470.7	0.28
S-114	1,214	7.2	470.7	4.1
S-11	1,807	11	470.7	9.4
S-12	1,186	66	470.7	36.8
S-13	1,186	11	470.7	6.1
S-53	250	12	470.7	1.4
S-69	1,680	12.2	470.7	9.6
S-90	102	7.9	470.7	0.38
S-101	480	12.5	470.7	2.8
S-104	2,206	15.7	470.7	16.3
S-117	274	14.4	470.7	1.9
S-124	2,206	0	470.7	0.0
None	50	6.6	470.7	0.16

Table 3-6-18
2014 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2014 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
None	50	9.3	470.7	0.22
None	50	10.3	470.7	0.24
S-112	50	10.2	470.7	0.24
			Subtotal	**279**

Notes:

1. List of campus-wide emergency generators along with their BAAQMD ID, year, and engine rating was provided by Stanford. There are three generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.
2. Based on actual non-emergency and emergency run hours in 2014.
3. A representative GHG emission factor (in g/hp-hr) was derived for emergency generators because fuel consumption rate information was not available for all units. The emission factor was derived by taking the emission factor for diesel fuel (22.6 lb/gal), converting to grams, and normalizing by a fuel rate (34.7 gal/hr) and horsepower (755 HP) of a representative engine (Cummins, QSX15-G9 NR 2, @ 1800 RPM). The GHG CO_2e emission factor in lb/gal for diesel fuel was obtained from the CO_2, CH_4 and N_2O emission factors found in 40 CFR Part 98 Mandatory Greenhouse Gas Reporting Tables C-1 and C-2. Note that according to the Regulation, diesel fuel is defined as distillate fuel oil in Table C-1 and petroleum in Table C-2. Global warming potentials are from IPCC Fourth Assessment Report.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
bhp - brake horsepower
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
g - gram
gal - gallon
GHG - Greenhouse gas
hp - horsepower
hr - hour
ID - identification
MT - metric tons
N_2O - nitrous oxide
RPM - revolutions per minute
yr - year

References:

Cummins Specification Sheet. QSX15-G9 NR 2, @ 1800 RPM, 755 HP
CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

Table 3-6-19
2015, Fall 2018, Fall 2020, and Fall 2035 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2015 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-14	755	10.1	470.7	3.6
S-15	1,490	7.9	470.7	5.5
S-16	73	8.7	470.7	0.3
S-17	300	65.9	470.7	9.3
S-18	135	7.3	470.7	0.5
S-21	465	13	470.7	2.8
S-23	465	14.4	470.7	3.2
S-28	900	8.5	470.7	3.6
S-30	166	7.4	470.7	0.6
S-31	166	10.2	470.7	0.8
S-32	390	8	470.7	1.5
S-33	1,008	8.3	470.7	3.9
S-34	605	46.1	470.7	13.1
S-35	170	7.3	470.7	0.6
S-37	207	11.6	470.7	1.1
S-38	380	8.5	470.7	1.5
S-39	210	8.1	470.7	0.8
S-46	79	7.8	470.7	0.3
S-47	207	8	470.7	0.8
S-56	60	6.5	470.7	0.2
S-57	218	6.5	470.7	0.7
S-58	504	6.5	470.7	1.5
S-59	135	7	470.7	0.4
S-60	317	6.5	470.7	1.0
S-61	300	6.5	470.7	0.9
S-62	300	6.5	470.7	0.9
S-63	300	7	470.7	1.0
S-65	672	8.1	470.7	2.6
S-67	1,008	6.8	470.7	3.2
S-68	1,848	9.9	470.7	8.6
S-71	270	7.7	470.7	1.0
S-72	380	7.5	470.7	1.3
S-73	900	7.9	470.7	3.3
S-74	102	7.9	470.7	0.4
S-75	102	8.1	470.7	0.4
S-76	317	7.8	470.7	1.2
S-77	755	8	470.7	2.8
S-78	2,220	12.3	470.7	12.9

Table 3-6-19
2015, 2018, Fall 2020, and Fall 2035 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2015 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-79	470	6.5	470.7	1.4
S-80	2,220	12.7	470.7	13.3
S-81	230	11.5	470.7	1.2
S-82	317	8.1	470.7	1.2
S-83	755	8.7	470.7	3.1
S-84	317	7.5	470.7	1.1
S-88	395	7.8	470.7	1.5
S-91	395	8.5	470.7	1.6
S-92	750	9.1	470.7	3.2
S-93	325	8.1	470.7	1.2
S-94	277	9.1	470.7	1.2
S-95	750	6.7	470.7	2.4
S-96	325	8.5	470.7	1.3
S-97	1,175	7.9	470.7	4.4
S-98	1,523	8.5	470.7	6.1
S-99	1,523	8.7	470.7	6.2
S-100	2,220	10.5	470.7	11.0
S-102	207	2.2	470.7	0.2
S-105	1,490	12.3	470.7	8.6
S-106	755	12.6	470.7	4.5
S-110	364	8.9	470.7	1.5
S-111	145	8.2	470.7	0.6
S-112	2,220	8.3	470.7	8.7
S-113	398	10.3	470.7	1.9
S-115	130	11.2	470.7	0.7
S-116	364	10.5	470.7	1.8
S-124	2,206	9	470.7	9.3
S-125	464	7.1	470.7	1.6
S-44	170	6.7	470.7	0.5
S-66	166	6.8	470.7	0.5
S-70	102	6.8	470.7	0.3
S-107	755	7.7	470.7	2.7
S-108	755	7.9	470.7	2.8
S-109	755	7.5	470.7	2.7
None	100	6.5	470.7	0.3
S-114	1,214	8.5	470.7	4.9
S-11	1,807	14	470.7	11.9

Table 3-6-19
2015, 2018, Fall 2020, and Fall 2035 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2015 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-12	1,186	41	470.7	22.9
S-13	1,186	13	470.7	7.3
S-53	250	13	470.7	1.5
S-69	1,680	12.6	470.7	10.0
S-90	102	34	470.7	1.6
S-101	480	13.6	470.7	3.1
S-104	2,206	41.6	470.7	43.2
S-117	274	10.9	470.7	1.4
None	50	10.2	470.7	0.2
None	50	8.4	470.7	0.2
None	50	3.6	470.7	0.1
None	50	2.2	470.7	0.1
S-122	755	5.8	470.7	2.1
S-123	2,922	11.9	470.7	16.4
S-121	145	5.4	470.7	0.4
			Total for 2015	**336**
			Scaling Factor for Fall 2018/2020[2]	8%
			Total for Fall 2018/2020	**363**
			Scaling Factor for Fall 2035[2]	22%
			Total for Fall 2035	**444**

Notes:

1. List of campus-wide emergency generators along with their BAAQMD ID, year, and engine rating was provided by Stanford for 2015. There are four generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.

2. 2015 is based on actual non-emergency and emergency run hours in 2015. For Fall 2018 and Fall 2020, it is assumed that the number of generators will increase proportional to the increase in academic square footage (8%); however, since the size and type of generator is unknown, Ramboll Environ assumed an 8% increase in total emissions. This same methodology was used to represent the increase in academic square footage from Fall 2020 to the buildout of the 2018 GUP (an additional 22% increase).

3. A representative GHG emission factor (in g/hp-hr) was derived for emergency generators because fuel consumption rate information was not available for all units. The emission factor was derived by taking the emission factor for diesel fuel (22.6 lb/gal), converting to grams, and normalizing by a fuel rate (34.7 gal/hr) and horsepower (755 HP) of a representative engine (Cummins, QSX15-G9 NR 2, @ 1800 RPM). The GHG CO_2e emission factor in lb/gal for diesel fuel was obtained from the CO_2, CH_4 and N_2O emission factors found in 40 CFR Part 98 Mandatory Greenhouse Gas Reporting Tables C-1 and C-2. Note that according to the Regulation, diesel fuel is defined as distillate fuel oil in Table C-1 and petroleum in Table C-2. Global warming potentials are from IPCC Fourth Assessment Report.

Table 3-6-19
2015, 2018, Fall 2020, and Fall 2035 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2015 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
bhp - brake horsepower
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
g - gram
gal - gallon
GHG - greenhouse gas
hp - horsepower
hr - hour
ID - identification
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
N_2O - nitrous oxide
RPM - revolutions per minute
yr - year

References:

Cummins Specification Sheet. QSX15-G9 NR 2, @ 1800 RPM, 755 HP
Code of Federal Regulations. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

Table 3-6-20
2014 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	Amount of Waste Disposed[1]	Diversion Rate[1]	Amount of Waste Sent to Landfill	Collection Efficiency[2]	Destruction Efficiency[2]	Oxidation efficiency of CH_4[2]	Generation Fraction[3]	Amount emitted[4,5]	GWP[6]	CO_2e
	[Ton/year]	[%]	[Ton/year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	22,455	65%	8,343	75%	98%	10%	0.05	81	25	2,023
CO_2							0.13	1,632	1	1,632
Total										**3,655**

Notes

1. Waste disposal and diversion rates for 2014 from Stanford Recycling and Peninsula Sanitary Service, Inc. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided for 2015 and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.

   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 65%, solve for amount diverted and add amount sent to landfill

2. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® defaults for a landfill with LFG collection.

3. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.

4. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)

5. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))

6. GWP from IPCC 4th report (2.10.2)

Abbreviations

CalEEMod® - California Emissions Estimator Model
CH_4 - Methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - general use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

Table 3-6-21
2015 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	Amount of Waste Disposed[1]	Diversion Rate[1]	Amount of Waste Sent to Landfill	Collection Efficiency[2]	Destruction Efficiency[2]	Oxidation efficiency of methane[2]	Generation Fraction[3]	Amount emitted[4,5]	GWP[6]	CO_2e
	[Ton/year]	[%]	[Ton/year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	23,528	66%	8,106	75%	98%	10%	0.05	83	25	2,087
CO_2							0.13	1,683	1	1,683
Total										**3,770**

Notes:

1. Campus waste disposal and diversion rates for 2015 from Stanford Recycling and Peninsula Sanitary Service, Inc. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.

   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 66%, solve for amount diverted and add amount sent to landfill

2. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® 2013.2.2 defaults for a landfill with LFG collection.

3. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.

4. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)

5. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))

6. GWP from IPCC 4th report

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - general use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

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Table 3-6-22
Fall 2018 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	2015 Amount of Waste Disposed[1]	Scaling for Fall 2018[2]	Fall 2018 Amount of Waste Disposed	Diversion Rate[1,2]	Amount of Waste Sent to Landfill	Collection Efficiency[3]	Destruction Efficiency[3]	Oxidation efficiency of methane[3]	Generation Fraction[4]	Amount emitted[5,6]	GWP[7]	CO_2e
	[Ton/Year]	[%]	[Ton/Year]	[%]	[Ton/Year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	23,528	8%	25,430	66%	8,761	75%	98%	10%	0.05	90	25	2,255
CO_2									0.13	1,819	1	1,819
											Total	**4,075**

Notes:

1. Waste disposal and diversion rates for 2015 from Stanford as shown in **Table 3-6-21**. Campus waste disposal and diversion rates for 2015 from Stanford Recycling and Peninsula Sanitary Service, Inc. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.
   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 66%, solve for amount diverted and add amount sent to landfill
2. The solid waste disposal data from Stanford gives one total for the entire campus, including faculty/staff housing, student housing, and academic buildings. Scaling for Fall 2018 is based on the increase in academic square footage expected from December 2015 to full buildout of the 2000 GUP. Waste disposal is assumed to scale linearly; i.e., disposal rates in new buildings is assumed equal to current buildings. The diversion rate is assumed to remain constant from 2015.
3. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® 2013.2.2 defaults for a landfill with LFG collection.
4. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.
5. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)
6. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))
7. GWP from IPCC 4th report

Abbreviations:

CalEEMod® - California Emission Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - General use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

Table 3-6-23
Fall 2020 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	Fall 2018 Amount of Waste Disposed[1]	Increase for Fall 2020[2]	Fall 2020 Amount of Waste Disposed	Diversion Rate[1,2]	Amount of Waste Sent to Landfill	Collection Efficiency[3]	Destruction Efficiency[3]	Oxidation efficiency of methane[3]	Generation Fraction[4]	Amount emitted[5,6]	GWP[7]	CO_2e
	[Ton/Year]	[Ton/Year]	[Ton/Year]	[%]	[Ton/Year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	25,430	591	26,021	66%	8,964	75%	98%	10%	0.05	92	25	2,308
CO_2									0.13	1,862	1	1,862
											Total	**4,169**

Notes:

1. Waste disposal and diversion rates for Fall 2018 is shown in **Table 3-6-22**.
   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 66%, solve for amount diverted and add amount sent to landfill
2. The solid waste disposal data from Stanford gives one total for the entire campus, including faculty/staff housing, student housing, and academic buildings. The total Fall 2020 solid waste disposal adds estimated waste from the Escondido Village graduate residences. The annual solid waste disposal is based on the CalEEMod® version 2013.2.2 default for mid rise apartments from Appendix D Table 10.1, shown below.

Disposal Rate (ton/size/year)	Number of Dwelling Units	Total waste (ton/year)
0.46	1,284	590.64

3. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® 2013.2.2 defaults for a landfill with LFG collection.
4. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.
5. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)
6. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))
7. GWP from IPCC 4th report

Abbreviations:

CalEEMod® - California Emission Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - General use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

Table 3-6-24
Fall 2035 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	Fall 2020 Amount of Waste Disposed[1]	Campus Scaling for Fall 2035[2]	Waste for new Faculty/Staff Houses[2]	Fall 2035 Amount of Waste Disposed	Diversion Rate[1,2]	Amount of Waste Sent to Landfill	Collection Efficiency[3]	Destruction Efficiency[3]	Oxidation efficiency of methane[3]	Generation Fraction[4]	Amount emitted[5,6]	GWP[7]	CO_2e
	[Ton/Year]	[%]	[Ton/Year]	[Ton/Year]	[%]	[Ton/Year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	26,021	22%	1,216	32,992	66%	11,366	75%	98%	10%	0.05	117	25	2,926
CO_2										0.13	2,360	1	2,360
												Total	**5,286**

Notes:

1. Waste disposal and diversion rates for Fall 2020 from Stanford as shown in **Table 3-6-23**. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.
   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 66%, solve for amount diverted and add amount sent to landfill
2. The solid waste disposal data from Stanford gives one total for the entire campus, including faculty/staff housing, student housing, and academic buildings. Scaling for Fall 2035 is based on the increase in academic square footage expected from Fall 2020 to full buildout of the 2018 GUP. Waste disposal for the 550 new faculty/staff houses is estimated based on 2015, with the waste per house (before diversion) calculated as 2.21 tons per year per house; therefore, 550 houses x 2.21 tons/house is added to the amount of waste disposed. Waste disposal is assumed to scale linearly; i.e., disposal rates in new buildings is assumed equal to current buildings. The diversion rate is assumed to remain constant from 2015.
3. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® 2013.2.2 defaults for a landfill with LFG collection.
4. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.
5. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)
6. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))
7. GWP from IPCC 4th report

Abbreviations:

CalEEMod® - California Emission Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - General use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

Table 3-6-25
2014 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Total Water Use Rate[1]	Water Use Rate, Study Area[1]	Electricity Intensity[2]					Electricity Emission Factor[3]	CO_2e Emission Factor	GHG Emissions
			Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[Mgal/yr]	[kWh/Mgal]					[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	738	626	2,117	111	1,272	--	3,500	0.437	0.695	435
Wastewater Treatment[4]	428	363	--	-	--	1,911	1,911		0.379	138
									Total Indirect Emissions:	**572**

Direct Emissions Associated with Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**494**	**MT CO_2e/yr**

Notes:

1. Stanford water use provided by the Stanford Sustainability and Energy Management Department. Emissions associated with electricity used to pump lake water are assumed to be captured under campus electricity GHG emissions. Total water use is initially overestimated for purpose of this inventory because the water usage includes water from all of the faculty/staff housing within the Academic Growth Boundary, even though 899 of these units are not within the study area. The water use from these units was estimated and removed from the total based on the April 2017 Water Supply Assessment (WSA) actual water use rates for FY2015-16 (WSA Table 2-4). Total water use from the 937 faculty/staff houses was 0.32 million gallons per day; water per house was thus 342 gallons per day. Water use for the 38 Searsville/Olmstead houses within the study area was retained, while water from the other 899 faculty/staff houses was removed. Wastewater was scaled proportionally since wastewater generation is proportional to indoor water use.
2. Energy intensities for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
3. Electricity emission factor for PGE.
4. Sewer water use rate taken from monthly sewer water data for 2014. This includes average daily indoor metered water use for Escondido Village (EVII Barnes and Abrams; EVII Units 56-69) and Stanford's Childcare Center, which do not have separate sewer water meters. December sewer water was calculated as the average of January through November monthly sewer use.
5. Emissions are calculated based on the CalEEMod® version 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
kWh - kilowatt hour
lb - pound
Mgal - million gallons
MT - metric tons
PGE - Pacific Gas & Electric
yr - year

Table 3-6-26
2015 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Total Water Use Rate[1]	Water Use Rate, Study Area[1]	Electricity Intensity[2]					Electricity Emission Factor[3]	CO_2e Emission Factor	GHG Emissions
			Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[Mgal/yr]	[kWh/Mgal]					[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	583	471	2,117	111	1,272	--	3,500	0.437	0.695	327
Wastewater Treatment[4]	404	327	--	-	--	1,911	1,911		0.379	124
									Total Indirect Water Emissions	**451**

Direct Emissions Associated with Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**445**	**MT CO_2e/yr**

Notes:

1. Stanford water use provided by the Stanford Sustainability and Energy Management Department. Emissions associated with electricity used to pump lake water are assumed to be captured under campus electricity GHG emissions. Total water use is overestimated for purposes of this inventory because the water usage includes water from all of the faculty/staff housing within the Academic Growth Boundary, even though 899 of these units are not within the study area. The water use from these units was estimated and removed from the total based on the April 2017 Water Supply Assessment (WSA) actual water use rates for FY2015-16 (WSA Table 2-4). Total water use from the 937 faculty/staff houses was 0.32 million gallons per day; water per house was thus 342 gallons per day. Water use for the 38 Searsville/Olmstead houses within the study area was retained, while water from the other 899 faculty/staff houses was removed. Wastewater was scaled proportionally since wastewater generation is proportional to indoor water use.
2. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
3. Electricity emission factor for PGE.
4. Sewer water use rate taken from monthly sewer water data for 2015. This includes average daily indoor metered water use for Escondido Village (EVII Barnes and Abrams; EVII Units 56-69) and Stanford's Childcare Center, which do not have separate sewer water meters.
5. Emissions are calculated based on the CalEEMod® version 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt hour
lb - pound
Mgal - million gallons
MT - metric tons
PGE - Pacific Gas & Electric
yr - year

Table 3-6-27
Fall 2018 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	2015 Water Use Rate[1]	Scaling for Fall 2018[2]							Electricity Intensity[3]					Electricity Emission Factor[4]	CO_2e Emission Factor	GHG Emissions
		Undergraduate and Graduate Residences	Use Rate	Academic Buildings Added	Use Rate	Total added	% Increase to Fall 2018	Fall 2018 Total	Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[# Beds Added]	[gal/bed/day]	[sq ft]	[gal/sf/day]	[Mgal/yr]	[%]	[Mgal/yr]						[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	471	416	40.6	769,354	0.072	26.4	6%	497	2,117	111	1,272	--	3,500	0.414	0.657	327
Wastewater Treatment	327	-					6%	345	--	-	--	1,911	1,911		0.359	124
															Total Emissions	**450**

Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**470**	**MT CO_2e/yr**

Notes:

1. 2015 Stanford water use is as shown in **Table 3-6-26**.
2. Scaling for Fall 2018 is based on the increase in student beds and academic square footage from December 2015 to full buildout of the 2000 GUP. Water use rates are from the April 2017 Water Supply Assessment, which were based on pre-drought water use rates. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use. Total water use is lower than the WSA because it does not include the faculty/staff houses outside the Study Area.
3. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
4. Electricity emission factor for PGE as projected for 2018 is shown in **Table 3-5-1.**
5. Emissions are calculated based on the CalEEMod® 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
ft - feet
gal - gallon
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt-hours
lb - pound
Mgal - Million gallons
PGE - Pacific Gas & Electric
sf - square feet
sq - square
yr - year

Table 3-6-28
Fall 2020 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Fall 2018 Water Use Rate[1]	Scaling for Fall 2020[2]							Electricity Intensity[3]					Electricity Emission Factor[4]	CO_2e Emission Factor	GHG Emissions
		Undergraduate and Graduate Residences	Use Rate	Academic Buildings Added	Use Rate	Total added	% Increase to Fall 2020	Fall 2020 Total	Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[# Beds Added]	[gal/bed/day]	[sq ft]	[gal/sf/day]	[Mgal/yr]	[%]	[Mgal/yr]						[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	497	2,020	40.6	0	0.072	29.9	6%	527	2,117	111	1,272	--	3,500	0.402	0.638	336
Wastewater Treatment	345	-					6%	366	--	-	--	1,911	1,911		0.348	127
															Total Emissions	**464**

Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**498**	**MT CO_2e/yr**

Notes:

1. Fall 2018 Stanford water use is as shown in **Table 3-6-26.**
2. Scaling for Fall 2020 is based on the increase in student beds due to the new Escondido Village Graduate Residences. Water use rates are from the April 2017 Water Supply Assessment, which were based on pre-drought water use rates. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use. Total water use is lower than the WSA because it does not include the faculty/staff houses outside the Study Area.
3. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
4. Electricity emission factor projection for PGE in 2020 is shown in **Table 3-5-1.**
5. Emissions are calculated based on the CalEEMod® 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
ft - feet
gal - gallon
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt-hours
lb - pound
Mgal - Million gallons
PGE - Pacific Gas & Electric
sf - square feet
sq - square
yr - year

Table 3-6-29a
Fall 2035 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Fall 2020 Water Use Rate[1]	Scaling for Fall 2035[2]									Electricity Intensity[3]					Electricity Emission Factor[4]	CO_2e Emission Factor	GHG Emissions
		Undergraduate and Graduate Residences	Use Rate	Academic Buildings Added	Use Rate	Faculty and Staff Residences	Use Rate	Total added	% Increase to Fall 2035	Fall 2035 Total[2]	Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[# Beds Added]	[gal/bed/day]	[sq ft]	[gal/sf/day]	[# Units Added]	[gal/unit/day]	[Mgal/yr]	[%]	[Mgal/yr]						[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	527	2,600	40.6	2,275,000	0.072	550	225	143	27%	671	2,117	111	1,272	--	3,500	0.300	0.477	320
Wastewater Treatment	366	--							27%	465	--	-	--	1,911	1,911		0.260	121
Total Indirect Water Emissions																		**441**

Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**633**	**MT CO_2e/yr**

Notes:

1. Fall 2020 Stanford water use is as shown in **Table 3-6-28.**
2. 2035 water use rates are from the April 2017 Water Supply Assessment (WSA), which were based on pre-drought water use rates. The water use rate in Mgal/day is multiplied by 365 days to result in the totals in Mgal/yr. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use. Total water use is lower than the WSA because it does not include the faculty/staff houses outside the Study Area.
3. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
4. The PGE emission factor is based on the achieving 50% RPS in 2030 consistent with SB 350 and SB 32. See **Table 3-5-1** for derivation.
5. Emissions are calculated based on the CalEEMod® version 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A Section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
ft - feet
gal - gallon
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt-hours
lb - pound
Mgal - Million gallons
PGE - Pacific Gas & Electric
sf - square feet
sq - square
yr - year

Table 3-6-29b
Fall 2035 with RPS Projection GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Fall 2035 Water Use Rate[1]	Electricity Intensity[2]					Electricity Emission Factor[3]	CO_2e Emission Factor	GHG Emissions
		Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]						[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	671	2,117	111	1,272	--	3,500	0.256	0.406	272
Wastewater Treatment	465	--	-	--	1,911	1,911		0.222	103
Total Indirect Water Emissions with 2035 RPS Projection									**376**

Wastewater[4]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**633**	**MT CO_2e/yr**

Notes:

1. Fall 2035 Stanford water use is as shown in **Table 3-6-29a.**
2. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
3. The PGE electricity intensity factor is based on a projection of the utility achieving 57.5% RPS in 2035, as shown in **Table 3-5-1.**
4. Emissions are calculated based on the CalEEMod® version 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A Section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
ft - feet
gal - gallon
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt-hours
lb - pound
Mgal - Million gallons
PGE - Pacific Gas & Electric
sf - square feet
sq - square
yr - year

Table 5-1-1
California 2020 GHG Emissions, Population Projections and GHG Service Population Target
Stanford University
Stanford, CA

BAAQMD 2020 Service Population Calculation (Based on the 2008 Scoping Plan)[1]	
Land Use Sectors Greenhouse Gas Emissions Target (metric tons CO_2e/yr)	295,530,000
Population	44,135,923
Employment	20,194,661
California Service Population (Population + Employment)	64,330,584
AB 32 Goal GHG emissions (MT CO_2e/SP/yr)[2]	**4.6**

Notes:

1. Table 6 of May 2011 BAAQMD California Environmental Quality Act Guidelines Update - Proposed CEQA Thresholds of Significance. Bay Area Air Quality Management District (BAAQMD). 2011.
2. This target is based on the IPCC Second Assessment Report Global Warming Potentials (GWP). If updated to the Fourth Assessment Report GWPs, the emissions would increase slightly, but would remain at 4.6 MT CO_2e/SP/yr, due to negligible impacts of the GWPs.

Abbreviations:

AB - Assembly Bill
BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
MT - metric tons
SP - service population
yr - year

Table 5-1-2
California 2030 GHG Emissions, Population Projections and GHG Service Population Target
Stanford University
Stanford, CA

2030 Service Population Calculation (Based on the 2014 First Updated Scoping Plan)[1]	
Original 2020 Limit (MMT CO_2e) (i.e., 1990 level approved in 2007)[2]	427
BAAQMD-used California Land Use Sector Emissions Target Based on Original 2020 Limit (MMT CO_2e/yr)[3]	296
BAAQMD-used Land Use Sector 2020 Emission Target/2020 Emission Limit	69.21%
Updated 2020 Limit (i.e., 1990 level approved in 2014 and most correct) (MMT CO_2e)[2]	431
California Land Use Sector Emissions Target Based on Updated 2020 Limit (MMT CO_2e/yr)	298
Percentage the 2030 GHG Target Emissions Relative to 1990 level[3]	60%
Estimate 10-year employment growth rate (2012 -2022)[4]	14.9%
Estimated 2030 Data[4]	**CY 2030**
Land Use Sectors Greenhouse Gas Emissions Target[4] (MT CO_2e/yr)	178,979,059
Population[6]	44,085,600
Employment[7]	23,205,813
California Service Population (Population + Employment)	67,291,413
AB 32 Goal GHG emissions (MT CO_2e/SP/yr)	**2.7**

Notes:

1. Using AR4 Global Warming Potentials for the 1990 Inventory
2. California 1990 Greenhouse Gas Emissions Level and 2020 Limit. Available at: http://www.arb.ca.gov/cc/inventory/1990level/1990level.htm. Accessed: February 2016.
3. Executive Order B-30-15. Available at: https://www.gov.ca.gov/news.php?id=18938. Accessed: February 2016.
4. California Industry Employment Projections Between 2012-2022. Employment Development Department (EDD), State of California, September 19, 2014. Available at: http://www.labormarketinfo.edd.ca.gov/file/indproj/cal$indnarr.pdf. Accessed: February 2016.
5. California Environmental Quality Act Guidelines Update - Proposed Air Quality CEQA Thresholds of Significance. Bay Area Air Quality Management District (BAAQMD), May 3, 2010. Emissions adjusted by AR4 GWP and reduction target for 2030.
6. Report P-1 (County): State and County Total Population Projections, 2010-2060 (5-year increments). California Department of Finance. Available at: http://www.dof.ca.gov/research/demographic/reports/projections/P-1/documents/P-1_Total_CAProj_2010-2060_5-Year.xls
7. Assume the 10-year employment growth rate between 2020 and 2030 is the same as that of the 2012-2022.

Abbreviations:

AB - Assembly Bill
BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
SP - service population
yr - year

Table 5-1-3
California 2035 GHG Emissions, Population Projections and GHG Service Population Target
Stanford University
Stanford, California

2035 Service Population Calculation (Based on the 2014 First Updated Scoping Plan) [1]	
Original 2020 Limit (MMT CO_2e) (i.e., 1990 level approved in 2007)[2]	427
BAAQMD-used California Land Use Sector Emissions Target Based on Original 2020 Limit (MMT CO_2e/yr)[3]	296
BAAQMD-used Land Use Sector 2020 Emission Target/2020 Emission Limit	69.21%
Updated 2020 Limit (i.e., 1990 level approved in 2014 and most correct) (MMT CO_2e)[2]	431
California Land Use Sector Emissions Target Based on Updated 2020 Limit (MMT CO_2e/yr)	298
Percentage the 2035 GHG Target Emissions Relative to 1990 level[3]	50%
Estimate 10-year employment growth rate (2012 -2022)[4]	14.9%
Estimated 2035 Data[4]	**CY 2035**
Land Use Sectors Greenhouse Gas Emissions Target[4] (MT CO_2e/yr)	149,149,215
Population[6]	45,747,645
Employment[7]	24,875,790
California Service Population (Population + Employment)	70,623,435
AB 32 Goal GHG emissions (MT CO_2e/SP/yr)	**2.1**

Notes:

1. Using AR4 Global Warming Potentials for the 1990 Inventory
2. California 1990 Greenhouse Gas Emissions Level and 2020 Limit. Available at: http://www.arb.ca.gov/cc/inventory/1990level/1990level.htm. Accessed: February 2016.
3. This percentage was calculated for 2035 based on a linear interpolation between the 2030 reduction target of 40% below 1990 levels and 2050 reduction target of 80% below 1990 levels.
4. California Industry Employment Projections Between 2012-2022. Employment Development Department (EDD), State of California, September 19, 2014. Available at: http://www.labormarketinfo.edd.ca.gov/file/indproj/cal$indnarr.pdf
5. California Environmental Quality Act Guidelines Update - Proposed Air Quality CEQA Thresholds of Significance. Bay Area Air Quality Management District (BAAQMD), May 3, 2010. Emissions adjusted by AR4 GWP and reduction target for 2030.
6. Report P-1 (County): State and County Total Population Projections, 2010-2060 (5-year increments). California Department of Finance. Available at: http://www.dof.ca.gov/research/demographic/reports/projections/P-1/documents/P-1_Total_CAProj_2010-2060_5-Year.xls
7. Assume the 10-year employment growth rate between 2025 and 2035 is the same as that of the 2012-2022.

Abbreviations:

AB - Assembly Bill
BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
SP - service population
yr - year

FIGURES

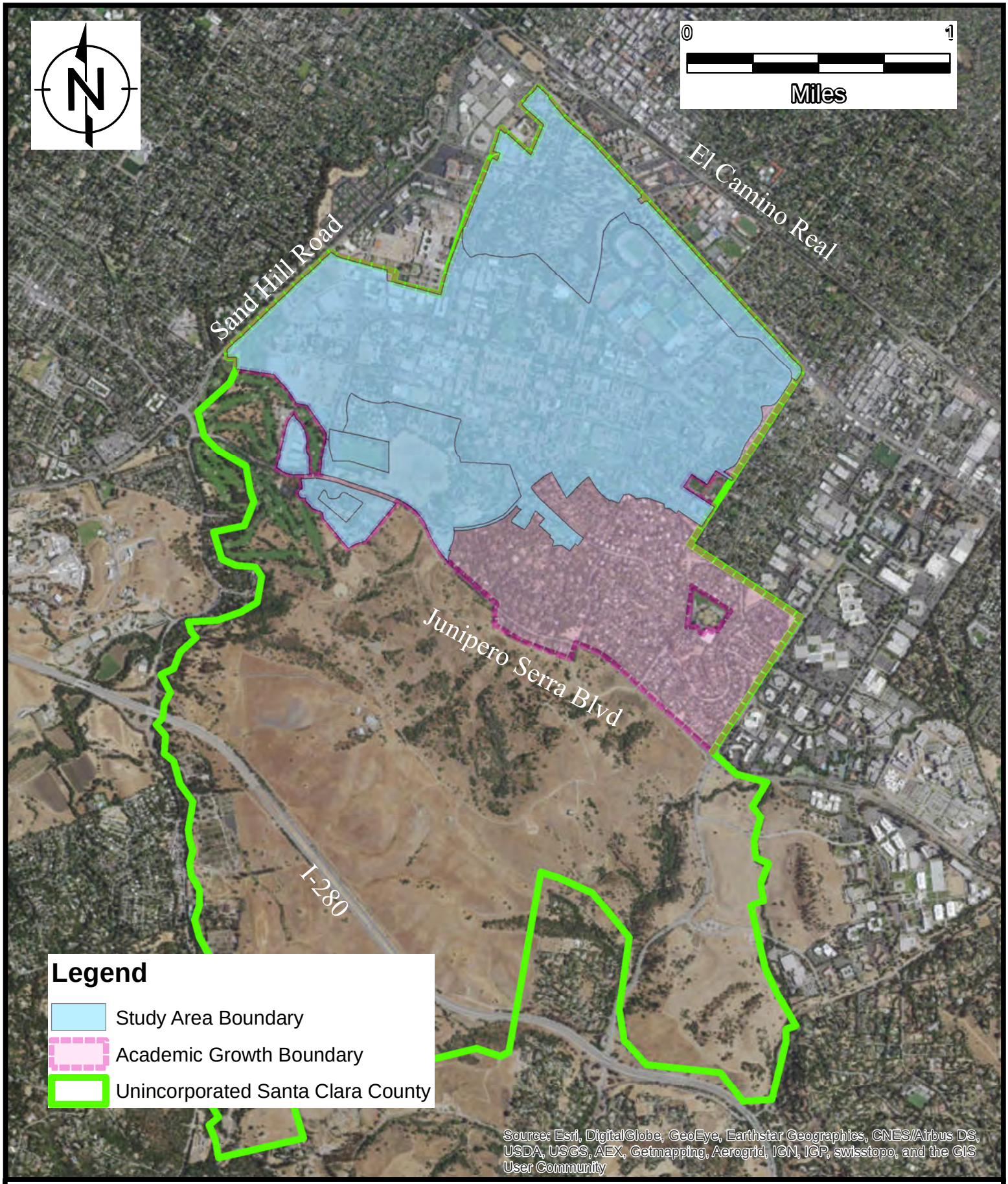

Figure 1-2 Study Area Boundaries
Stanford University
Stanford, CA

RAMBOLL ENVIRON

APPENDIX A
RAMBOLL ENVIRON GHG TECHNICAL APPENDIX

Prepared for
Stanford University
Stanford, California

Prepared by
Ramboll Environ US Corporation
San Francisco, California

Project Number
0338006A

Date
August 2, 2017

APPENDIX A
STANFORD 2018 GENERAL USE PERMIT: GREENHOUSE GAS TECHNICAL REPORT
STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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Figure 1-3-1: 2014 Electricity Account Locations

Figure 1-3-2: 2014 Natural Gas Account Locations

Figure 1-4-1: 2015 Electricity Account Locations

Figure 1-4-2: 2015 Natural Gas Account Locations

ACRONYMS AND ABBREVIATIONS

ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
bhp-hr	Brake Horsepower-Hour
CalEEMod®	California Emissions Estimator Model
CEC	California Energy Commission
CEF	Central Energy Facility
CFR	Code of Federal Regulations
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPUC	California Public Utilities Commission
EMFAC	EMission FACtor Model
GHG	Greenhouse Gas
GUP	General Use Permit
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
hp	Horsepower
IPCC	Intergovernmental Panel on Climate Change
Lb	Pound
LFG	Landfill Gas
Mgal	Million Gallons
MSW	Municipal Solid Waste
MT	Metric Tons
MWh	Megawatt-Hour
N_2O	Nitrous Oxide
OFFROAD	Missions Inventory Program Model
PGE	Pacific Gas & Electric
PSSI	Peninsula Sanitary Service, Inc.
Ramboll Environ	Ramboll Environ US Corporation
SCAQMD	South Coast Air Quality Management District
SESI	Stanford Energy Systems Innovations

sq ft	Square Feet
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
WECC	Western Electricity Coordinating Council
WSA	Water Supply Assessment

1. GHG EMISSIONS INVENTORIES

1.1 Methodology for Calculating Emissions

This section describes the methodology that Ramboll Environ US Corporation (Ramboll Environ) used to develop the existing conditions and Project greenhouse gas (GHG) emission inventories, for construction and operational emissions. GHG operational emissions sources within the study area at Stanford University include: electricity use, natural gas use, mobile sources, emergency generator use, solid waste, and water supply and wastewater. This appendix provides the methodology for inventories developed for four existing conditions analysis years (i.e., 2014, 2015, Fall 2018, and 2020) and Project year (2035). The four existing conditions analysis years were selected based on the changes in operation as noted in Section 1.2.3 of the GHG Report: 2014 represents the actual historic emissions during the year before operation of the Stanford Energy Systems Innovations (SESI) project, 2015 is the year representative of the current operations after the implementation of SESI, Fall 2018 represents the conditions expected to exist prior to commencement of the proposed 2018 General Use Permit, and Fall 2020 represents the conditions that will exist after the occupation of the new Escondido Village Graduate Residences. For the Fall 2018 analysis, it is assumed that the development authorized by the 2000 General Use Permit (GUP) has been permitted and occupied, with the exception of the Escondido Village Graduate Residences. The Fall 2035 ("Project") analysis includes the anticipated construction and operation of the additional academic buildings and residences proposed in the 2018 GUP. The "Fall 2035 With RPS Projection" analysis represents an estimate of Project emissions in Fall 2035 incorporating intensity factors for electricity generation consistent with expected implementation of renewable portfolio standards in 2035.

1.1.1 Units of measurement: Tonnes of CO_2 and CO_2e

As discussed in Section 2 of the report, the term "GHGs" includes gases from fossil fuel use that contribute to the global l greenhouse effect, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs) and chlorofluorocarbons. Water, although a GHG, is not typically evaluated, as water vapor is ubiquitous and typically considered in the context of global feedback loops rather than as an emission from a single project. GHG emissions are typically measured in terms of mass of carbon dioxide equivalent (CO_2e). CO_2e are calculated as the product of the mass of a given GHG and its specific global warming potential (GWP), as described in Section 2.1 of the report.[1] GWPs of 25 and 298, corresponding to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, were used for CH_4 and N_2O, respectively, for this analysis.[2] In many sections of the report, including the final summary sections, emissions are presented in units of CO_2e either because the GWPs of CH_4 and N_2O were accounted for explicitly, or the CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from that particular emissions category.

[1] CalEEMod® 2013.2.2, the primary tool used to develop the emissions inventory uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. The GWPs in the IPCC Fourth Assessment Report of 298 for N_2O and 25 for CH_4 have been manually incorporated to CalEEMod® output.

[2] IPCC Fourth Assessment Report: Climate Change 2007. Available at: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html.

In this report, a tonne refers to a metric ton (MT) (1,000 kilograms). Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

1.1.2 Resources

1.1.2.1 CalEEMod®

Ramboll Environ primarily utilized the methodology from the California Emissions Estimator Model (CalEEMod®) version 2013.2.2[3] to assist in quantifying the GHG emissions in the inventories presented in this report for the Project. CalEEMod® is a statewide program designed to calculate both criteria and GHG emissions from development projects in California. This model was developed under the auspices of the South Coast Air Quality Management District (SCAQMD) and received input from other California air districts, and is currently supported by numerous lead agencies for use in quantifying the emissions associated with development projects undergoing environmental review. CalEEMod® utilizes widely accepted models for emission estimates combined with appropriate default data that can be used if site-specific information is not available.

CalEEMod® provides a platform to calculate annual operational GHG emissions from a land use development project. The model also provides default values for water and energy use. Specifically, the model aids the user in estimating emissions from operational emissions associated with the land use development under evaluation. This includes emissions from on-road mobile vehicle traffic associated with the land uses, emissions from landscaping equipment and other off-road mobile sources, emissions from natural gas usage in the buildings, emissions associated with electricity usage in the buildings and electricity use associated with water usage. This also includes solid waste disposal.

CalEEMod® uses sources such as the USEPA AP-42 emission factors,[4] ARB's approved on-road and off-road equipment emission models such as the EMission FACtor model (EMFAC) and the Emissions Inventory Program model (OFFROAD), and studies commissioned by California agencies such as the California Energy Commission (CEC) and CalRecycle. OFFROAD[5] is an emission factor model used to calculate emission rates from off-road mobile sources (e.g., construction equipment, agricultural equipment). The off-road diesel emission factors used by CalEEMod® are based on the ARB OFFROAD2011 program. EMFAC[6] is an emission factor model used to calculate emissions rates from on-road vehicles (e.g., passenger vehicles). The emission factors used by CalEEMod® are based on the ARB EMFAC2011 program. The California Air Resources Board (ARB) has released an updated EMFAC2014 version that includes various updates, notably the incorporation of the United States Environmental Protection Agency (USEPA) and ARB regulations and standards (e.g., Advanced Clean Cars and the Truck and Bus Rule). To more accurately assess the mobile GHG emission inventories, EMFAC2014 was incorporated into the analysis.

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[3] SCAQMD. 2013. California Emissions Estimator Model®. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

[4] The USEPA maintains a compilation of Air Pollutant Emission Factors and process information for several air pollution source categories. The data is based on source test data, material balance studies, and engineering estimates. Available at: http://epa.gov/ttnchie1/ap42/. Accessed: May 2016.

[5] ARB. 2011. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: September 2016.

[6] ARB. 2011. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: September 2016.

In addition, CalEEMod® contains default values and existing regulation methodologies to use in each specific local air district region. Appropriate statewide default values can be utilized if regional default values are not defined. Ramboll Environ used default factors for Santa Clara County for the GHG emission inventory, unless otherwise noted in the methodology descriptions below.

CalEEMod® 2013.2.2 uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. However, the GWPs in the IPCC Fourth Assessment Report of 298 for N_2O and 25 for CH_4 have been incorporated in these calculations instead, as the Fourth Assessment Report is the basis of the GWPs in the 2016 California GHG inventory.[7] The vast majority of emissions from this Project are CO_2. As a result, small changes in global warming potential for methane and nitrous oxide between the various scientific updates provided by the IPCC have a minimal impact on the overall GHG emissions from the project.

1.1.2.2 Other Resources

Ramboll Environ directly or indirectly relied on emissions estimation guidance from government-sponsored organizations, government-commissioned studies of energy use patterns, Project specific studies, and emission estimation software as described above. In cases noted below, third-party studies were also relied upon to support analyses and assumptions made outside of the approach described above. Where Stanford-specific data were available, it was used preferentially instead of model defaults. The methodology used to calculate this emissions inventory is described in detail in the following sections, including citations to information used in this inventory.

1.1.3 Indirect GHG Emissions from Electricity Use

Indirect GHG emissions, which occur when electricity is used, are typically due to electricity generation from offsite power plant locations. Electrical power is supplied to the Project site by Pacific Gas & Electric (PGE), through the direct access program, and from the on-site Cardinal Cogen Plant (for the 2014 inventory only).

To estimate emissions, the electricity usage is multiplied by the emission intensity factors for the GHGs. Emission intensity factors are GHG emission rates from a given source in terms of the amount of GHG released pounds (lbs) per megawatt hour (MWh) of energy produced.

Stanford purchases “direct access” electricity for a portion of its operations. This program allows for a choice of energy services provider rather than solely purchasing electricity from the utility company.[8] The default intensity for the direct access electricity in the 2014 and 2015 inventories are based on the USEPA eGRID most recent (2014v2) values for the Western Electricity Coordinating Council (WECC) California electricity region for the electricity supplier mix specified by Stanford’s Office of Sustainability for each inventory year.[9] A more specific electricity intensity factor was not available for Stanford’s 2014 direct access provider, Constellation Energy. In addition, the Stanford Office of Sustainability provided the PGE intensity for the commercially supplied PGE electricity. Electricity intensity for the

[7] CARB. 2016. California Greenhouse Gas Emission Inventory – 2016 Edition. Available at: https://www.arb.ca.gov/cc/inventory/data/data.htm. Accessed: September 2016.

[8] PGE. 2016. Electricity – Direct Access. Available at: http://www.pge.com/b2b/retailenergysuppliers/espresourcecenter/directaccessfaqs/. Accessed: July 2016.

[9] USEPA. 2017. eGRID2014v2. Available at: https://www.epa.gov/energy/egrid-2014-summary-tables. Accessed: April 2017

Cardinal Cogen plant was provided by Stanford. Intensity factors for the Fall 2018 campus electricity are adjusted based on Stanford's commitment to operate the Stanford Solar Generating Station that will provide half of campus electricity by renewable sources by 2017;[10] renewable sources are assumed to have an electricity intensity of zero. The electricity intensity factors for the Fall 2018 inventory is based on a linear interpolation to meet the State's requirement for 33 percent renewable power supply by 2020. The 2020 electricity intensity factor is based on the assumption that the State's requirement for 33 percent renewable power supply is met. The electricity intensity factors for Project emissions are based on the assumption the PGE and WECC California achieve the State's SB 350 goal of acquiring 50 percent of energy from renewable sources in 2030.[11] The electricity intensity factor for the Fall 2035 with RPS Projection inventory is derived based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050.[12] The default electricity intensity for CH_4 and N_2O were obtained from CalEEMod® Appendix D value for PGE and were conservatively not adjusted for future inventory years, even though as more renewable energy is integrated into the electricity grid, these intensity factors will also decrease which will cause the total CO_2e intensity factor to decrease.

1.2 Construction Emissions

This section describes the estimation of GHG emissions from construction activities within the study area. Average annual construction and demolition square footage from fiscal year 2001 through fiscal year 2015 were used to estimate the annual emissions from construction and demolition for all existing conditions inventory years and the Project year. The major construction phases included in this analysis are:

- Demolition: involves demolishing/removing existing buildings.
- Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- Paving: involves the laying of concrete or asphalt such as in parking lots or roads.
- Building Construction: involves the construction of structures and buildings.
- Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

GHG emissions from these construction phases are largely attributable to fuel use from off-road construction equipment and vendor vehicles. GHG emissions from construction worker, vendor, and hauling vehicles are already included separately in the mobile emissions section.

[10] Stanford. 2015. Stanford Energy System Innovations. Available at: http://news.stanford.edu/features/2015/sesi/. Accessed: July 2016.

[11] CEC. 2016. Clean Energy & Pollution Reduction Act SB 350 Overview. Available at: http://www.energy.ca.gov/sb350/. Accessed: October 2016.

[12] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

Ramboll Environ used CalEEMod® version 2013.2.2 to quantify the construction emissions. The construction schedule, off-road equipment lists and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 square feet (sq ft),demolition of 50,306 sq ft of buildings per year, and excavation of 62,062 cubic yards (CY) of soil, with the assumption that the annual construction activities occur each year. This annual average is based on the average construction and demolition on the Stanford campus from 2001 to 2015. The excavation quantity is derived by dividing the excavation quantity from a known large Stanford project by the square footage of floor area for that project, then multiplying by the annual average square footage of construction. If this constant annual construction activity is projected forward from Fall 2018 to Fall 2035, the total construction square footage will be similar to the total anticipated in the 2018 GUP. Approximately 200,000 net sq ft per year of construction is proposed in the 2018 GUP, on average. Annual demolition square footage is likely to be lower than in the 2000 GUP because most of the in-fill development under the 2000 GUP has been in the denser core campus, whereas much of the 2018 GUP development would occur as redevelopment at the less dense fringes or on parking lots. Additionally, annual excavation quantities are likely to be lower as the amount calculated and applied as an annual average is derived from a single large project and some future projects may not incorporate much, if any, excavation. Overall, this analysis is likely to be conservative because the total disturbed area (and thus construction emissions) in the 2018 GUP are likely to be lower than in this analysis.

1.2.1 Emissions from Construction Equipment

The emission calculations associated with construction equipment are from off-road equipment engine use based on the equipment list and phase length, and on-road vehicle trips and phase length.

Since the majority of the off-road construction equipment used for construction projects are diesel fueled, CalEEMod® assumes all of the equipment operates on diesel fuel. The calculations associated with this screen include the running exhaust emissions from off-road equipment. Since the equipment is assumed to be diesel, there are no starting emissions associated with the equipment, as these are de minimis for diesel-fueled equipment. CalEEMod® calculates the exhaust emissions based on CARB's OFFROAD2011 methodology using the equation presented below.[13]

$$\text{Emissions}_{\text{Diesel}} = \sum_{i} \left(EF_i \times Pop_i \times AvgHP_i \times Load_i \times Activity_i \right)$$

Where:

EF = Emission factor in grams per horsepower-hour (g/bhp-hr) as processed from OFFROAD2011

Pop = Population, or the number of pieces of equipment

AvgHp = Maximum rated average horsepower

Load = Load factor

Activity = Hours of operation

[13] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

i = equipment type

Ramboll Environ assumes that the majority of construction equipment used by Stanford for these inventories meets final Tier 4 emissions standards.

1.2.1.1 Emissions from On-Road Construction Trips

Construction generates on-road vehicle GHG emissions trucks for soil and material hauling. These emissions are based on the number of trips and vehicle miles traveled (VMT) along with emission factors from EMFAC2011. Emissions associated with on-road worker,vendor, and hauling vehicles are captured separately in the operational mobile category, as these vehicle trips are included in the traffic analysis by Fehr & Peers (see **SB 743 VMT Analysis Appendices B, C,** and **D**).

The emissions from mobile sources were calculated in Excel with the trip rates, trip lengths and emission factors for running from EMFAC2014 as follows:[14]

$$Emissions_{pollutant} = VMT * EF_{running,\ pollutant}$$

Where:

$Emissions_{pollutant}$ = emissions from vehicle running for each pollutant

VMT = vehicle miles traveled

$EF_{running,\ pollutant}$ = emission factor for running emissions

Starting and idling emissions were also calculated in Excel by multiplying the number of trips by the respective emission factor for each pollutant.

1.2.1.2 Total Construction Emissions

The total annual emissions from construction are summarized in **GHG Report Table 3-2-1**. The construction emissions vary slightly based on the existing conditions and Project analysis years (i.e., 2014, 2015, Fall 2018, Fall 2020, and Fall 2035 Project) because the emission factors for the off-road equipment reflect lower GHG emissions over time, per regulation.[15] The Project inventory conservatively uses 2030 vehicle emission factors; if 2035 vehicle emission factors were used instead, it is expected that emissions would decrease. Detailed emission inventories from the CalEEMod® output files are included in **GHG Report Appendix B**.

1.2.2 Vegetation Changes

Permanent vegetation changes that occur as a result of land use development constitute a one-time change in the carbon sequestration capacity of a project site. In this case, no construction is proposed in open space areas, and redevelopment will primarily occur in the core campus and parking lots and will be landscaped with trees. This will result in an overall negligible change in carbon sequestration once the vegetation reaches a steady state (i.e.,

[14] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

[15] Note that CalEEMod® off-road GHG emissions for the Project are higher than all other years, due to limitations of the OFFROAD model, which CalEEMod® relies on. OFFROAD2011, the current OFFROAD model, does not contain emission factors for years later than 2029, therefore for years 2030 and after, emission factors are derived from an older (and less accurate) version of the model (OFFROAD2007). This is an artefact of the calculation method, and does not reflect a true increase in GHG emissions from construction.

new vegetation replaces dying vegetation). Consequently, vegetation change results in a negligible change in GHG emissions.

1.3 Annual Operational Emissions: 2014 Inventory

1.3.1 Electricity

Locations on campus acquire electricity from several providers. These are summarized in **GHG Report Table 3-6-1**.

1.3.1.1 PGE Commercial

Monthly electricity consumption for all PGE commercial addresses associated with Stanford University were provided by the Stanford Office of Sustainability. Prior to the decommissioning of the Cardinal Cogen plant, PGE Commercial electricity was consumed typically by just a few entities within the study area, including a research laboratory and a dormitory. PGE commercial accounts include addresses outside the study area, such as the Redwood City campus and Stanford-owned locations as far away as Livermore and Monterey. All addresses are geocoded using Batchgeo[16] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE commercial accounts within the study area. The locations with commercial PGE accounts in 2014 are shown in **Figure 1-3-1**. The total electricity consumption is the sum of the electricity consumption from each of these addresses.

The resulting energy use (in MWh) is converted to GHG emissions by multiplying the energy usage by the PGE electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2**.

1.3.1.2 PGE, Other Housing

As described in the GHG Technical Report, faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions are included in the study area. These make up a total of 38 single-family homes whose electricity use was not provided by Stanford.

Stanford does not have access to the individual electricity bills of private residents, therefore, default assumptions must be used to estimate electricity usage in these private, on-campus homes. Accordingly, CalEEMod® assumptions are used to calculate the residential energy use, with the assumption that the average faculty/staff unit uses a similar amount of electricity as a single-family home built to 2008 Title 24 standards. Climate Zone 4 is selected based on the CEC forecast climate zone map shown in the CalEEMod® User's Guide.

The resulting energy use (in MWh) is converted to GHG emissions by multiplying the usage by the PGE electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

1.3.1.3 Direct Access

Monthly electricity consumption for all direct access addresses associated with Stanford University were provided. The direct access accounts in 2014 do not include electricity distributed to the campus by the Cardinal Cogeneration plant. Direct access energy is distributed to addresses both inside and outside the study area. All addresses are geocoded

[16] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

using Batchgeo[17] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent direct access accounts within the study area. The locations with direct access accounts are shown in **Figure 1-3-1**. The total electricity consumption is the sum of the electricity consumption from each of these addresses.

The resulting energy use (in MWh) is converted to GHG emissions by multiplying the energy use by the eGRID 2014v2 electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

1.3.1.4 Cardinal Cogen

The Cardinal Cogen plant provided electricity and steam to Stanford through Spring 2015. Total emissions are from natural gas combustion associated with turbine and boiler operation. In addition to distribution throughout campus, a portion of electricity and steam was sold off-campus to PGE and the Stanford Hospital.

Stanford's Office of Sustainability provided the breakdown of energy consumption and emissions by end use for the 2014 inventory. Ramboll Environ uses the emissions by end use to divide the emissions among the following categories:

1. Cogen electrical sales to Stanford Campus and Stanford Central Energy Facility (CEF) (35%)
2. Cogen electrical sales to PGE (18%)
3. Chilled water and steam for campus (34%)
4. Chilled water and steam sold to the hospital (13%)

The Bay Area Air Quality Management District (BAAQMD) provided daily 2014 CO_2, CH_4, and N_2O emissions from the Cardinal Cogen plant in response to a stationary source information request. The fraction of the total emissions associated with electricity sales to the Stanford Campus and Stanford CEF is applied to this BAAQMD emissions inventory. The resulting electricity use quantities are converted to GHG emissions by multiplying the electricity use by the electricity intensity factor provided by Stanford. Consistent with the discussion above, this represents approximately 35% of the total emissions provided by BAAQMD. Emissions are summarized in **GHG Report Table 3-6-2**.

This section of the GUP inventory includes emissions associated with Cardinal Cogen electricity used on campus only. This electricity was distributed throughout the academic buildings, dormitories, and graduate student residences. Emissions associated with the remaining gas combustion and steam generation is discussed in Section 1.3.2. The reason for separating out the Cardinal Cogen into approximate electricity-related versus gas-related emissions is to enable an "apples-to-apples" comparison of campus electricity and gas consumption between existing conditions inventory years.

1.3.1.5 Imported to Campus

Electricity was imported to campus in 2014, such as during downtimes of the Cardinal Cogen. This electricity consumption was provided by Stanford and is converted to GHG emissions by multiplying the usage by the default eGRID electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

[17] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

1.3.1.6 Imported to CEF

Electricity was imported to the CEF in 2014, such as during downtimes of the Cardinal Cogen. This electricity consumption was provided by Stanford and is converted to GHG emissions by multiplying by the default eGRID electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

1.3.1.7 Commercial Non-Stanford

A subset of accounts that lease space on Stanford's campus used electricity from the Cardinal Cogen in 2014. Stanford provided the electricity consumption from these accounts, which include entities such as the Carnegie Institute and the US Post Office. Since these energy consumers are within the study area, emissions from their electricity usage was included in the overall existing conditions inventory. Stanford does not anticipate that there are other large commercial consumers who are not otherwise captured under the campus, PGE, or direct access accounts. The electricity use (in MWh) are converted to GHG emissions by multiplying the usage by the Cardinal Cogen electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

1.3.1.8 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-2.**

1.3.2 Natural Gas

1.3.2.1 PGE Residential

Monthly natural gas consumption for all PGE residential addresses associated with Stanford University were provided. This includes addresses outside the study area, such as the Redwood City campus and Stanford-owned accounts as far away as Livermore and Monterey. It does not include private staff/faculty residences in the Searsville Block and Olmsted Staff Rental subdivisions located within the study area. All addresses are geocoded using Batchgeo[18] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE residential accounts within the study area, mainly concentrated in Escondido Village. The locations with residential PGE accounts is shown in **Figure 1-3-2**. The total gas consumption is the sum of the gas consumption from each of these addresses.

The resulting energy use (in therms) are converted to GHG emissions. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors (on a per therm basis) presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 Code of Federal Regulations [CFR] 98). Emissions are summarized in **GHG Report Table 3-6-7.**

1.3.2.2 PGE Commercial

Monthly natural gas consumption for all PGE commercial addresses associated with Stanford University were provided. PGE commercial accounts include addresses outside the study area, such as the Redwood City campus and Stanford-owned accounts as far away as Livermore and Monterey. All addresses are geocoded using Batchgeo[19] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE commercial accounts within the study area. The locations with commercial

[18] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

[19] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

PGE accounts are shown in **Figure 1-3-2.** The total gas consumption is the sum of the gas consumption from each of these addresses.

The resulting energy use (in therms) are converted to GHG emissions. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors (on a per therm basis) presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). Emissions are summarized in **GHG Report Table 3-6-7.**

1.3.2.3 PGE Other Housing

Natural gas consumption and emissions from the private faculty/staff housing, Searsville Block and Olmsted Staff Rental subdivisions, included in the study area are estimated using CalEEMod® default assumptions. Similar to that described in section 1.3.1.2, CalEEMod® can be used to estimate GHGs from buildings from natural gas use. CalEEMod® defaults are used to calculate the private residential energy use, with the assumption that the average faculty/staff unit uses a similar amount of natural gas as a single-family home built to 2008 Title 24 standards in Santa Clara County.

The resulting energy use (in therms) are converted to GHG emissions. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors on a per therm basis presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). Emissions are summarized in **GHG Report Table 3-6-7.**

1.3.2.4 Cardinal Cogen

As described in Section 3.2.1.3, the Cardinal Cogen plant emitted GHGs through combustion of natural gas. The portion of the total emissions associated with boilers and steam used on campus as described in Section 3.2.1.3 are included in the natural gas portion of the existing conditions inventory. This represents approximately 34% of the total emissions provided by BAAQMD. Emissions are summarized in **GHG Report Table 3-6-8.**

1.3.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-6-7 and 3-6-8**.

1.3.3 Mobile Sources

The GHG emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles associated with the land use types in the Project. The GHG emissions from the on-road mobile sources include running and starting exhaust emissions. Running emissions are dependent VMT. Starting emissions are associated with the number of starts or time between vehicle uses and the assumptions used in determining these values are described below. Ramboll Environ estimated mobile source emissions using the trip rates and trip length information specified by Fehr & Peers as described in **SB 743 VMT Analysis Appendix A**. Detailed emission factors and campus fleet calculations are shown in **GHG Report Appendix C.**

1.3.3.1 Off-campus (Worker) trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix A**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **GHG Report Table 3-6-13**.

1.3.3.2 On-campus (Resident) trips

Fehr & Peers calculated on-campus trips and VMT associated with workers or residents who travel from campus. This might include trips such as lunchtime excursions or home-based commercial trips for residents who live on campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix A**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **GHG Report Table 3-6-13**. Detailed emission factors and fleet breakdowns are shown in **GHG Report Appendix C.**

1.3.3.3 Campus fleet: On-road

Stanford-owned on-road vehicles can be split into the following fleets: Bonair fueling station, Peninsula Sanitary Service, Inc. (PSSI) fleet, Marguerite shuttle/buses, and Public Safety vehicles. Methodologies used for estimating emissions from each fleet are described in the sections below.

Bonair Fueling Station Fleet

Stanford provided a vehicles list with annual fuel totals for each vehicle using the Bonair fuel station for refueling. This list of vehicles was filtered using keywords to generate four major categories of vehicles: light passenger/mid-duty, buses, off-road/landscaping equipment, and light towers/generators. Stanford also provided additional "off-ledger" fuel totals that include gasoline and diesel purchases made outside the Bonair fueling station but used to fuel the campus fleet. This off-ledger fuel usage was added to the Bonair fuel totals to calculate GHG emissions. Annual fuel usage was converted to annual vehicle miles traveled using ARB's EMission FACtor model (EMFAC2014) average miles per gallons based on the specific vehicle category. Vehicle miles traveled, number of vehicles, and an assumed trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) were used to calculate emissions. Fuel usage from off-road equipment and light towers/generators was converted to brake horsepower-hour in order to calculate emissions. More detail on off-road vehicle estimates can be found in Section 1.3.3.4.

Peninsula Sanitation Systems, Inc (PSSI) Fleet

Peninsula Sanitary Service, Inc. (PSSI) operates an aboveground diesel storage tank within the Bonair fuel station service yard to fuel its own fleet of recycling, compost, and garbage collection and hauling trucks, as well as some light duty company vehicles. Stanford provided fuel usage and fleet size for this fleet as well as an estimate of the trip length and frequency for the collection trucks. To estimate emissions, the fleet was split into larger hauling trucks and light duty company vehicles. Based on communication with Stanford, large trucks were assumed to travel 4 one-way 52-mile trips per day to the end-use facility plus the default trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) for collection. This information was used to estimate annual VMT and estimate emissions using ARB's EMission FACtor model (EMFAC2014). Only fuel usage information was available for the light duty company vehicle fleet, so annual fuel usage was converted to annual VMT using ARB's EMission FACtor model (EMFAC2014) average miles per gallon for light duty diesel vehicles. Vehicle miles traveled, number of vehicles, and an assumed trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) were used to calculate emissions.

Marguerite Bus/Shuttle Fleet

Detailed data on vehicles and mileage traveled for each vehicle in this fleet allowed for more detailed emissions estimates. Emissions were estimated for each bus and shuttle individually

based on the vehicle classification, model year, fuel type, total vehicle miles traveled, and a fleet average trip length. Some routes never cross into the study area, so the vehicle miles traveled for the entire fleet was adjusted to remove mileage from routes that never cross into the boundary. Only break and tire wear particulate matter emissions were estimated for electric buses. Hybrid bus fuel efficiency is 33% greater than that of a normal bus so VMT for hybrid buses was reduced by 33% to account for the higher fuel efficiency. [20,21] By calculating emissions for each vehicle individually, future changes in the Marguerite fleet can be easily incorporated.

Public Safety Fleet

Stanford provided total vehicle miles traveled (by the entire public safety fleet) and the total number of vehicles. GHG emissions were calculated using the data provided and an assumed fleet population of light duty vehicles and trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County).

1.3.3.4 Campus fleet: Off-road

Off-road equipment was separated from the Bonair fueling station data. This includes landscaping equipment and light towers/generators. Annual fuel totals were used to estimate total brake horsepower-hour (bhp-hr) using conversion factors that originate from the USEPA Nonroad Engine and Vehicle Emission Study. CalEEMod® off-road emission factors for the represented equipment type category were used to estimate GHG emissions.

Additionally, although the Stanford golf course (and fuel tanks at the golf course) is located outside of the study area boundary, some of the off-road equipment that fuel at the golf course also service parts of the campus within the study area boundary. To be conservative, emissions were included from equipment activity at the Siebel Varsity Golf Training Complex and Red Barn, which are both within the study area boundary. Equipment activity occurring in these two areas was estimated from a location-based allocation of total fuel usage from the golf course fuel tanks, provided by Stanford. Emissions were estimated using this annual fuel consumption estimate provided by Stanford to estimate total bhp-hr using conversion factors that originate from the USEPA Nonroad Engine and Vehicle Emission Study. CalEEMod® off-road emission factors for the represented equipment type category were used to estimate GHG emissions.

1.3.3.5 Visitors

Ramboll Environ calculated the trips and VMT associated with various types of campus visitors based on Stanford-specific information and assumptions. These visitor categories are divided below on whether they represent regular weekday trips, or one-time weekend trips to allow a determination of whether they should be considered in the total weekday cordon count.

- One-time visitor events primarily on weekends include the following types of events:
- Athletic events
- Milestone events (Graduation, Parent's Weekend, Homecoming, etc.)

[20] Duluth Transit Authority, 2016. http://www.duluthtransit.com/green/hybrid.

[21] Iowa State University Institute for Transportation, 2012. Assessing the Costs for Hybrid versus Regular Transit Buses. http://www.intercitytransit.com/SiteCollectionDocuments/HybridFactSheet20120802.pdf.

- Camps
- Stanford Live performances

Frequent visitor trips that happen throughout the year include the following categories:

- Alumni center
- Conferences
- Walking tours
- Tour bus visitors
- Executive education

Emissions are shown in **GHG Report Table 3-6-13.**

1.3.3.6 Vendors

Vendor trips include deliveries and other commercial-nonwork visitors not described above. Fehr & Peers estimated the number of vendor trips as described in **SB 743 VMT Analysis Appendix A**. Emissions are shown in **GHG Report Table 3-6-13.**

1.3.3.7 Mobile Emissions Summary

Mobile emissions are summarized in **GHG Report Table 3-6-13**.

1.3.4 Emergency Generators

A list of campus-wide emergency generators along with their BAAQMD Source ID, model year, engine rating, and actual non-emergency and emergency run hours in 2014 was provided by Stanford. There are three generators smaller than 50 horsepower (hp) that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.

GHG emissions are calculated by multiplying the engine rating, hours of operation, and GHG emission factor. Emissions are shown in **GHG Report Table 3-6-18**.

1.3.5 Waste

Municipal solid waste (MSW) is the amount of material that is disposed of by landfilling, recycling, or composting. CalEEMod® calculates the indirect GHG emissions associated with waste that is disposed of at a landfill using waste disposal rates by land use and overall composition. The emission estimates in this Existing Conditions Report are based on Stanford actual disposal and diversion rates across campus in 2014.

CalEEMod® uses the overall California Waste Stream composition to generate the necessary types of different waste disposed into landfills. The program quantifies the GHG emissions associated with the decomposition of the waste, which generates methane based on the total amount of degradable organic carbon. The program also quantifies the CO_2 emissions associated with the combustion of methane, if applicable. Default landfill gas concentrations were used as reported in Section 2.4 of the USEPA's AP-42. The IPCC has a similar method to calculate GHG emissions from MSW in its 2006 Guidelines for National Greenhouse Gas Inventories.

The analysis assumes that additional waste is diverted from landfills by a variety of means, such as reducing the amount of waste generated, recycling, and/or composting. The remainder of the waste not diverted is disposed of at a landfill. GHG emissions from landfills

are associated with the anaerobic breakdown of material. The CalEEMod® version 2013.2.2 solid waste module determines the GHG emissions associated with the disposal of solid waste into landfills in quantities that are based upon land use type according to waste disposal studies conducted by CalRecycle. Stanford waste is sent to Newby Island Landfill, which contains a landfill gas (LFG) collection and destruction system. The collection efficiency, destruction efficiency, and oxidation efficiency used in the calculations are based on CalEEMod® defaults for a landfill with LFG collection.

GHG emissions associated with non-landfill diverted waste streams are not considered, because it is generally assumed that these diversions do not result in any appreciable amounts of GHG emissions when operated effectively.[22] These waste diversion alternatives may result in differences in life-cycle emissions of GHGs, but it is not appropriate to combine life-cycle emissions for only one category of emissions.[23] Biogenic CO_2 emissions were not included when ARB analyzed the GHG emissions inventory under Assembly Bill 32. Therefore, they are not included in the emissions inventory.

The 2014 operations within the Stanford campus generated 23,837 tons per year of solid waste and was estimated to result in 3,880 $MTCO_2e$ per year as shown in **GHG Report Table 3-6-20.** Waste disposal and diversion rates for 2014 are from Stanford Recycling and Peninsula Sanitary Service, Inc. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided for 2015 and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.

1.3.6 Water Use and Emissions

Indirect GHG emissions result from the production of electricity used to convey, treat, and distribute water and wastewater. The amount of electricity required to convey, treat, and distribute water depends on the volume of water as well as the sources of the water. Stanford potable water is sourced from the San Francisco Public Utilities Commission. Non-potable water comes from groundwater and lake water. Additional emissions from wastewater treatment include CH_4 and N_2O, which are emitted directly from the wastewater.

Water usage and wastewater generation values are based on Stanford data for domestic water use for the Stanford campus in 2014 with adjustments based on the Stanford Water Supply Assessment (WSA)[24]. Emissions from electricity from lake water pumping is already captured under campus electricity. Wastewater quantities are derived by summing monthly sewer water records. Total water use is initially overestimated for purposes of this inventory because the water usage includes water from all of the faculty/staff housing within the Academic Growth Boundary, even though 899 of these units are not within the study area. The water use from these units was estimated and removed from the total based on the

[22] ARB. 2010. Local Government Operations Protocol. Chapter 9.4.

[23] This inventory represents scope 1 and 2 emission categories. A life-cycle analysis of waste diversion would be a scope 3 inventory. ARB's Local Government Operations Protocol Version 1.1 (May 2010) clearly states that scope 3 emissions should not be combined with scope 1 and 2 emissions.

[24] Stanford University and Schaaf & Wheeler. 2016. Water Supply Assessment for the Stanford 2018 General Use Permit. October.

October 2016 WSA actual water use rates for fiscal year 2015-2016 (WSA Table 2-4). Total water use from the 937 faculty/staff houses was 0.32 million gallons per day; water per house was thus 342 gallons per day. Water use for the 38 Searsville/Olmstead houses within the study area was retained, while water from the other 899 faculty/staff houses was removed. Wastewater was scaled proportionally since wastewater generation is proportional to indoor water use.

Ramboll Environ used CalEEMod® default assumptions for average embodied energy in water[25] for Santa Clara County, which are based on a study commissioned by the CEC.[26] This study published recommended electricity intensities for the supply and conveyance, treatment and distribution of water, as well as treatment of wastewater, for Northern and Southern California. These factors account for the energy embodied in water use and were used to calculate emissions for the campus. The PGE electricity emission factor is used to estimate GHG emissions per kilowatt-hour, since it is assumed that the electricity from the conveyance, treatment, and distribution comes from PGE.

Wastewater treatment emissions are calculated based on the CalEEMod® default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A Section 8.4.

Emissions are shown in **GHG Report Table 3-6-25**.

1.3.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression. Emissions are shown in **GHG Report Table 3-2-1**.

1.3.8 2014 Inventory Emissions Summary

Emissions are summarized in **GHG Report Table 3-2-1**.

1.4 Annual Operational Emissions: Post-SESI 2015 Inventory

1.4.1 Electricity

The 2015 inventory electricity consumption is based on data and energy usage from the second half of 2015, because the Cardinal Cogen was not fully decommissioned until June 2015. To provide a reasonable estimate of campus energy consumption after the completion of SESI, electricity and gas consumption from July through December 2015 are doubled and assumed to represent annual energy consumption for the campus facilities operational by December 2015. Comparisons between total electricity consumption in the first versus second half of 2014 reveal that consumption from January through June is similar to that from July through December.

[25] Embodied energy refers to the amount of energy that was used in delivering water to the specific land use.

[26] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF.

1.4.1.1 PGE Commercial

The same methodology is used as that for the 2014 inventory, except data for usage from July through December 2015 is doubled to represent the 2015 electricity consumption. The locations of PGE commercial electricity accounts for the 2015 inventory are shown in **Figure 1-4-1**. Emissions are summarized in **GHG Report Table 3-6-3**.

1.4.1.2 Direct Access

The same methodology is used as that for the 2014 inventory, except data for usage from July through December 2015 is doubled to represent the 2015 inventory electricity consumption. The locations of direct access electricity accounts for the 2015 inventory are shown in **Figure 1-4-1**. Emissions are summarized in **GHG Report Table 3-6-3.**

1.4.1.3 Campus and New CEF Consumption

Similar to the methodology for 2014, Stanford provided the monthly campus and new CEF electricity consumption for 2015. The new CEF electricity is used in support of creating hot and chilled water for heating and cooling. This electricity is supplied by a direct access electricity service provider, so the 2014v2 WECC California emission factor is used to calculate GHG emissions. Emissions are summarized in **GHG Report Table 3-6-3.**

1.4.1.4 PGE, Other Housing

The same methodology is used as that for the 2014 inventory, with CalEEMod® assumptions for the number of single-family homes and electricity consumption per home remaining constant. Emissions are summarized in **GHG Report Table 3-6-3**.

1.4.1.5 Commercial Non-Stanford

The same electricity consumption is assumed as that for the 2014 inventory, because these commercial on-campus energy consumers continue to exist and are assumed to purchase a similar amount of electricity from the grid that they previously purchased from the Cardinal Cogen. The emission factor has been updated to assume PGE is the electricity provider. Emissions are summarized in **GHG Report Table 3-6-3**.

1.4.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-3.**

1.4.2 Natural Gas

The emission factors for natural gas usage are from the same source as described in the 2014 calculations.

1.4.2.1 PGE Residential

The same methodology is used as that for the 2014 inventory, except usage data from July through December 2015 is doubled to represent the 2015 inventory natural gas consumption. The locations of PGE residential gas accounts for the 2015 inventory, which are slightly different than for the 2014 inventory are shown in **Figure 1-4-2**. Emissions are summarized in **GHG Report Table 3-6-9.**

1.4.2.2 PGE Commercial

The same methodology is used as that for the 2014 inventory, except data from July through December 2015 is doubled to represent the 2015 natural gas consumption. The locations of PGE commercial gas accounts for the 2015 inventory, which are slightly different than for the

Fall 2015 inventory are shown in **Figure 1-4-2**. Emissions are summarized in **GHG Report Table 3-6-9.**

1.4.2.3 PGE, Other Housing

The same methodology is used as that for the 2014 inventory, with CalEEMod® assumptions for the number of single-family homes and gas consumption per home remaining constant. Emissions are summarized in **GHG Report Table 3-6-9.**

1.4.2.4 New CEF and Replacement Process Steam Plant

Natural gas throughput was provided for the new CEF and Replacement Process Steam Plant. Throughput from July through December 2015 is doubled to represent the 2015 inventory natural gas consumption. Emissions are summarized in **GHG Report Table 3-6-9.**

1.4.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-6-9**.

1.4.3 Mobile Sources

The same methodology, traffic data, and assumptions are used as that for the 2014 inventory. Emissions are summarized in **GHG Report Table 3-6-14.**

1.4.4 Emergency Generators

The same methodology is used as that for the 2014 inventory (that uses 2014 data), except 2015 actual hours of operation are used and certain generators are added or retired. Emissions are summarized in **GHG Report Table 3-6-19.**

1.4.5 Waste

The same methodology is used as that for the 2014 inventory (that uses 2014 data), except 2015 waste generation data is used. Emissions are summarized in **GHG Report Table 3-6-21.**

1.4.6 Water Use and Emissions

The same methodology is used as that for the 2014 inventory (that uses 2014 data), except data for 2015 water and wastewater usage is used. Emissions are summarized in **GHG Report Table 3-6-26.**

1.4.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression in 2015. Emissions are shown in **GHG Report Table 3-2-1**.

1.5 Annual Operational Emissions: Fall 2018 Inventory

The Fall 2018 inventory is based on the assumption that the remaining 2000 GUP square footage is permitted by Fall 2018, with the exception of the Escondido Village Graduate Residences. The 2015 inventory emissions are based on all the buildings and residences constructed by December 2015. The electricity, gas, water, and waste consumption for Fall 2018 are assumed to increase proportionally with academic square footage, population, or number of residential beds, depending on sub-category. Electricity emission factors are updated to reflect Fall 2018 projections and the Stanford solar commitment. The mobile emissions are updated to account for fleet turnover and changes in VMT as described in **SB 743 VMT Analysis Appendix B1** prepared by Fehr & Peers.

1.5.1 Electricity

1.5.1.1 PGE Commercial

The PGE Commercial category includes a few buildings such as a research lab, the driving range, and a few single-family homes near Escondido Village. No changes in energy use are assumed from 2015 to Fall 2018. The PGE emission factor has been updated to reflect the California Public Utilities Commission (CPUC) projection for 2018.[27] Emissions are summarized in **GHG Report Table 3-6-4**.

1.5.1.2 Direct Access not Included with the Campus and New CEF

Direct access not associated with the campus and CEF is a small energy use category, so no changes are assumed for Fall 2018. Emissions calculations continue to use the eGRID 'current' (2014v2)[28] emission factor for WECC California, but incorporate an interpolation from 2014 to the 2020 requirement of 33 percent RPS. Emissions are summarized in **GHG Report Table 3-6-4**.

1.5.1.3 Campus and New CEF Consumption

The majority of growth in energy consumption between 2015 and Fall 2018 is assumed to occur in the campus and new CEF category. This category includes both academic buildings and on-campus residential energy consumption. Electricity consumption is assumed to linearly increase based on the total academic square footage increase. As shown in **GHG Report Table 3-6-4**, the square footage increase from December 2015 to Fall 2018 is 8%; this factor is applied to the 2015 inventory electricity use. Since new buildings must meet more stringent California building energy efficiency standards than older buildings, the energy demand of the new buildings on campus will be much lower than that of existing buildings. This additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for charging electric vehicles.

By Fall 2018, Stanford will procure approximately 159,000 MWh/year of electricity from its Kern County solar farm and an additional 7,300 MWh/year from on-campus rooftop solar installations. The emission factor in **GHG Report Table 3-6-4** incorporates the 166,300 MWh/year of solar electricity with zero GHG emissions and the remainder with the eGRID 2018 projected emission factor for WECC California.

1.5.1.4 PGE, Other Housing

The same methodology is used as that for the 2014 and 2015 inventories, with CalEEMod® assumptions for the number of single-family homes and electricity consumption per home remaining constant. The PGE emission factor has been updated to reflect the projection for 2018 on the path to achieving 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-4.**

1.5.1.5 Commercial Non-Stanford

The same electricity consumption is assumed as that for 2015 inventory. The PGE emission factor has been updated to reflect the projection for 2018. Emissions are summarized in **GHG Report Table 3-6-4.**

[27] https://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

[28] https://www.epa.gov/energy/egrid-2014-summary-tables

1.5.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-4.**

1.5.2 Natural Gas

1.5.2.1 PGE Residential

Natural gas usage for Fall 2018 is based on the ratio of natural gas usage per bed in 2015, scaled for the increase in beds from new graduate and undergraduate housing projects by Fall 2018 (4%). Natural gas will be used for purposes such as water heating and laundry for these housing projects, so it is assumed that the amount of gas per bed remains constant. Natural gas consumption and scaling ratios are summarized in **GHG Report Table 3-6-10.**

1.5.2.2 PGE Commercial

Natural gas usage for Fall 2018 is based on the ratio of natural gas usage to built-and-occupied academic GUP square footage by December 2015, scaled by the remaining GUP square footage allocation to be used by Fall 2018. Six individual replacement boilers included in the 2015 inventory serve select locations that do not connect to the new CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Natural gas consumption and scaling ratios are summarized in **GHG Report Table 3-6-10.**

1.5.2.3 PGE, Other Housing

The same methodology is used as that for the 2014 and 2015 inventories, with CalEEMod® assumptions for the number of single-family homes and gas consumption per home remaining constant. Emissions are summarized in **GHG Report Table 3-6-10.**

1.5.2.4 New CEF and Replacement Process Steam Plant

The same methodology is used as that for the 2015 inventory. The throughput for the new CEF and the Process Steam Plant is expected to linearly increase based on the total academic square footage increase by Fall 2018. Emissions are summarized in **GHG Report Table 3-6-10.**

1.5.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-5-10.**

1.5.3 Mobile Sources

1.5.3.1 Off-Campus (Worker) and On-Campus (Resident) Trips

Number of trips and VMT for workers and residents are scaled up for Fall 2018 based on scaled values provided by Fehr & Peers. Values are scaled by increase in academic square footage or number of residents (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix B1**. The methodology used to estimate emissions remained unchanged from the 2015 inventory.

1.5.3.2 Campus Fleet

No changes will be made to emissions estimates for the Public Safety fleet from the 2015 inventory. The 10 oldest vehicles from the Marguerite fleet will be assumed to be electric by Fall 2018, contributing zero GHG emissions. As described above, the additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for

charging electric vehicles. Additionally, to accommodate for growth, Marguerite VMT was scaled up by the remaining GUP square footage allocation to be used by 2018. The Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, while reducing the total number of vehicles. This fleet reduction program is assumed to reduce emissions from Bonair vehicles by 5%. Emission factors for operational year 2018 are used. Emissions are summarized in **GHG Report Table 3-6-15**.

1.5.3.3 Visitors

Only those visitor trip categories expected to change with increased academic square footage and housing are scaled up for Fall 2018, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix B1**.

1.5.3.4 Vendors

Vendor trips include deliveries and other commercial-nonwork visitors not described above. Fehr & Peers estimated the number of vendor trips as described in **SB 743 VMT Analysis Appendix B1**. Emissions are shown in **GHG Report Table 3-6-15.**

1.5.4 Emergency Generators

Emergency generator usage for Fall 2018 is based on the ratio of generator usage to built-and-occupied academic square footage by December 2015, scaled by the remaining GUP square footage allocation to be used by Fall 2018. The same emissions methodology is used as that for the 2014 and 2015 inventories. Emissions are summarized in **GHG Report Table 3-6-19.**

1.5.5 Waste

The total disposal data from Stanford includes waste generation from academic buildings, on-campus residents, and faculty/staff housing. Waste generation is assumed to linearly increase based on the total academic square footage increase between 2015 and Fall 2018. The solid waste diversion rate is assumed to remain constant. As shown in **GHG Report Table 3-6-22**, the square footage increase from December 2015 to Fall 2018 is 8%; so the waste generation increases by 8% over that reported in the 2015 inventory. There is no new faculty/staff housing proposed between 2015 and Fall 2018.

1.5.6 Water Use and Emissions

Fall 2018 water use is based on 2015 water use plus increases on a gallons/bed/day and gallons/sqft/day basis from the October 2016 Stanford Water Supply Assessment (WSA) Report. These water use rates are conservatively calculated as pre-drought use rates. The calculation results in approximately 6% increase in total potable water consumption, which is assumed to result in a 6% increase in wastewater production. Total water use for this inventory is lower than shown in the WSA because it does not include the 899 faculty/staff houses outside the study area. The same emissions methodology is used as that for the 2014 and 2015 inventories. Emissions are summarized in **GHG Report Table 3-6-27.**

1.5.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression in 2015 Emissions are shown in **GHG Report Table 3-2-1**.

1.6 Annual Operational Emissions: Fall 2020 Inventory

1.6.1 Electricity

The Fall 2020 inventory electricity consumption is based on the Fall 2018 inventory, with additional electricity consumption calculated for the new Escondido Village Graduate Residences. This annual electricity use is based on the CalEEMod® 2013.2.2 default for mid-rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). Electricity intensity factors have also been updated.

1.6.1.1 PGE Commercial

The same consumption is used as the Fall 2018 inventory, except the electricity intenstiy factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5**.

1.6.1.2 Direct Access

The same consumption is used as the Fall 2018 inventory, except the electricity intensity factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5.**

1.6.1.3 Campus and New CEF Consumption

The same consumption is used as the Fall 2018 inventory, with additions due to the new Escondido Village Graduate Residences. This annual electricity use is based on the CalEEMod® 2013.2.2 default for mid-rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The electricity intenstiy factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5.**

1.6.1.4 PGE, Other Housing

The same consumption is used as the Fall 2018 inventory, except the electricity intenstiy factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5**.

1.6.1.5 Commercial Non-Stanford

The same consumption is used as the Fall 2018 inventory, except the electricity intenstiy factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5**.

1.6.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-5.**

1.6.2 Natural Gas

The emission factors for natural gas usage are from the same source as described in the Fall 2018 calculations.

1.6.2.1 PGE Residential

The same methodology is used as that for the Fall 2018 inventory, except the natural gas consumption is scaled up by the number of new beds due to the Escondido Village Graduate Residences. Emissions are summarized in **GHG Report Table 3-6-11.**

1.6.2.2 PGE Commercial

The same consumption is used as the Fall 2018 inventory. Emissions are summarized in **GHG Report Table 3-6-11.**

1.6.2.3 PGE, Other Housing

The same consumption is used as the Fall 2018 inventory. Emissions are summarized in **GHG Report Table 3-6-11.**

1.6.2.4 New CEF and Replacement Process Steam Plant

The same consumption is used as the Fall 2018 inventory. Emissions are summarized in **GHG Report Table 3-6-11.**

1.6.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-6-11**.

1.6.3 Mobile Sources

The same methodology, traffic data, and assumptions are used as that for the Fall 2018 inventory, except that the worker and resident VMT have been updated per **Fehr & Peers Appendix B2** to incorporate changes due to the new Escondido Village Graduate Residences. Mobile emission factors have been updated to reflect the 2020 calendar year. Emissions are summarized in **GHG Report Table 3-6-16.**

1.6.4 Emergency Generators

The same consumption is used as the Fall 2018 inventory. Emissions are summarized in **GHG Report Table 3-6-19.**

1.6.5 Waste

The Fall 2020 inventory waste emissions are based on the Fall 2018 inventory, with additional waste disposal calculated for the new Escondido Village Graduate Residences. Waste generated by the new residents is based on the CalEEMod® 2013.2.2 default for mid-rise apartments. The diversion rate is assumed to remain constant from the 2015 rate. Emissions are summarized in **GHG Report Table 3-6-23.**

1.6.6 Water Use and Emissions

The Fall 2020 inventory water and wastewater use are based on the Fall 2018 inventory, with additional water use calculated for the new Escondido Village Graduate Residences on a per-bed basis based on the consumption in the WSA. The 2020 PGE electricity intensity factor is incorporated. Emissions are summarized in **GHG Report Table 3-6-28.**

1.6.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression in 2015. Emissions are shown in GHG Report **Table 3-2-1**.

1.7 Annual Operational Emissions: Fall 2035 (Project) Inventory

1.7.1 Electricity

1.7.1.1 PGE Commercial

The PGE Commercial category includes a few buildings such as a research lab, the driving range, and a few single-family homes near Escondido Village. This category is small with respect to total campus electricity use. No changes in energy use are assumed from Fall 2020 to Fall 2035. The PGE emission factor has been updated to reflect the California SB 350/SB 32 mandate that providers achieve 50% of electricity from renewables by 2030.[29] The derivation of the emission factor is shown in **GHG Report Table 3-5-1**. Emissions are summarized in **GHG Report Table 3-6-6a**.

1.7.1.2 Direct Access not Included with the Campus and New CEF

Direct access not associated with the campus and CEF is a small energy use category, so no changes are assumed for Fall 2035. The Direct access emission factor is based on achieving 50% RPS in 2030 consistent with SB 350 and SB 32. See **GHG Report Table 3-5-1** for derivation. A portion of Stanford's Direct Access electricity will actually be net metered with on-campus solar generation, but for simplicity this adjustment has been reflected in the Campus and CEF Consumption category. Emissions are summarized in **GHG Report Table 3-6-6a**.

1.7.1.3 Campus and CEF Consumption

The majority of growth in electricity consumption between Fall2020 and Fall 2035 is assumed to occur in the campus and CEF category. This category includes both academic buildings and on-campus residential energy consumption. Since the majority of electricity consumption within the study area is within the Campus and CEF Consumption category, all increases are assigned to this category, with no expected changes in electricity use for the other providers, except for the additional faculty/staff housing added separately. Electricity consumption is assumed to linearly increase based on the total academic square footage increase. As shown in **GHG Report Table 3-6-6a**, the square footage increase from Fall 2020 to Fall 2035 is 22%; this factor is applied to the Fall 2020 inventory electricity use. Since new buildings must meet more stringent California building energy efficiency standards than older buildings, the energy demand of the new buildings on campus will be much lower than that of existing buildings, making this a conservative scaling assumption. This additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for charging electric vehicles.

Just as in the Fall 2018 and Fall 2020 inventories, this category accounts for electricity provided by Stanford's Solar Generation Farm and on-campus solar panels. The emission factor in **GHG Report Table 3-6-6** incorporates the 166,300 MWh/year of solar electricity with zero GHG emissions and the remainder with the WECC California emission factor adjusted for achieving 50% RPS in 2030 consistent with SB 350 and SB 32.

[29] http://www.energy.ca.gov/sb350/

1.7.1.4 PGE, Other Housing

No changes in electricity use were assumed for the Searsville/Olmstead housing units, which is estimated based on CalEEMod® 2013.2.2 default values for single family homes built to 2008 Title 24 standards in climate zone 4.

Five hundred fifty (550) new faculty/staff high-density homes are to be constructed within the study boundary by 2035. The annual electricity use is based on the CalEEMod® 2013.2.2 default for the "condo/townhouse" category built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown in **GHG Report Table 3-6-6a**. This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24 standards.

The PGE emission factor for both housing categories listed above has been updated to reflect the California SB 350/SB 32 mandate that providers achieve 50% of electricity from renewables by 2030. Emissions are summarized in **GHG Report Table 3-6-6a.**

1.7.1.5 Commercial Non-Stanford

The same electricity consumption is assumed as that for Fall 2020 inventory. The PGE emission factor has been updated to reflect the California SB 350/SB 32 mandate that providers achieve 50% of electricity from renewables by 2030. Emissions are summarized in **GHG Report Table 3-6-6a.**

1.7.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-6a.**

1.7.2 Natural Gas

1.7.2.1 PGE Residential

Natural gas usage for Fall 2035 is scaled based on the percent increase in total number of student beds from Fall 2020 to full buildout of the 2018 GUP (an increase of 18%). Natural gas will be used for purposes such as water heating and laundry for these housing projects, so it is assumed that the quantity of natural gas per bed remains constant. This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24. Natural gas consumption and scaling ratios are summarized in **GHG Report Table 3-6-12.**

1.7.2.2 PGE Commercial

Natural gas usage for Fall 2035 is based on the percent increase in academic square footage from Fall 2020 to full buildout of the 2018 GUP (an increase of 22%). Six individual replacement boilers included in the 2018 inventory serve select locations that do not connect to the CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Natural gas consumption and scaling ratios are summarized in **GHG Report Table 3-6-12.**

1.7.2.3 PGE, Other Housing

No changes in natural gas use were assumed for the Searsville/Olmstead housing units, which is estimated based on CalEEMod® 2013.2.2 default values for single family homes built to 2008 Title 24 standards in climate zone 4.

Five hundred fifty (550) new faculty/staff high-density homes are to be constructed within the study boundary by 2030. The annual natural gas use is based on the CalEEMod® 2013.2.2 default for the "condo/townhouse" category built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown in **GHG Report Table 3-6-12**. This natural gas consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.

Emissions are summarized in **GHG Report Table 3-5-11.**

1.7.2.4 CEF and Replacement Process Steam Plant

The throughput for the CEF and the Process Steam Plant is expected to linearly increase based on the total academic square footage increase from Fall 2020 to full buildout of the 2018 GUP in 2035 (an increase of 22%). Emissions are summarized in **GHG Report Table 3-6-12.**

1.7.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-6-12.**

1.7.3 Mobile Sources

1.7.3.1 Off-Campus (Worker) and On-Campus (Resident) Trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus and on-campus trips and VMT associated with workers or residents who travel from campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix C**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **GHG Report Table 3-6-17**. Detailed emission factors and fleet breakdowns are shown in **GHG Report Appendix C.**

1.7.3.2 Campus Fleet

Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the Fall 2020 inventory was estimated to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the Fall 2020 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are scaled down assuming only 30% non-electric vehicles contribute to emissions in 2035 versus 60% in Fall 2020 Additionally, Stanford expects the entire Marguerite fleet to be electric by 2035. As described above, the additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for charging electric vehicles. To accommodate for growth, Marguerite VMT is scaled up based on the percent increase in academic square footage from Fall 2020 to full buildout of the 2018 GUP (an increase of 22%).

Emissions due to electricity consumption from electric vehicles are assumed to be captured in the "Campus and CEF Consumption" electricity use category, as these EVs will constitute additional plug loads on campus. New buildings will be much more energy-efficient than existing buildings due to increasingly stringent building codes, so if not for additional plug loads due to EV charging, the electricity consumption in **GHG Report Table 3-6-6** would

likely be overestimated. Emission factors for operational year 2030 are used. Emissions are summarized in **GHG Report Table 3-6-17**.

1.7.3.3 Visitors

Only those visitor trip categories expected to change with increased academic square footage and housing are scaled up for Fall 2035, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix C**.

1.7.3.4 Vendors

Vendor trips include deliveries and other commercial-nonwork visitors not described above. Fehr & Peers estimated the number of vendor trips as described in **SB 743 VMT Analysis Appendix C**. Emissions are shown in **GHG Report Table 3-6-17.** Since EMFAC2014 does not incorporate the GHG benefits of the NHTSA Phase 2 regulation, emissions for medium- and heavy-duty vehicles are overestimated for the 2035 operational year.

1.7.4 Emergency Generators

Emergency generator emissions for Fall 2035 is based on the increase in academic square footage from Fall 2020 to the buildout of the 2018 GUP (a 22% increase). Emissions are summarized in **GHG Report Table 3-6-19.**

1.7.5 Waste

The total disposal data from Stanford includes waste generation from academic buildings, on-campus residents, and faculty/staff housing. Waste generation is assumed to linearly increase based on the increase in academic square footage expected from Fall 2020 to full buildout of the 2018 GUP. Waste associated with the new faculty/staff housing is added based on the 2015 per-house waste disposal rates. Waste disposal is assumed to scale linearly; i.e., disposal rates in new buildings is assumed equal to current buildings. The diversion rate is assumed to remain constant from 2015, even though diversion rate statewide is expected to increase by 2035. Emissions are summarized in **GHG Report Table 3-6-23.**

1.7.6 Water Use and Emissions

Fall 2035 water use rates are from the April 2017 Stanford Water Supply Assessment, which were based on pre-drought water use rates per undergraduate and graduate bed, academic building square foot, and faculty and staff residence. These water use rates in million gallons per day (Mgal/day) are multiplied by 365 days to result in the totals in Mgal/yr for the incremental increase in water consumption from Fall 2020 to Fall 2035. Consistent with the existing inventories, total water consumption is lower in the GHG Report than in the Water Supply Assessment, because the WSA includes water use from the 899 faculty and staff houses not included in the study area. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use.

Emissions from domestic water use and wastewater treatment are summarized in **GHG Report Table 3-6-29a.**

1.7.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene

combustion as well as the HFCs used in fire suppression in 2035. Emissions are shown in **GHG Report Table 3-2-1**.

1.8 Annual Operational Emissions: Fall 2035 (Project) with RPS Projection Inventory

The Fall 2035 with RPS Projection inventory mirrors the Fall 2035 inventory with the exception of the electricity emission factors, affecting the electricity and water/wastewater category emissions as discussed below.

1.8.1 Electricity

1.8.1.1 PGE Commercial

PGE Commercial electricity usage (in MWh) is consistent with the Fall 2035 inventory.

The PGE emission factor has been updated based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050. This is consistent with the CARB Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan[30], and results in 57.5% of electricity from renewables by 2035. The derivation of the emission factor is shown in **GHG Report Table 3-5-1**. Emissions are summarized in **GHG Report Table 3-6-6b**.

1.8.1.2 Direct Access not Included with the Campus and New CEF

Direct access electricity usage (in MWh) is consistent with the Fall 2035 inventory.

The Direct access emission factor is based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, resulting in 57.5% of electricity from renewables by 2035. See **GHG Report Table 3-5-1** for derivation. A portion of Stanford's Direct Access electricity will actually be net metered with on-campus solar generation, but for simplicity this adjustment has been reflected in the Campus and CEF Consumption category. Emissions are summarized in **GHG Report Table 3-6-6b**.

1.8.1.3 Campus and CEF Consumption

The Campus and CEF electricity usage (in MWh) is consistent with the Fall 2035 inventory.

Just as in the Fall 2018, Fall 2020, and Fall 2035 inventories, this category accounts for electricity provided by Stanford's Solar Generation Farm and on-campus solar panels. The emission factor in **GHG Report Table 3-6-6b** incorporates the 166,300 MWh/year of solar electricity with zero GHG emissions and the remainder with the WECC California emission factor adjusted for achieving 57.5% RPS in 2035, based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels.

1.8.1.4 PGE, Other Housing

PGE electricity use (in MWh) for Other Housing is consistent with the Fall 2035 inventory.

The PGE emission factor for both the Searsville/Olmstead housing units and the new faculty/staff high-density homes has been updated to reflect a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, resulting in 57.5% of

[30] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

electricity from renewables by 2035. Emissions are summarized in **GHG Report Table 3-6-6b.**

1.8.1.5 Commercial Non-Stanford

Commercial Non-Stanford electricity use (in MWh) is consistent with the Fall 2035 inventory.

The PGE emission factor has been updated to reflect a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, resulting in 57.5% of electricity from renewables by 2035. Emissions are summarized in **GHG Report Table 3-6-6b.**

1.8.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-6b.**

1.8.2 Water Use and Emissions

Waster use rates are consistent with the Fall 2035 inventory.

The electricity emission factor has been updated consistent with the update described in **Section 1.8.1.1** above.

Emissions from domestic water use and wastewater treatment are summarized in **GHG Report Table 3-6-29b.**

2. GHG INVENTORIES IN CONTEXT

This section compares the three existing conditions inventories and one Project inventory.

2.1 2014 Inventory

The site emitted approximately 222,069 $MTCO_2e$ per year in 2014 (see **GHG Report Table 3-2-1**). The dominant emissions sources were the Cardinal Cogen and transportation, which contributed 67% and 25% of the total inventory, respectively.

2.2 2015 Inventory

The site emitted approximately 166,924 $MTCO_2e$ per year in 2015 (see **GHG Report Table 3-2-1**). The dominant emissions sources were transportation and electricity imported to campus, which contributed 45% and 33% of the total inventory, respectively. The reduction compared to 2014 primarily is due to completion of the SESI.

2.3 Fall 2018 Inventory

The site is expected to emit approximately 125,672 $MTCO_2e$ per year in Fall 2018 prior to commencement of the proposed 2018 General Use Permit (see **GHG Report Table 3-2-1)**. The dominant emissions sources are transportation and electricity imported to campus, which contributed 42% and 27% of the total inventory, respectively. The reduction compared to 2015 primarily is due to operation of the Stanford Solar Generating Station.

2.4 Fall 2020 Inventory

The site is expected to emit approximately 124,525 $MTCO_2e$ per year in Fall 2020 (see **GHG Report Table 3-2-1)**. The dominant emissions sources are transportation and electricity imported to campus, which contributed 43% and 27% of the total inventory, respectively. The slight decrease in emissions compared to Fall 2018 is due to the addition of the Escondido Village Graduate Residences that reduces graduate student mobile trips coupled with a decrease in electricity and mobile emission factors.

2.5 Fall 2035 Inventory

The site is expected to emit approximately 125,412 $MTCO_2e$ per year in Fall 2035 (see **GHG Report Table 3-2-1)**. The dominant emissions sources are almost evenly transportation, electricity imported to campus, and natural gas which contributed 34%, 30%, and 30% of the total inventory, respectively.

2.6 Fall 2035 with RPS Projection Inventory

Emissions for a second Fall 2035 scenario ("Fall 2035 with RPS Projection") are calculated to represent a reasonable estimate of 2035 Project emissions as the electricity grid continues to incorporate additional renewables after 2030. The electricity intensity factor for the Fall 2035 with RPS Projection inventory is derived based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050.[31] This linear trajectory would require 57.5 percent of electricity to come from renewable sources in 2035. As shown in **Table 3-2-1**, the site is expected to

[31] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

emit approximately 119,875 $MTCO_2e$ per year in Fall 2035 after incorporating the 2035 RPS projection**.**

2.7 Summary

A category-by-category comparison of emissions between the three existing conditions inventories is shown in **GHG Report Table 3-2-1.** Even with growth in population and building square footage, total mass emissions of GHGs decrease significantly from 2014 to 2015 to Fall 2018. The decrease from 2014 to 2015 is due to the changes in electricity and gas consumption due to SESI, and the continued decrease through Fall 2018 and Fall 2020 are due to the Stanford Solar Generating Station and the cleaner PGE electricity. The relatively flat GHG level from Fall 2020 to Fall 2035, despite campus growth, is primarily due to the cleaner electricity and cleaner mobile vehicles. As described in GHG Report Section 1.2.3, the 2035 Project inventory is the developed using 2030 emission factors. This is conservative, as the electricity intensity factor, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. As shown in the Fall 2035 with RPS Projection scenario, incorporating a reasonable estimate of the electricity intensity factor in 2035 further decreases GHG emissions. The Project would not result in a net increase in campus-wide GHG emissions from the baseline year of 2018 through full build out of the 2018 General Use Permit in 2035.

FIGURES

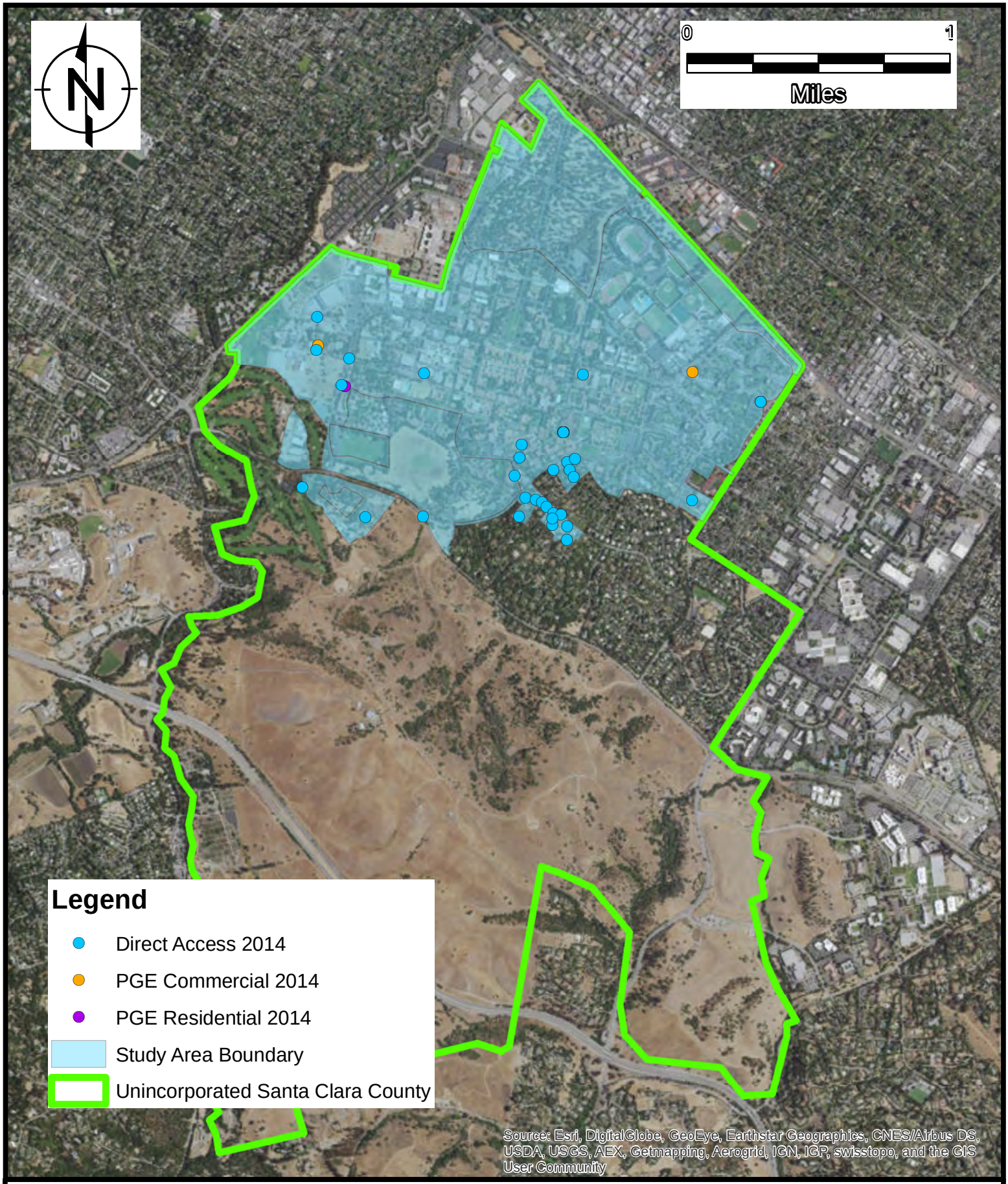

Figure 1-3-1 2014 Electricity Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

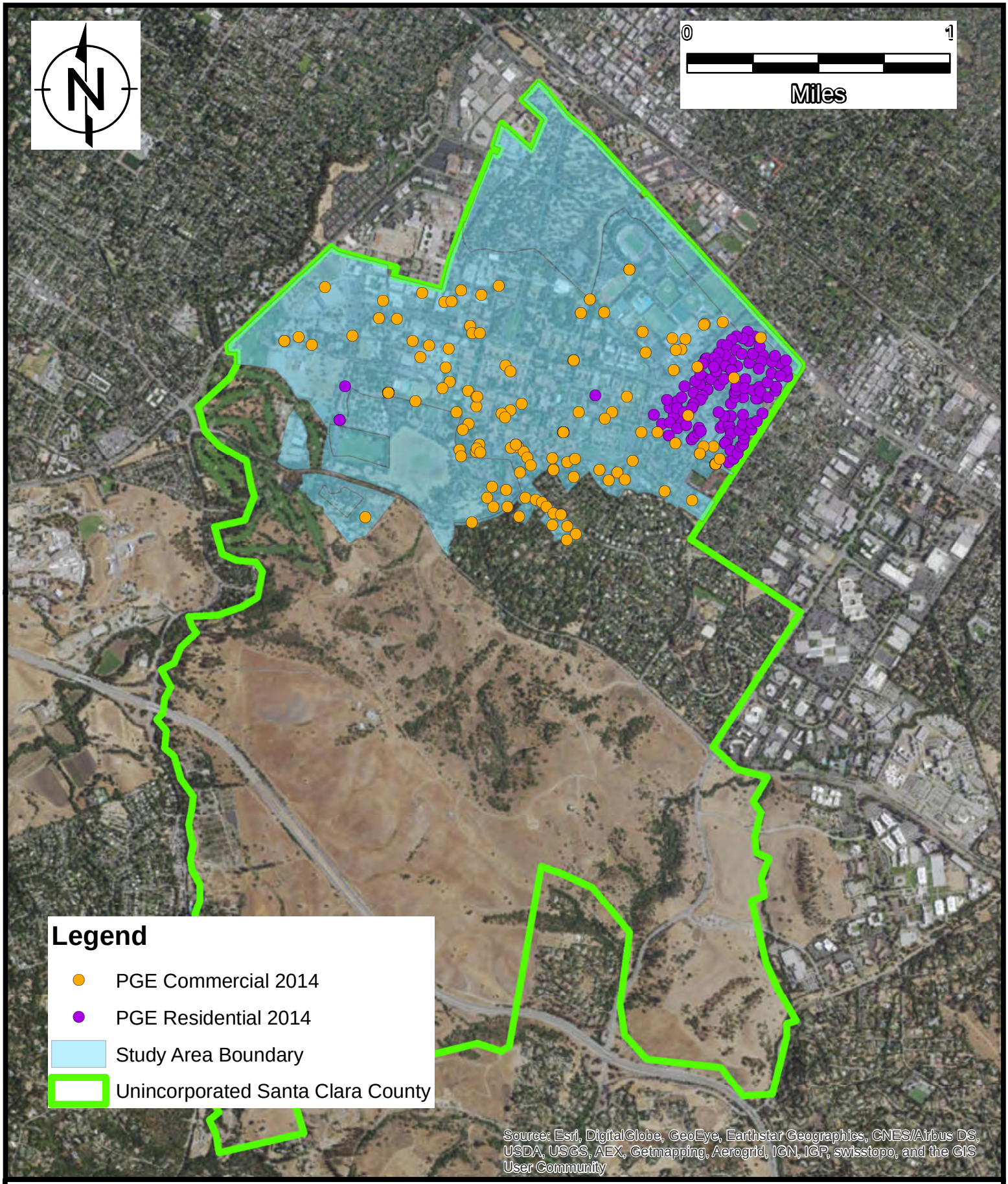

Figure 1-3-2 2014 Natural Gas Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

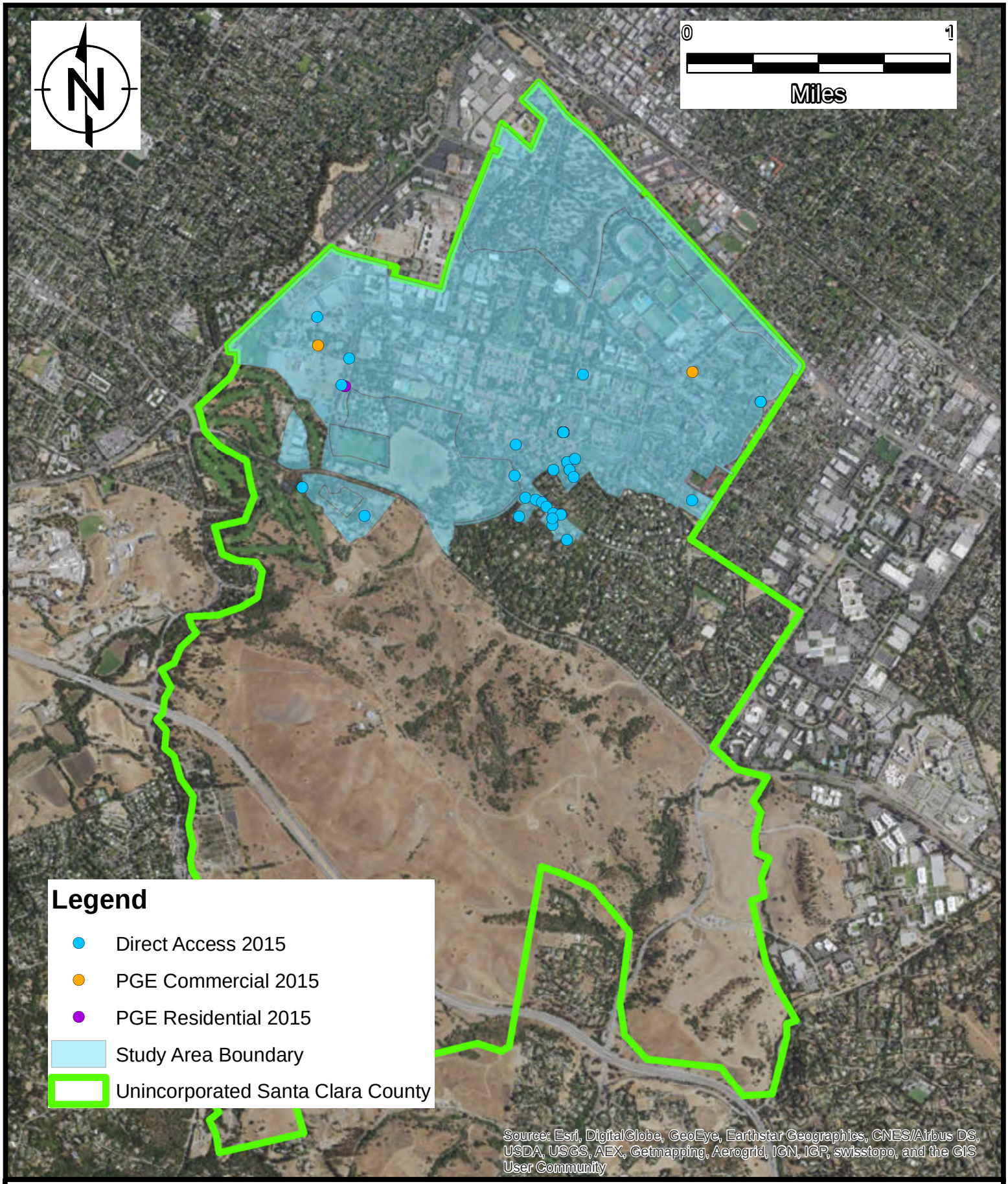

Figure 1-4-1 2015 Electricity Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

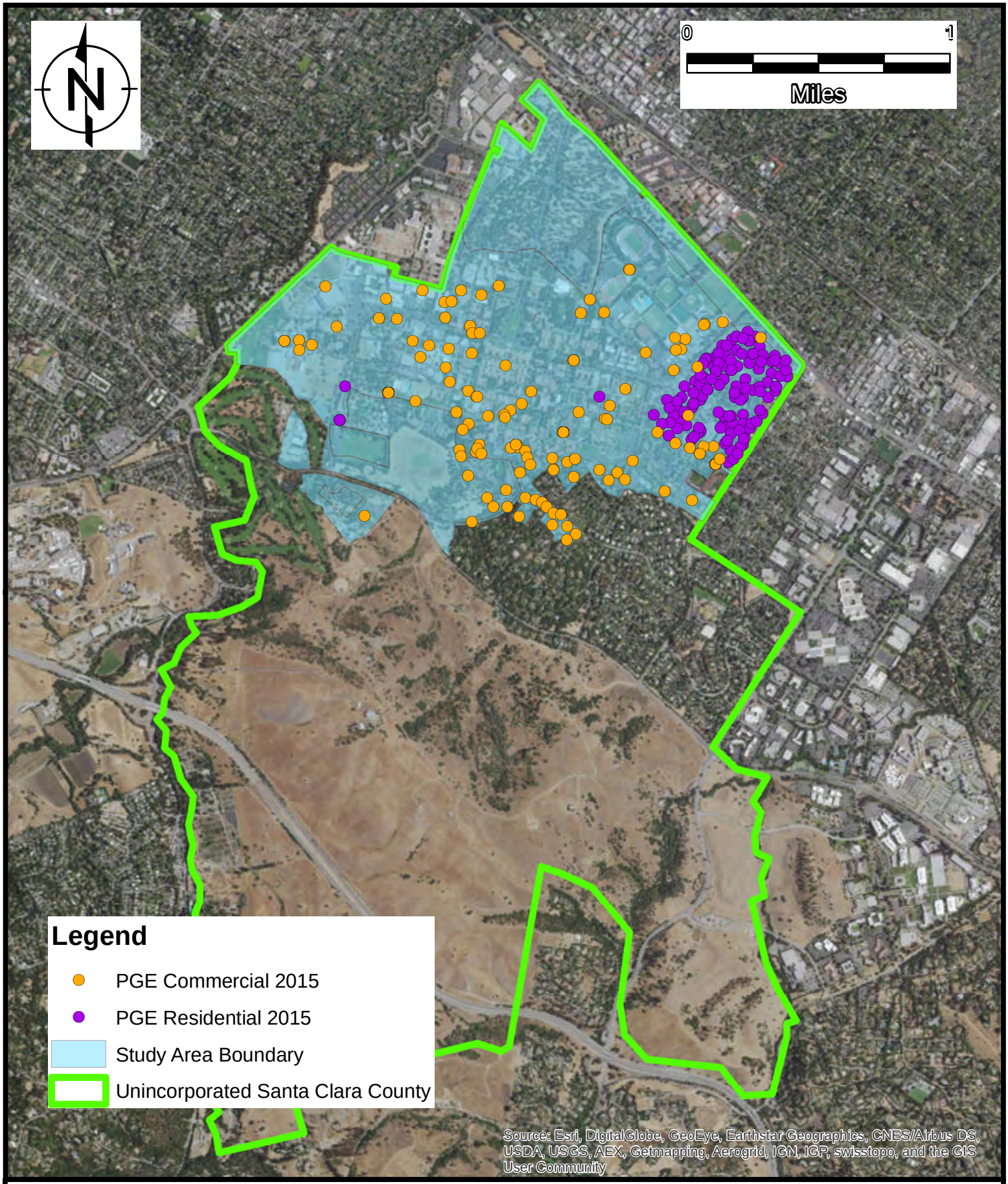

Figure 1-4-2 2015 Natural Gas Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

APPENDIX B
CALEEMOD® CONSTRUCTION OUTPUT FILES

Table B-1. CalEEMod® Model Outputs Descriptions
Stanford University
Stanford, California

Construction CalEEMod® Runs	
Output	**Scenario**
2014 Average Output	2014 Annual Average Off-Road Construction Emissions
2015 Average Output	2015 Annual Average Off-Road Construction Emissions
2018 Average Output	2018 Annual Average Off-Road Construction Emissions
2020 Average Output	2020 Annual Average Off-Road Construction Emissions
2030 Average Output	2030 Annual Average Off-Road Construction Emissions

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel

Stanford Construction/Demolition, Average Year (2014)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2014
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2014. Made schedule fit in 1 year

Trips and VMT - Worker/vendor trips already captured in other mobile emissions calcs. - Hauling trips also captured in mobile emission calcs

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	5/6/2014	12/31/2014
tblConstructionPhase	PhaseEndDate	1/13/2015	12/31/2014
tblConstructionPhase	PhaseEndDate	1/14/2015	3/11/2014
tblConstructionPhase	PhaseStartDate	4/9/2014	12/4/2014
tblConstructionPhase	PhaseStartDate	2/26/2014	2/13/2014
tblConstructionPhase	PhaseStartDate	1/1/2015	2/26/2014

tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Year	tons/yr										MT/yr					
2014	1.7598	5.0773	3.1910	4.2300e-003	0.1841	0.3379	0.5220	0.0876	0.3168	0.4045	0.0000	391.9506	391.9506	0.1028	0.0000	394.1099
Total	**1.7598**	**5.0773**	**3.1910**	**4.2300e-003**	**0.1841**	**0.3379**	**0.5220**	**0.0876**	**0.3168**	**0.4045**	**0.0000**	**391.9506**	**391.9506**	**0.1028**	**0.0000**	**394.1099**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.2552	0.6161	2.7110	4.2300e-003	0.1841	0.0249	0.2090	0.0876	0.0237	0.1113	0.0000	391.9502	391.9502	0.1028	0.0000	394.1095
Total	**1.2552**	**0.6161**	**2.7110**	**4.2300e-003**	**0.1841**	**0.0249**	**0.2090**	**0.0876**	**0.0237**	**0.1113**	**0.0000**	**391.9502**	**391.9502**	**0.1028**	**0.0000**	**394.1095**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**28.67**	**87.87**	**15.04**	**0.00**	**0.00**	**92.64**	**59.96**	**0.00**	**92.51**	**72.48**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Area	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2014	1/28/2014	5	20	
2	Paving	Paving	1/29/2014	2/25/2014	5	20	
3	Building Construction	Building Construction	2/13/2014	12/31/2014	5	230	
4	Site Preparation	Site Preparation	2/26/2014	3/11/2014	5	10	
5	Grading	Grading	3/12/2014	4/8/2014	5	20	
6	Architectural Coating	Architectural Coating	12/4/2014	12/31/2014	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0460	0.4954	0.3629	4.0000e-004		0.0253	0.0253		0.0236	0.0236	0.0000	37.7760	37.7760	0.0102	0.0000	37.9903

Total	**0.0460**	**0.4954**	**0.3629**	**4.0000e-004**	**0.0248**	**0.0253**	**0.0500**	**3.7500e-003**	**0.0236**	**0.0273**	**0.0000**	**37.7760**	**37.7760**	**0.0102**	**0.0000**	**37.9903**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0119	0.0716	0.2380	4.0000e-004		4.8500e-003	4.8500e-003		4.8500e-003	4.8500e-003	0.0000	37.7759	37.7759	0.0102	0.0000	37.9903
Total	**0.0119**	**0.0716**	**0.2380**	**4.0000e-004**	**0.0248**	**4.8500e-003**	**0.0296**	**3.7500e-003**	**4.8500e-003**	**8.6000e-003**	**0.0000**	**37.7759**	**37.7759**	**0.0102**	**0.0000**	**37.9903**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.2609	0.1497	2.2000e-004		0.0145	0.0145		0.0134	0.0134	0.0000	21.4412	21.4412	6.3400e-003	0.0000	21.5743
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0236**	**0.2609**	**0.1497**	**2.2000e-004**		**0.0145**	**0.0145**		**0.0134**	**0.0134**	**0.0000**	**21.4412**	**21.4412**	**6.3400e-003**	**0.0000**	**21.5743**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.2609	0.1497	2.2000e-004		0.0145	0.0145		0.0134	0.0134	0.0000	21.4412	21.4412	6.3400e-003	0.0000	21.5743
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0236**	**0.2609**	**0.1497**	**2.2000e-004**		**0.0145**	**0.0145**		**0.0134**	**0.0134**	**0.0000**	**21.4412**	**21.4412**	**6.3400e-003**	**0.0000**	**21.5743**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4448	3.5942	2.1769	3.0900e-003		0.2562	0.2562		0.2412	0.2412	0.0000	282.6403	282.6403	0.0719	0.0000	284.1495
Total	**0.4448**	**3.5942**	**2.1769**	**3.0900e-003**		**0.2562**	**0.2562**		**0.2412**	**0.2412**	**0.0000**	**282.6403**	**282.6403**	**0.0719**	**0.0000**	**284.1495**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0900e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	282.6400	282.6400	0.0719	0.0000	284.1492
Total	**0.0376**	**0.2563**	**2.0023**	**3.0900e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**282.6400**	**282.6400**	**0.0719**	**0.0000**	**284.1492**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Site Preparation - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2881	0.2148	2.0000e-004		0.0157	0.0157		0.0144	0.0144	0.0000	18.8508	18.8508	5.5700e-003	0.0000	18.9678
Total	**0.0265**	**0.2881**	**0.2148**	**2.0000e-004**	**0.0903**	**0.0157**	**0.1060**	**0.0497**	**0.0144**	**0.0641**	**0.0000**	**18.8508**	**18.8508**	**5.5700e-003**	**0.0000**	**18.9678**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	18.8508	18.8508	5.5700e-003	0.0000	18.9678
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**18.8508**	**18.8508**	**5.5700e-003**	**0.0000**	**18.9678**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0387	0.4110	0.2675	3.0000e-004		0.0237	0.0237		0.0218	0.0218	0.0000	28.6891	28.6891	8.4800e-003	0.0000	28.8671
Total	**0.0387**	**0.4110**	**0.2675**	**3.0000e-004**	**0.0690**	**0.0237**	**0.0927**	**0.0342**	**0.0218**	**0.0560**	**0.0000**	**28.6891**	**28.6891**	**8.4800e-003**	**0.0000**	**28.8671**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	28.6890	28.6890	8.4800e-003	0.0000	28.8671
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**28.6890**	**28.6890**	**8.4800e-003**	**0.0000**	**28.8671**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.4600e-003	0.0278	0.0192	3.0000e-005		2.4500e-003	2.4500e-003		2.4500e-003	2.4500e-003	0.0000	2.5533	2.5533	3.6000e-004	0.0000	2.5609
Total	**1.1803**	**0.0278**	**0.0192**	**3.0000e-005**		**2.4500e-003**	**2.4500e-003**		**2.4500e-003**	**2.4500e-003**	**0.0000**	**2.5533**	**2.5533**	**3.6000e-004**	**0.0000**	**2.5609**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	3.6000e-004	0.0000	2.5609
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**3.6000e-004**	**0.0000**	**2.5609**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-...	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552333	0.058138	0.185246	0.125281	0.029961	0.004506	0.012317	0.020953	0.001764	0.001280	0.005920	0.000536	0.001765

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Unmitigated	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.2000e-004	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.2000e-004	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e

Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000

Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2015)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2015
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2015. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido.

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/26/2016	12/29/2015
tblConstructionPhase	PhaseEndDate	1/26/2016	12/29/2015
tblConstructionPhase	PhaseEndDate	1/28/2015	1/27/2015
tblConstructionPhase	PhaseEndDate	2/24/2015	2/23/2015
tblConstructionPhase	PhaseEndDate	3/9/2015	2/10/2015
tblConstructionPhase	PhaseStartDate	12/30/2015	12/2/2015
tblConstructionPhase	PhaseStartDate	3/11/2015	2/11/2015
tblConstructionPhase	PhaseStartDate	1/28/2015	1/27/2015
tblConstructionPhase	PhaseStartDate	2/24/2015	1/28/2015
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2015

tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.7313	4.8790	3.1470	4.2100e-003	0.1829	0.3218	0.5047	0.0874	0.3015	0.3889	0.0000	386.9797	386.9797	0.1008	0.0000	389.0955
Total	**1.7313**	**4.8790**	**3.1470**	**4.2100e-003**	**0.1829**	**0.3218**	**0.5047**	**0.0874**	**0.3015**	**0.3889**	**0.0000**	**386.9797**	**386.9797**	**0.1008**	**0.0000**	**389.0955**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.2535	0.5998	2.6990	4.2100e-003	0.1829	0.0239	0.2068	0.0874	0.0227	0.1102	0.0000	386.9792	386.9792	0.1008	0.0000	389.0951
Total	**1.2535**	**0.5998**	**2.6990**	**4.2100e-003**	**0.1829**	**0.0239**	**0.2068**	**0.0874**	**0.0227**	**0.1102**	**0.0000**	**386.9792**	**386.9792**	**0.1008**	**0.0000**	**389.0951**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**27.60**	**87.71**	**14.24**	**0.00**	**0.00**	**92.59**	**59.03**	**0.00**	**92.46**	**71.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2015	1/27/2015	5	20	
2	Paving	Paving	1/27/2015	2/23/2015	5	20	
3	Site Preparation	Site Preparation	1/28/2015	2/10/2015	5	10	
4	Grading	Grading	2/11/2015	3/10/2015	5	20	
5	Building Construction	Building Construction	2/11/2015	12/29/2015	5	230	
6	Architectural Coating	Architectural Coating	12/2/2015	12/29/2015	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0235	0.0000	0.0235	3.5600e-003	0.0000	3.5600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0428	0.4595	0.3427	3.8000e-004		0.0233	0.0233		0.0217	0.0217	0.0000	35.5692	35.5692	9.6400e-003	0.0000	35.7717
Total	**0.0428**	**0.4595**	**0.3427**	**3.8000e-004**	**0.0235**	**0.0233**	**0.0468**	**3.5600e-003**	**0.0217**	**0.0253**	**0.0000**	**35.5692**	**35.5692**	**9.6400e-003**	**0.0000**	**35.7717**

3.2 Demolition - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0235	0.0000	0.0235	3.5600e-003	0.0000	3.5600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0107	0.0644	0.2258	3.8000e-004		4.2100e-003	4.2100e-003		4.2100e-003	4.2100e-003	0.0000	35.5692	35.5692	9.6400e-003	0.0000	35.7717
Total	**0.0107**	**0.0644**	**0.2258**	**3.8000e-004**	**0.0235**	**4.2100e-003**	**0.0277**	**3.5600e-003**	**4.2100e-003**	**7.7700e-003**	**0.0000**	**35.5692**	**35.5692**	**9.6400e-003**	**0.0000**	**35.7717**

3.2 Demolition - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0232	0.2518	0.1498	2.2000e-004		0.0142	0.0142		0.0130	0.0130	0.0000	21.2272	21.2272	6.3400e-003	0.0000	21.3603
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0232**	**0.2518**	**0.1498**	**2.2000e-004**		**0.0142**	**0.0142**		**0.0130**	**0.0130**	**0.0000**	**21.2272**	**21.2272**	**6.3400e-003**	**0.0000**	**21.3603**

3.3 Paving - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0232	0.2518	0.1498	2.2000e-004		0.0142	0.0142		0.0130	0.0130	0.0000	21.2272	21.2272	6.3400e-003	0.0000	21.3603
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0232**	**0.2518**	**0.1498**	**2.2000e-004**		**0.0142**	**0.0142**		**0.0130**	**0.0130**	**0.0000**	**21.2272**	**21.2272**	**6.3400e-003**	**0.0000**	**21.3603**

3.3 Paving - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0263	0.2845	0.2132	2.0000e-004		0.0154	0.0154		0.0142	0.0142	0.0000	18.6506	18.6506	5.5700e-003	0.0000	18.7675
Total	**0.0263**	**0.2845**	**0.2132**	**2.0000e-004**	**0.0903**	**0.0154**	**0.1058**	**0.0497**	**0.0142**	**0.0639**	**0.0000**	**18.6506**	**18.6506**	**5.5700e-003**	**0.0000**	**18.7675**

3.4 Site Preparation - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	18.6505	18.6505	5.5700e-003	0.0000	18.7675
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**18.6505**	**18.6505**	**5.5700e-003**	**0.0000**	**18.7675**

3.4 Site Preparation - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0383	0.4042	0.2667	3.0000e-004		0.0233	0.0233		0.0214	0.0214	0.0000	28.3860	28.3860	8.4700e-003	0.0000	28.5639
Total	**0.0383**	**0.4042**	**0.2667**	**3.0000e-004**	**0.0690**	**0.0233**	**0.0923**	**0.0342**	**0.0214**	**0.0556**	**0.0000**	**28.3860**	**28.3860**	**8.4700e-003**	**0.0000**	**28.5639**

3.5 Grading - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	28.3859	28.3859	8.4700e-003	0.0000	28.5639
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**28.3859**	**28.3859**	**8.4700e-003**	**0.0000**	**28.5639**

3.5 Grading - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Building Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4208	3.4534	2.1556	3.0800e-003		0.2434	0.2434		0.2289	0.2289	0.0000	280.5935	280.5935	0.0704	0.0000	282.0719
Total	**0.4208**	**3.4534**	**2.1556**	**3.0800e-003**		**0.2434**	**0.2434**		**0.2289**	**0.2289**	**0.0000**	**280.5935**	**280.5935**	**0.0704**	**0.0000**	**282.0719**

3.6 Building Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	280.5932	280.5932	0.0704	0.0000	282.0716
Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**280.5932**	**280.5932**	**0.0704**	**0.0000**	**282.0716**

3.6 Building Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.0700e-003	0.0257	0.0190	3.0000e-005		2.2100e-003	2.2100e-003		2.2100e-003	2.2100e-003	0.0000	2.5533	2.5533	3.3000e-004	0.0000	2.5602
Total	**1.1799**	**0.0257**	**0.0190**	**3.0000e-005**		**2.2100e-003**	**2.2100e-003**		**2.2100e-003**	**2.2100e-003**	**0.0000**	**2.5533**	**2.5533**	**3.3000e-004**	**0.0000**	**2.5602**

3.7 Architectural Coating - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	3.3000e-004	0.0000	2.5602
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**3.3000e-004**	**0.0000**	**2.5602**

3.7 Architectural Coating - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552608	0.057937	0.185322	0.124470	0.029726	0.004465	0.012479	0.021685	0.001768	0.001276	0.005971	0.000530	0.001762

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Unmitigated	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.1000e-004	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.1000e-004	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2018)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2018. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	5/4/2018	12/28/2018
tblConstructionPhase	PhaseEndDate	1/25/2019	12/28/2018
tblConstructionPhase	PhaseEndDate	1/25/2019	4/6/2018
tblConstructionPhase	PhaseStartDate	4/7/2018	12/2/2018
tblConstructionPhase	PhaseStartDate	3/10/2018	2/10/2018
tblConstructionPhase	PhaseStartDate	12/29/2018	3/10/2018

tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2018
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	1.5889	3.7737	2.9182	4.2300e-003	0.1841	0.2299	0.4140	0.0876	0.2153	0.3029	0.0000	376.3667	376.3667	0.0972	0.0000	378.4085
Total	**1.5889**	**3.7737**	**2.9182**	**4.2300e-003**	**0.1841**	**0.2299**	**0.4140**	**0.0876**	**0.2153**	**0.3029**	**0.0000**	**376.3667**	**376.3667**	**0.0972**	**0.0000**	**378.4085**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	1.2451	0.5122	2.7052	4.2300e-003	0.1841	0.0181	0.2022	0.0876	0.0174	0.1050	0.0000	376.3663	376.3663	0.0972	0.0000	378.4080
Total	**1.2451**	**0.5122**	**2.7052**	**4.2300e-003**	**0.1841**	**0.0181**	**0.2022**	**0.0876**	**0.0174**	**0.1050**	**0.0000**	**376.3663**	**376.3663**	**0.0972**	**0.0000**	**378.4080**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**21.64**	**86.43**	**7.30**	**0.00**	**0.00**	**92.12**	**51.15**	**0.00**	**91.93**	**65.34**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	
2	Site Preparation	Site Preparation	1/27/2018	2/9/2018	5	10	
3	Grading	Grading	2/10/2018	3/9/2018	5	20	
4	Building Construction	Building Construction	2/10/2018	12/28/2018	5	230	
5	Paving	Paving	3/10/2018	4/6/2018	5	20	
6	Architectural Coating	Architectural Coating	12/2/2018	12/28/2018	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Paving	Pavers	2	8.00	125	0.42

Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0356	0.3683	0.3173	4.0000e-004		0.0181	0.0181		0.0169	0.0169	0.0000	36.1362	36.1362	9.9900e-003	0.0000	36.3460
Total	**0.0356**	**0.3683**	**0.3173**	**4.0000e-004**	**0.0248**	**0.0181**	**0.0429**	**3.7500e-003**	**0.0169**	**0.0206**	**0.0000**	**36.1362**	**36.1362**	**9.9900e-003**	**0.0000**	**36.3460**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.3100e-003	0.0570	0.2369	4.0000e-004		3.2200e-003	3.2200e-003		3.2200e-003	3.2200e-003	0.0000	36.1361	36.1361	9.9900e-003	0.0000	36.3459
Total	**9.3100e-003**	**0.0570**	**0.2369**	**4.0000e-004**	**0.0248**	**3.2200e-003**	**0.0280**	**3.7500e-003**	**3.2200e-003**	**6.9700e-003**	**0.0000**	**36.1361**	**36.1361**	**9.9900e-003**	**0.0000**	**36.3459**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0215	0.2280	0.1812	2.0000e-004		0.0118	0.0118		0.0109	0.0109	0.0000	17.8705	17.8705	5.5600e-003	0.0000	17.9873
Total	**0.0215**	**0.2280**	**0.1812**	**2.0000e-004**	**0.0903**	**0.0118**	**0.1022**	**0.0497**	**0.0109**	**0.0605**	**0.0000**	**17.8705**	**17.8705**	**5.5600e-003**	**0.0000**	**17.9873**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	17.8705	17.8705	5.5600e-003	0.0000	17.9873
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**17.8705**	**17.8705**	**5.5600e-003**	**0.0000**	**17.9873**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0300	0.3107	0.2400	3.0000e-004		0.0172	0.0172		0.0158	0.0158	0.0000	27.1530	27.1530	8.4500e-003	0.0000	27.3305
Total	**0.0300**	**0.3107**	**0.2400**	**3.0000e-004**	**0.0690**	**0.0172**	**0.0862**	**0.0342**	**0.0158**	**0.0500**	**0.0000**	**27.1530**	**27.1530**	**8.4500e-003**	**0.0000**	**27.3305**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	27.1529	27.1529	8.4500e-003	0.0000	27.3304
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**27.1529**	**27.1529**	**8.4500e-003**	**0.0000**	**27.3304**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.6750	2.0163	3.0800e-003		0.1718	0.1718		0.1616	0.1616	0.0000	272.2851	272.2851	0.0666	0.0000	273.6844
Total	**0.3069**	**2.6750**	**2.0163**	**3.0800e-003**		**0.1718**	**0.1718**		**0.1616**	**0.1616**	**0.0000**	**272.2851**	**272.2851**	**0.0666**	**0.0000**	**273.6844**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	272.2848	272.2848	0.0666	0.0000	273.6841

Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**272.2848**	**272.2848**	**0.0666**	**0.0000**	**273.6841**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0161	0.1716	0.1449	2.2000e-004		9.3900e-003	9.3900e-003		8.6400e-003	8.6400e-003	0.0000	20.3687	20.3687	6.3400e-003	0.0000	20.5019
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0161**	**0.1716**	**0.1449**	**2.2000e-004**		**9.3900e-003**	**9.3900e-003**		**8.6400e-003**	**8.6400e-003**	**0.0000**	**20.3687**	**20.3687**	**6.3400e-003**	**0.0000**	**20.5019**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0161	0.1716	0.1449	2.2000e-004		9.3900e-003	9.3900e-003		8.6400e-003	8.6400e-003	0.0000	20.3687	20.3687	6.3400e-003	0.0000	20.5019
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0161**	**0.1716**	**0.1449**	**2.2000e-004**		**9.3900e-003**	**9.3900e-003**		**8.6400e-003**	**8.6400e-003**	**0.0000**	**20.3687**	**20.3687**	**6.3400e-003**	**0.0000**	**20.5019**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.9900e-003	0.0201	0.0185	3.0000e-005		1.5100e-003	1.5100e-003		1.5100e-003	1.5100e-003	0.0000	2.5533	2.5533	2.4000e-004	0.0000	2.5584
Total	**1.1788**	**0.0201**	**0.0185**	**3.0000e-005**		**1.5100e-003**	**1.5100e-003**		**1.5100e-003**	**1.5100e-003**	**0.0000**	**2.5533**	**2.5533**	**2.4000e-004**	**0.0000**	**2.5584**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	2.4000e-004	0.0000	2.5584
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**2.4000e-004**	**0.0000**	**2.5584**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551461	0.058468	0.185554	0.123211	0.029507	0.004440	0.012712	0.023230	0.001775	0.001270	0.006089	0.000516	0.001766

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Unmitigated	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2020)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2020. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/26/2021	12/29/2020
tblConstructionPhase	PhaseEndDate	12/29/2020	12/28/2020
tblConstructionPhase	PhaseEndDate	1/25/2021	3/10/2020
tblConstructionPhase	PhaseEndDate	4/7/2020	12/29/2020
tblConstructionPhase	PhaseStartDate	12/30/2020	12/2/2020
tblConstructionPhase	PhaseStartDate	2/12/2020	2/11/2020

tblConstructionPhase	PhaseStartDate	12/29/2020	2/12/2020
tblConstructionPhase	PhaseStartDate	3/11/2020	12/2/2020
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2020
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	1.5095	3.1128	2.7824	4.2300e-003	0.1841	0.1748	0.3589	0.0876	0.1636	0.2512	0.0000	365.7192	365.7192	0.0951	0.0000	367.7161
Total	**1.5095**	**3.1128**	**2.7824**	**4.2300e-003**	**0.1841**	**0.1748**	**0.3589**	**0.0876**	**0.1636**	**0.2512**	**0.0000**	**365.7192**	**365.7192**	**0.0951**	**0.0000**	**367.7161**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	1.2412	0.4723	2.7034	4.2300e-003	0.1841	0.0154	0.1996	0.0876	0.0148	0.1025	0.0000	365.7188	365.7188	0.0951	0.0000	367.7157
Total	**1.2412**	**0.4723**	**2.7034**	**4.2300e-003**	**0.1841**	**0.0154**	**0.1996**	**0.0876**	**0.0148**	**0.1025**	**0.0000**	**365.7188**	**365.7188**	**0.0951**	**0.0000**	**367.7157**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**17.77**	**84.83**	**2.84**	**0.00**	**0.00**	**91.17**	**44.40**	**0.00**	**90.93**	**59.22**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.0900e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.0900e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e

Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2020	1/28/2020	5	20	
2	Site Preparation	Site Preparation	1/29/2020	2/11/2020	5	10	
3	Building Construction	Building Construction	2/11/2020	12/28/2020	5	230	
4	Grading	Grading	2/12/2020	3/10/2020	5	20	
5	Paving	Paving	12/2/2020	12/29/2020	5	20	
6	Architectural Coating	Architectural Coating	12/2/2020	12/29/2020	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37

Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0310	0.3102	0.2961	4.0000e-004		0.0149	0.0149		0.0139	0.0139	0.0000	34.9914	34.9914	9.9200e-003	0.0000	35.1997
Total	**0.0310**	**0.3102**	**0.2961**	**4.0000e-004**	**0.0248**	**0.0149**	**0.0397**	**3.7500e-003**	**0.0139**	**0.0176**	**0.0000**	**34.9914**	**34.9914**	**9.9200e-003**	**0.0000**	**35.1997**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.3000e-003	0.0508	0.2365	4.0000e-004		2.5300e-003	2.5300e-003		2.5300e-003	2.5300e-003	0.0000	34.9914	34.9914	9.9200e-003	0.0000	35.1997
Total	**8.3000e-003**	**0.0508**	**0.2365**	**4.0000e-004**	**0.0248**	**2.5300e-003**	**0.0273**	**3.7500e-003**	**2.5300e-003**	**6.2800e-003**	**0.0000**	**34.9914**	**34.9914**	**9.9200e-003**	**0.0000**	**35.1997**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0186	0.1943	0.1646	2.0000e-004		9.6500e-003	9.6500e-003		8.8800e-003	8.8800e-003	0.0000	17.2015	17.2015	5.5600e-003	0.0000	17.3183
Total	**0.0186**	**0.1943**	**0.1646**	**2.0000e-004**	**0.0903**	**9.6500e-003**	**0.1000**	**0.0497**	**8.8800e-003**	**0.0585**	**0.0000**	**17.2015**	**17.2015**	**5.5600e-003**	**0.0000**	**17.3183**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	17.2015	17.2015	5.5600e-003	0.0000	17.3183
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**17.2015**	**17.2015**	**5.5600e-003**	**0.0000**	**17.3183**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2428	2.1947	1.9330	3.0800e-003		0.1280	0.1280		0.1203	0.1203	0.0000	265.2474	265.2474	0.0646	0.0000	266.6045
Total	**0.2428**	**2.1947**	**1.9330**	**3.0800e-003**		**0.1280**	**0.1280**		**0.1203**	**0.1203**	**0.0000**	**265.2474**	**265.2474**	**0.0646**	**0.0000**	**266.6045**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	265.2471	265.2471	0.0646	0.0000	266.6042
Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**265.2471**	**265.2471**	**0.0646**	**0.0000**	**266.6042**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0256	0.2590	0.2268	3.0000e-004		0.0137	0.0137		0.0126	0.0126	0.0000	26.1236	26.1236	8.4500e-003	0.0000	26.3010
Total	**0.0256**	**0.2590**	**0.2268**	**3.0000e-004**	**0.0690**	**0.0137**	**0.0828**	**0.0342**	**0.0126**	**0.0469**	**0.0000**	**26.1236**	**26.1236**	**8.4500e-003**	**0.0000**	**26.3010**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	26.1236	26.1236	8.4500e-003	0.0000	26.3010
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**26.1236**	**26.1236**	**8.4500e-003**	**0.0000**	**26.3010**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0133	0.1378	0.1435	2.2000e-004		7.3900e-003	7.3900e-003		6.8000e-003	6.8000e-003	0.0000	19.6021	19.6021	6.3400e-003	0.0000	19.7352
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0133**	**0.1378**	**0.1435**	**2.2000e-004**		**7.3900e-003**	**7.3900e-003**		**6.8000e-003**	**6.8000e-003**	**0.0000**	**19.6021**	**19.6021**	**6.3400e-003**	**0.0000**	**19.7352**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0133	0.1378	0.1435	2.2000e-004		7.3900e-003	7.3900e-003		6.8000e-003	6.8000e-003	0.0000	19.6020	19.6020	6.3400e-003	0.0000	19.7352
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0133**	**0.1378**	**0.1435**	**2.2000e-004**		**7.3900e-003**	**7.3900e-003**		**6.8000e-003**	**6.8000e-003**	**0.0000**	**19.6020**	**19.6020**	**6.3400e-003**	**0.0000**	**19.7352**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.4200e-003	0.0168	0.0183	3.0000e-005		1.1100e-003	1.1100e-003		1.1100e-003	1.1100e-003	0.0000	2.5533	2.5533	2.0000e-004	0.0000	2.5574
Total	**1.1782**	**0.0168**	**0.0183**	**3.0000e-005**		**1.1100e-003**	**1.1100e-003**		**1.1100e-003**	**1.1100e-003**	**0.0000**	**2.5533**	**2.5533**	**2.0000e-004**	**0.0000**	**2.5574**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	2.0000e-004	0.0000	2.5574
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**2.0000e-004**	**0.0000**	**2.5574**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551785	0.058740	0.185183	0.122735	0.029388	0.004432	0.012603	0.023662	0.001776	0.001268	0.006159	0.000502	0.001767

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Unmitigated	0.8809	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Total	**0.8809**	**2.0000e-005**	**2.0900e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.0900e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2030)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2030
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2030. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/24/2031	12/27/2030
tblConstructionPhase	PhaseEndDate	1/13/2031	12/20/2030
tblConstructionPhase	PhaseEndDate	1/17/2031	12/27/2030
tblConstructionPhase	PhaseEndDate	1/10/2031	12/27/2030
tblConstructionPhase	PhaseStartDate	12/28/2030	12/2/2030
tblConstructionPhase	PhaseStartDate	2/26/2030	2/2/2030

tblConstructionPhase	PhaseStartDate	12/21/2030	12/2/2030
tblConstructionPhase	PhaseStartDate	12/28/2030	12/14/2030
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2030
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2030	1.3898	1.2250	2.4831	4.8400e-003	0.1841	0.0284	0.2125	0.0876	0.0284	0.1160	0.0000	419.4097	419.4097	0.0173	0.0000	419.7725
Total	**1.3898**	**1.2250**	**2.4831**	**4.8400e-003**	**0.1841**	**0.0284**	**0.2125**	**0.0876**	**0.0284**	**0.1160**	**0.0000**	**419.4097**	**419.4097**	**0.0173**	**0.0000**	**419.7725**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2030	1.2396	0.3886	2.7145	4.8400e-003	0.1841	9.6700e-003	0.1938	0.0876	9.6700e-003	0.0973	0.0000	419.4092	419.4092	0.0173	0.0000	419.7720
Total	**1.2396**	**0.3886**	**2.7145**	**4.8400e-003**	**0.1841**	**9.6700e-003**	**0.1938**	**0.0876**	**9.6700e-003**	**0.0973**	**0.0000**	**419.4092**	**419.4092**	**0.0173**	**0.0000**	**419.7720**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**10.81**	**68.27**	**-9.32**	**0.00**	**0.00**	**65.94**	**8.81**	**0.00**	**65.94**	**16.14**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e

Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2030	1/28/2030	5	20	
2	Paving	Paving	1/29/2030	2/25/2030	5	20	
3	Building Construction	Building Construction	2/2/2030	12/20/2030	5	230	
4	Grading	Grading	12/2/2030	12/27/2030	5	20	
5	Architectural Coating	Architectural Coating	12/2/2030	12/27/2030	5	20	
6	Site Preparation	Site Preparation	12/14/2030	12/27/2030	5	10	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74

Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0208	0.0941	0.1962	4.4000e-004		3.4300e-003	3.4300e-003		3.4300e-003	3.4300e-003	0.0000	40.7184	40.7184	1.6900e-003	0.0000	40.7538
Total	**0.0208**	**0.0941**	**0.1962**	**4.4000e-004**	**0.0248**	**3.4300e-003**	**0.0282**	**3.7500e-003**	**3.4300e-003**	**7.1800e-003**	**0.0000**	**40.7184**	**40.7184**	**1.6900e-003**	**0.0000**	**40.7538**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.4200e-003	0.0352	0.2360	4.4000e-004		9.2000e-004	9.2000e-004		9.2000e-004	9.2000e-004	0.0000	40.7184	40.7184	1.6900e-003	0.0000	40.7538
Total	**6.4200e-003**	**0.0352**	**0.2360**	**4.4000e-004**	**0.0248**	**9.2000e-004**	**0.0257**	**3.7500e-003**	**9.2000e-004**	**4.6700e-003**	**0.0000**	**40.7184**	**40.7184**	**1.6900e-003**	**0.0000**	**40.7538**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0698	0.1552	2.7000e-004		3.2300e-003	3.2300e-003		3.2300e-003	3.2300e-003	0.0000	23.5867	23.5867	1.1100e-003	0.0000	23.6099
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0136**	**0.0698**	**0.1552**	**2.7000e-004**		**3.2300e-003**	**3.2300e-003**		**3.2300e-003**	**3.2300e-003**	**0.0000**	**23.5867**	**23.5867**	**1.1100e-003**	**0.0000**	**23.6099**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0698	0.1552	2.7000e-004		3.2300e-003	3.2300e-003		3.2300e-003	3.2300e-003	0.0000	23.5867	23.5867	1.1100e-003	0.0000	23.6099
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0136**	**0.0698**	**0.1552**	**2.7000e-004**		**3.2300e-003**	**3.2300e-003**		**3.2300e-003**	**3.2300e-003**	**0.0000**	**23.5867**	**23.5867**	**1.1100e-003**	**0.0000**	**23.6099**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1500	0.9106	1.8551	3.5400e-003		0.0170	0.0170		0.0170	0.0170	0.0000	300.9635	300.9635	0.0121	0.0000	301.2172
Total	**0.1500**	**0.9106**	**1.8551**	**3.5400e-003**		**0.0170**	**0.0170**		**0.0170**	**0.0170**	**0.0000**	**300.9635**	**300.9635**	**0.0121**	**0.0000**	**301.2172**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.5400e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	300.9631	300.9631	0.0121	0.0000	301.2168
Total	**0.0376**	**0.2563**	**2.0023**	**3.5400e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**300.9631**	**300.9631**	**0.0121**	**0.0000**	**301.2168**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0163	0.0766	0.1739	3.4000e-004		2.4500e-003	2.4500e-003		2.4500e-003	2.4500e-003	0.0000	31.1492	31.1492	1.3100e-003	0.0000	31.1768
Total	**0.0163**	**0.0766**	**0.1739**	**3.4000e-004**	**0.0690**	**2.4500e-003**	**0.0715**	**0.0342**	**2.4500e-003**	**0.0367**	**0.0000**	**31.1492**	**31.1492**	**1.3100e-003**	**0.0000**	**31.1768**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	3.6300e-003	0.0157	0.1966	3.4000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	31.1491	31.1491	1.3100e-003	0.0000	31.1767
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.4000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**31.1491**	**31.1491**	**1.3100e-003**	**0.0000**	**31.1767**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Architectural Coating - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.3100e-003	8.5600e-003	0.0180	3.0000e-005		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	2.5533	2.5533	1.0000e-004	0.0000	2.5554
Total	**1.1771**	**8.5600e-003**	**0.0180**	**3.0000e-005**		**2.0000e-004**	**2.0000e-004**		**2.0000e-004**	**2.0000e-004**	**0.0000**	**2.5533**	**2.5533**	**1.0000e-004**	**0.0000**	**2.5554**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	1.0000e-004	0.0000	2.5554
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**1.0000e-004**	**0.0000**	**2.5554**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Site Preparation - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0121	0.0653	0.0847	2.1000e-004		2.1100e-003	2.1100e-003		2.1100e-003	2.1100e-003	0.0000	20.4388	20.4388	9.9000e-004	0.0000	20.4595
Total	**0.0121**	**0.0653**	**0.0847**	**2.1000e-004**	**0.0903**	**2.1100e-003**	**0.0924**	**0.0497**	**2.1100e-003**	**0.0518**	**0.0000**	**20.4388**	**20.4388**	**9.9000e-004**	**0.0000**	**20.4595**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.1000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	20.4387	20.4387	9.9000e-004	0.0000	20.4594
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.1000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**20.4387**	**20.4387**	**9.9000e-004**	**0.0000**	**20.4594**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552333	0.058808	0.184358	0.118913	0.029447	0.004459	0.013404	0.026791	0.001843	0.001224	0.006259	0.000436	0.001725

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Unmitigated	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.9000e-004	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.9000e-004	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

APPENDIX C
RAMBOLL ENVIRON MOBILE EMISSIONS CALCULATIONS
(provided electronically)

Prepared for
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STANFORD 2018 GENERAL USE PERMIT: ENERGY TECHNICAL REPORT

STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ABAG	Association of Bay Area Governments
ARB	California Air Resources Board
BAU	"Business-As-Usual"
CalEEMod®	California Emissions Estimator Model
CARB	California Air Resources Board
CEC	California Energy Commission
CEF	Central Energy Facility
CEQA	California Environmental Quality Act
CHP	Combined Heat and Power
CPUC	California Public Utilities Commission
DOT	Department of Transportation
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
GUP	General Use Permit
GWh	Gigawatt Hours
HRC	Heat-recovery chillers
ISO	Independent System Operator
ISTEA	Intermodal Surface Transportation Efficiency Act
LCFS	Low Carbon Fuel Standard
LPG	Liquefied Petroleum Gas
MMBTU	Million British Thermal Units
MMT CO_2e	Million Metric Ton of Carbon Dioxide-Equivalent
MPG	Miles per Gallon
MWh	megawatt-hour
OPR	Office of Planning and Research
PG&E	Pacific Gas & Electric
PV	Photovoltaic
RPS	Responsible Laboratory Management Practices
SB	Senate Bill

SESI	Stanford Energy System Innovations
Sq Ft	Square Feet
USEPA	United States Environmental Protection Agency
VMT	vehicle miles traveled

1. INTRODUCTION

Please note that this report replaces the Energy Technical Report dated May 15, 2017. This updated report incorporates updates to the traffic data that result in minor changes to mobile fuel consumption.

1.1 Project Description

Stanford University's contiguous lands occupy over 8,000 acres, with 4,017 of those acres in unincorporated Santa Clara County. The development of the Stanford land in unincorporated Santa Clara County currently is subject to conditions of approval in the 2000 General Use Permit (GUP). The 2000 GUP authorized the development of 2.035 million square feet (sq ft) of net new academic space and 3,018 net new housing units. In March 2016 the Santa Clara County Planning Commission authorized an additional 1,450 housing units. As of December 2015, 769,354 sq ft of academic buildings remained to be built under the 2000 GUP. Stanford is proposing a 2018 General Use Permit that would authorize 2.275 million net new academic space and 3,150 net new housing units. Stanford estimates that the new development authorized by the proposed 2018 General Use Permit would occur between 2018 and 2035.

1.2 Analysis Years

This report evaluates the potential energy impacts of the proposed Project with particular emphasis on avoiding or reducing inefficient, wasteful, or unnecessary consumption of energy. Existing conditions presented here represent the following years of operation: 2014, 2015, and annualized emissions for Fall 2018. The Fall 2018 analysis year is used as the baseline, and this baseline includes all development under the 2000 General Use Permit expected to be built and occupied by the date of approval of the 2018 General Use Permit. An estimate for Fall 2020 operations is presented to show the additional consumption due to the new Escondido Village graduate housing. Estimates for the Project buildout year of 2035 are also presented.

1.2.1 Study Area Boundaries

Stanford anticipates that the 2018 GUP will continue to cover all of its lands in unincorporated Santa Clara County. However, the GUP does not apply to land uses within those areas that are permitted as of right. The single-family and two-family residences in the faculty/staff subdivision are permitted as of right, and therefore are not included in the study area for this existing conditions report. In addition, Stanford does not propose development under the 2018 GUP in areas zoned for medium-density faculty and staff housing (the Peter Coutts, Pearce Mitchell, and Olmsted Terrace housing areas). Nor does Stanford propose development outside the Academic Growth Boundary, including on the Stanford Golf Course. Therefore, these areas similarly are not included in the study area boundary for this existing conditions report.

The study area boundary includes all of the Academic Campus and Campus Open Space lands, including the Stanford Driving Range, which Stanford proposes to designate as Academic Campus rather than medium-density residential. Thirty-eight faculty and staff housing units are included in the study area in the Searsville and Olmsted staff rental subdivisions. The study area within which the emissions are analyzed is shown on Figure 1-2.

1.2.2 Existing Conditions Analysis Years

This document contains the evaluation of three scenario years to represent existing conditions. A more complete description of the existing condition years and the recent history of Stanford's emissions profile is provided in **Section 3.1**. The scenario years are:

1. 2014, which represents the actual historic campus energy usage prior to the implementation of the Stanford Energy System Innovations (SESI) and also includes the operations of the Valero Service Station. This period uses data from 2014. A major feature of SESI was the replacement of the steam-based heating system with a hot-water based heating system, and replacement of the cogeneration plant with a new more efficient Central Energy Facility (CEF). A fuller description of the SESI and a comparison of the old and new CEF is provided in **Section 3.1**. The 2014 information is provided to aid in understanding the degree to which historic energy consumption has been reduced.
2. 2015, which represents the current campus usage after implementation of SESI. This period uses data from 2015. Natural gas and electricity usage is based on July – December 2015, after SESI is implemented. This scenario also reflects emission factors consistent with a period beginning in 2015.
3. Fall 2018, Baseline, which represents the annualized campus energy usage that is expected to exist immediately prior to commencement of operations under the proposed 2018 GUP. This includes buildings that would be expected to be permitted and occupied during implementation of the 2000 GUP and also reflects emission factors consistent with 2018. The Fall 2018 Baseline scenario assumes that the Escondido Village Graduate Residences Project is under construction, but not yet occupied and operational.
4. Fall 2020, which represents the annualized campus energy usage that is expected to exist after complete buildout of the 2000 GUP, including the operations from the Escondido Village Graduate Residences. This scenario reflects emission factors consistent with 2020.

Both pre-SESI (2014) and post-SESI (2015) inventories are provided here to provide context for the Fall 2018 Baseline inventory. 2014 represents the historic campus energy usage prior to SESI. 2015 represents the current campus usage after SESI. The 2015 emissions inventory was used to develop the Fall 2018 Baseline inventory by incorporating assumptions on additional campus growth under the existing 2000 GUP in certain categories, such as an increase in academic square footage and residential beds. The Fall 2020 emissions inventory represents the same conditions as Fall 2018 but with the addition of 2,020 net new beds for Escondido Village Graduate Residences. Sections 3 and 4 of this technical report provide comparisons of the 2014, 2015, Fall 2018 Baseline, and Fall 2020 inventories, illustrating the effect of SESI (between 2014 and 2015), the remaining growth of the campus under the 2000 GUP with the exception of the Escondido Village Graduate Residences, and the impact of increased electricity generation from the solar farm (Fall 2018, Baseline), and the effect of the additional Escondido Village Graduate Residences (Fall 2020).

1.2.3 Project Analysis

This document evaluates the energy consumption for complete buildout of the 2018 GUP (i.e., the Project). This scenario is called "Fall 2035" because it consists of the full Project operations expected by 2035; however, because California has adopted regulatory measures for GHG emissions that take effect by 2030, the Project energy inventory is based on these adopted 2030 regulatory measures (e.g., RPS) and emission factors (e.g., EMFAC2014

mobile factors), assuming the total operational activity from complete buildout and operation of the 2018 GUP in 2030. If 2035 emission factors were used instead of 2030 emission factors, mobile fuel consumption would result in a lower value than reported here but all other categories would remain the same. The analysis is conservative because California revises its building energy standards (Title 24) on a periodic basis. California's building codes are published in their entirety every three years. Intervening Code Adoption Cycles produce Supplement pages half-way (18 months) into each triennial period. The next Title 24 code to be published is the 2016 Supplement, which will be published before January 2018 and will take effect on July 2018. Each subsequent building code has required more energy efficiency than the previous codes. Accordingly, because this analysis is based on current codes, it necessarily will result in an overestimate of actual energy usage in buildings.

2. ENERGY ENVIRONMENTAL AND REGULATORY OVERVIEW

2.1 General Setting

2.1.1 Energy Production and Distribution

Among the states, California ranks third in the nation in production of crude oil, 15th in production of natural gas, fourth in generation of hydroelectric power, 15th in electricity generation from nuclear power, second in net electricity generation from all other renewable energy sources besides hydroelectric, and first as a producer of electricity from biomass, geothermal, and solar energy.[1] California produces approximately 10% of the natural gas used in the state; approximately 90% of the natural gas used in California is imported from Canada, the Southwest, and the Rocky Mountains region of the United States. Over half of the crude oil refined in California is from foreign countries, including Saudi Arabia, Ecuador, and Colombia. Additional crude oil is imported from Alaska. Over one-fourth of California's electricity is from out-of-state locations in the Pacific Northwest and the Southwest.[2]

Electricity and Natural Gas Supply

The production of electricity requires the combustion, consumption, or conversion of other energy resources, including water, wind, oil, natural gas, coal, solar, geothermal, and nuclear. Of the electricity that is generated within the state, 54% is generated by natural gas-fired power plants, 8% by nuclear power plants, 13% by hydroelectric, and a remaining 25% by other renewables.[3]

Natural gas ultimately supplies the largest portion of California's electricity market; natural gas-fired power plants in California meet approximately 32% of the in-state electricity demand.[3] In addition to the generation of electricity, natural gas is also widely used for industrial, commercial, and residential heating. Most of the natural gas consumed in California comes from the Southwest, the Rocky Mountains, and Canada, while the remainder is produced in California. Although contractually California can receive natural gas from any producing region in North America, it can only take supplies from the three producing regions due to the current pipeline configuration.

For Santa Clara County, Pacific Gas & Electric (PG&E) is the primary supplier of electricity and natural gas to businesses and residents of the area. PG&E's service area extends from Eureka to Bakersfield (north to south), and from the Sierra Nevada to the Pacific Ocean (east to west). PG&E's electricity production facilities include natural gas-fired, coal-fired, and hydroelectric plants. PG&E obtains its energy supplies from power plants and natural gas fields in northern California and from electricity and natural gas purchased outside its service area and delivered through high-voltage transmission lines of the power grid and through gas pipelines.

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[1] U.S. Energy Information Administration. 2016. California State Profile and Energy Estimates: Quick Facts. Available online at: http://www.eia.gov/state/?sid=CA. Accessed November 28, 2016.
[2] U.S. Energy Information Administration. 2016. California State Profile and Energy Estimates: Profile Analysis. Available online at: https://www.eia.gov/state/analysis.cfm?sid=CA. Accessed November 30, 2016.
[3] U.S. Energy Information Administration. 2016. California State Profile and Energy Estimates: Electricity. Available online at: http://www.eia.gov/state/?sid=CA#tabs-4. Accessed November 28, 2016.

Stanford purchases "direct access" electricity for the majority of its campus operations. This program allows for a choice of energy services provider rather than solely purchasing electricity from the utility company.[4] Stanford's 2014 direct access provider is Constellation Energy. Previously, campus electricity was also generated by the Cardinal Cogen in 2014. By 2017, Stanford will operate the Stanford Solar Generating Station in Kern County that will provide half of campus electricity by renewable sources.[5]

Transportation Fuels Supply

Most petroleum fuel refined in California is for use in on-road motor vehicles and is refined within California to meet state-specific formulations required by the California Air Resources Board (CARB). The major categories of petroleum fuels are gasoline and diesel for passenger vehicles, transit, and rail vehicles; and fuel oil for industry and emergency electrical power generation. Other liquid fuels include kerosene, jet fuel, and residual fuel oil for marine vessels.

California's oil fields comprise the fourth-largest petroleum-producing area in the United States, behind federal offshore production, Texas, and North Dakota. Crude oil is moved from area to area within California through a network of pipelines that carry it from both onshore and offshore oil wells to the refineries that are located in the San Francisco Bay Area, the Los Angeles area, and the Central Valley. Currently, 16 petroleum refineries operate in California, processing approximately 2.0 million barrels per day of crude oil.[6]

Other transportation fuel sources are alternative fuels, such as methanol and denatured ethanol (alcohol mixtures that contain no less than 70% alcohol), natural gas (compressed or liquefied), liquefied petroleum gas (LPG), hydrogen, and fuels derived from biological materials (i.e., biomass).

2.1.2 Energy Consumption

Electricity and Natural Gas Consumption

Californians consumed 282,896 gigawatt hours (GWh) of electricity in 2015, which is the most recent year for which data is available.[7] Of this total, Santa Clara County consumed 16,812 GWh.[8]

Californians consumed 10,054 million therms of natural gas in 2015.[9] Of this total, Santa Clara County consumed 411 million therms of natural gas.[10]

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[4] PGE. 2016. Electricity – Direct Access. Available at: http://www.pge.com/b2b/retailenergysuppliers/espresourcecenter/directaccessfaqs/. Accessed: July 2016.

[5] Stanford. 2015. Stanford Energy System Innovations. Available at: http://news.stanford.edu/features/2015/sesi/. Accessed: April 2017.

[6] U.S. Energy Information Administration. 2016. California State Profile and Energy Estimates: Reserves and Supply. Available online at: http://www.eia.gov/state/data.cfm?sid=CA#ReservesSupply. Accessed November 28, 2016.

[7] A watt hour is a unit of energy equivalent to one watt of power expended for one hour. For example, a typical light bulb is 60 watts, meaning that if it is left on for one hour, 60 watt hours have been used. One kilowatt equals 1,000 watts. The consumption of electrical energy by homes and businesses is usually measured in kilowatt hours (kWh). Some large businesses and institutions also use megawatt hours (MWh), where one MWh equals 1,000 kWh. One gigawatt equals one thousand (1,000) megawatts, or one million (1,000,000) kilowatts. The energy output of large power plants over long periods of time, or the energy consumption of jurisdictions, can be expressed in gigawatt hours (GWh).

[8] California Energy Commission. 2016. Energy Consumption Data Management Service. Electricity Consumption by County. Available online at: http://www.ecdms.energy.ca.gov/elecbycounty.aspx. Accessed November 28, 2016.

Transportation Sector Fuels Consumption

The transportation sector is a major end use of energy in California, accounting for approximately 38.7% of total statewide energy consumption in 2014.[11] In addition, energy is consumed in connection with construction and maintenance of transportation infrastructure, such as streets, highways, freeways, rail lines, and airport runways. California's 30 million vehicles consume more than 16 billion gallons of gasoline and more than 3 billion gallons of diesel each year, making California the second largest consumer of gasoline in the world.[12]

2.2 Regulatory Overview

2.2.1 Federal Programs

2.2.1.1 Energy Policy and Conservation Act

The Energy Policy and Conservation Act of 1975 was established in response to the oil crisis of 1973, which increased oil prices due to a shortage of reserves. The Act required that all vehicles sold in the U.S. meet certain fuel economy goals, known as the Corporate Average Fuel Economy standards. The National Highway Traffic Safety Administration (NHTSA) of the Department of Transportation (DOT) administers the Corporate Average Fuel Economy program, and the EPA provides the fuel economy data.

In April 2010, the Environmental Protection Agency (EPA) and NHTSA issued a Final Rulemaking establishing new federal fuel economy standards for model years 2012 to 2016 passenger cars and light-duty trucks. For model year 2012, the fuel economy standards for passenger cars, light trucks, and combined cars and trucks were 33.3 miles per gallon (mpg), 25.4 mpg, and 29.7 mpg, respectively.[13] These standards increase progressively up to 37.8 mpg, 28.8 mpg, and 34.1, respectively, for model year 2016. In subsequent rulemakings the agencies extended the national program of fuel economy standards to passenger vehicles and light-duty trucks of model years 2017-2025, culminating in fuel economy of 54.5 mpg by model year 2025,[14] as well as to medium- and heavy-duty vehicles of model years 2014-2018, including large pickup trucks and vans, semi-trucks, and all types and sizes of work trucks and buses.[15]

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[9] A British Thermal Unit (BTU) is the amount of energy needed to raise the temperature of one pound of water by one degree Fahrenheit. A kBTU is 1,000 BTUs. A MMBtu is 1,000,000 BTUs. A therm is 100,000 BTUs.

[10] California Energy Commission. 2016. Energy Consumption Data Management Service. Gas Consumption by County. Available online at: http://www.ecdms.energy.ca.gov/gasbycounty.aspx. Accessed November 28, 2016.

[11] U.S. Energy Information Administration. 2016. California State Profile and Energy Estimates: Consumption by Sector. Available online at: http://www.eia.gov/state/?sid=CA#tabs-2. Accessed November 28, 2016.

[12] California Energy Commission. 2016. Summary of California Vehicle and Transportation Energy. Available online at: http://www.energy.ca.gov/almanac/transportation_data/summary.html#vehicles. Accessed November 28, 2016.

[13] United States Environmental Protection Agency (EPA) and United States Department of Transportation (DOT). 2010. *Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*. Final Rule. 75 Fed. Reg. 25324-25728.

[14] United States Environmental Protection Agency (EPA) and United States Department of Transportation (DOT). 2012. *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards*; Final Rule. 77 Fed. Reg. 62623.

[15] United States Environmental Protection Agency (EPA) and United States Department of Transportation (DOT). 2011. *Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles.* 76 Fed. Reg. 57106.

2.2.1.2 Energy Policy Act of 2005 and Energy Independence and Security Act of 2007

The Energy Policy Act of 2005 seeks to reduce reliance on non-renewable energy resources and provide incentives to reduce current demand on these resources. For example, under the Energy Policy Act, consumers and businesses can attain federal tax credits for purchasing fuel-efficient appliances and products. Because driving fuel-efficient vehicles and installing energy-efficient appliances can provide many benefits, such as lower energy bills, increased indoor comfort, and reduced air pollution, businesses are eligible for tax credits for buying hybrid vehicles, building energy-efficient buildings, and improving the energy efficiency of commercial buildings. Additionally, tax credits are given for the installation of qualified fuel cells, stationary microturbine power plants, and solar power equipment.

The Energy Policy Act of 2005 also established the first renewable fuel volume mandate in the United States. The original Renewable Fuel Standard program required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012. Under the Energy Independence and Security Act of 2007, the Renewable Fuel Standard program was expanded to include diesel and to increase the volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022.

2.2.1.3 American Recovery and Reinvestment Act

The American Recovery and Reinvestment Act of 2009 was passed in response to the economic crisis of the late 2000s, with the primary purpose of maintaining existing jobs and creating new jobs. Among the secondary objectives of the American Recovery and Reinvestment Act was investment in “green” energy programs, including funding the following through grants, loans, or other funding: private companies developing renewable energy technologies; local and state governments implementing energy efficiency and clean energy programs; research in renewable energy, biofuels, and carbon capture; and development of high efficiency or electric vehicles.[16]

2.2.1.4 Intermodal Surface Transportation Efficiency Act

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 promotes the development of inter-modal transportation systems to maximize mobility as well as address national and local interests in air quality and energy. The Intermodal Surface Transportation Efficiency Act contains factors that metropolitan planning organizations, such as the Association of Bay Area Governments (ABAG), are to address in developing transportation plans and programs, including some energy-related factors. To meet the new Act requirements, metropolitan planning organizations have adopted explicit policies defining the social, economic, energy, and environmental values that guide transportation decisions in their respective metropolitan areas. The planning process for specific projects would then address these policies. Another requirement of the ISTEA is to consider the consistency of transportation planning with federal, state, and local energy goals. Through this requirement, energy consumption is expected to be a decision criterion, along with cost and other values to determine the best transportation solution.

[16] United States Environmental Protection Agency (EPA). 2009. *Recovery: EPA Gets Involved.* Accessed December 3, 2013. http://www.epa.gov/recovery.

2.2.1.5 Transportation Equity Act for the 21st Century

The Transportation Equity Act for the 21st Century ("TEA-21") was signed into law in 1998 and builds upon the initiatives established in the ISTEA legislation discussed above. TEA-21 authorizes highway, highway safety, transit, and other efficient surface transportation programs. TEA-21 continues the program structure established for highways and transit under ISTEA, such as flexibility in the use of funds, emphasis on measures to improve the environment, and focus on a strong planning process as the foundation of good transportation decisions. TEA-21 also provides for investment in research and its application to maximize the performance of the transportation system through, for example, deployment of Intelligent Transportation Systems, to help improve operations and management of transportation systems and vehicle safety.

2.2.1.6 Mobile Source Regulations

Corporate Average Fuel Economy

The Corporate Average Fuel Economy standards seek to reduce energy consumption by increasing the fuel economy of passenger cars and light-duty trucks. Additional information on this regulation can be found in the **Greenhouse Gas Technical Report**.

EPA and NHTSA Joint Rulemaking for Vehicle Standards

As discussed above, in April 2010, the EPA and NHTSA issued a final rulemaking establishing new federal greenhouse gas and fuel economy standards for model years 2012 to 2016 passenger cars, light-duty trucks, and medium-duty passenger vehicles. In addition, on August 9, 2011, the EPA and NHTSA finalized regulations to reduce greenhouse gas emissions and improve fuel efficiency of medium- and heavy-duty vehicles, including large pickup trucks and vans, semi-trucks, and all types and sizes of work trucks and buses.

In August 2016, the EPA and NHTSA adopted the next phase (Phase 2) of the fuel economy and GHG standards for medium- and heavy-duty trucks, which apply to vehicles with model year 2018 and later. [17] In response to the USEPA's adoption of the Phase 2 standards, California Air Resources Board (ARB) staff plan to bring a proposed California Phase 2 program before its Board in 2017.[18]

Additional information on this regulation can be found in the **Greenhouse Gas Technical Report**.

2.2.2 State Programs

2.2.2.1 AB 32 (Statewide GHG Reductions)

The California Global Warming Solutions Act of 2006 (AB 32) was signed into law in September 2006.[19] The law instructed ARB to develop and enforce regulations for the reporting and verification of state-wide GHG emissions. The bulk of GHG emissions in California are carbon dioxide that result from fossil fuel consumption. Therefore, a reduction in GHG emissions typically translates into reduced fuel and increased energy efficiency. The bill directed ARB to set a state-wide GHG emission limit based on 1990 levels, to be achieved

[17] USEPA. Available at: https://www3.epa.gov/otaq/climate/documents/420f16044.pdf. Accessed: September 2016.
[18] CARB, CA Phase 2 GHG webpage: http://www.arb.ca.gov/msprog/onroad/caphase2ghg/caphase2ghg.htm. Accessed: September 2016.
[19] ARB. Assembly Bill 32 Overview. 2006a. Accessed July 22, 2016. http://www.arb.ca.gov/cc/ab32/ab32.htm

by 2020. The bill set a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.

The heart of the bill is the requirement that state-wide GHG emissions be reduced to 1990 levels by 2020. Based on ARB's calculation of 1990 baseline emissions levels, California must reduce GHG emissions by approximately 28.5% below "business-as-usual" (BAU) predictions for 2020 to achieve this goal.

In June 2011, ARB revised its "BAU" GHG emission estimate for 2020 in order to account for the recent economic downturn in its emission projections.[20] The estimate presented in the Scoping Plan (596 MMT CO2e) was based on pre-recession, 2007 data from the Integrated Energy Policy Report. ARB has updated the projected "BAU" 2020 GHG emissions to 545 Million Metric Ton of Carbon Dioxide-Equivalent (MMT CO_2e).

AB 32 requires ARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions. In December 2008, ARB adopted its Climate Change Scoping Plan: A Framework for Change (Scoping Plan), which included the state's strategies for achieving AB 32's reduction targets. These strategies are implemented with additional rules and regulations pursuant to AB 32 such as Clean Cars, the low carbon fuel standard (LCFS), Title 24 building efficiency standards, and the RPS. These are discussed further below. Additional information on AB 32 can be found in the **Greenhouse Gas Technical Report**, and additional information about additional rules and regulations under the umbrella of AB 32 is below.

2.2.2.2 2008 California Energy Action Plan Update

The *2008 Energy Action Plan Update* provides a status update to the *2005 Energy Action Plan II,* which is the State of California's principal energy planning and policy document.[21] The plan continues the goals of the original *Energy Action Plan*, describes a coordinated implementation plan for state energy policies, and identifies specific action areas to ensure that California's energy is adequate, affordable, technologically advanced, and environmentally sound. First-priority actions to address California's increasing energy demands are energy efficiency, demand response (i.e., reduction of customer energy usage during peak periods in order to address system reliability and support the best use of energy infrastructure), and the use of renewable sources of power. If that these actions are unable to satisfy the increasing energy and capacity needs, the plan supports clean and efficient fossil-fired generation.

2.2.2.3 Title 24 Building Energy Efficiency Standards

The 2016 California Green Building Standards Code, as specified in Title 24, Part 11 of the California Code of Regulations, commonly referred to as CalGreen Building Standards (CalGreen), establishes voluntary and mandatory standards to improve public health, safety, and general welfare by enhancing the design and construction of buildings through the use of building concepts having a positive environmental impact and encouraging sustainable construction practices in five categories: planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and

[20] ARB. Supplement to the AB 32 Scoping Plan Functional Equivalent Document. Accessed July 22, 2016. http://www.arb.ca.gov/cc/scopingplan/document/Supplement_to_SP_FED.pdf

[21] California Public Utilities Commission and California Energy Commission (CPUC & CEC). 2008. *2008 Update, Energy Action Plan*. Available online at: http://www.energy.ca.gov/2008publications/CEC-100-2008-001/CEC-100-2008-001.PDF.

environmental quality. The provisions of this code apply to the planning, design, operation, construction, replacement, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such building structures throughout California. Examples of CalGreen provisions include reducing indoor water use, moisture sensing irrigation systems for landscaped areas, construction waste diversion goals, and energy system inspections. CalGreen is periodically amended; the most recent 2016 standards became effective on January 1, 2017.

The Energy Efficiency Standards for Residential and Nonresidential Buildings, as specified in Title 24, Part 6, of the California Code of Regulations, were established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods for building features such as space conditioning, water heating, lighting, and whole envelope. The 2005, 2008, and 2013 updates to the efficiency standards included provisions such as cool roofs on commercial buildings, increased use of skylights, and higher efficiency lighting, HVAC, and water heating systems. Additionally, some standards focused on larger energy saving concepts such as reducing loads at peak periods and seasons and improving the quality of such energy-saving installations. Past updates to the Title 24 standards have proved very effective in reducing building energy use, with the 2013 update estimated to reduce energy consumption in residential buildings by 25% and energy consumption in commercial buildings by 30%, relative to the 2008 standards.[22] The California Energy Commission (CEC) recently adopted another update in 2016, and these new standards become effective on January 1, 2017.[23] The 2016 updates include additional high efficiency lighting requirements, high performance attic and walls, and higher efficiency water and space heaters. The 2016 standards are expected to reduce residential electricity consumption by 28% and non-residential electricity by 5%.[24]

2.2.2.4 Senate Bill 32

Enacted in 2016, Senate Bill (SB) 32 (Pavley, 2016) codifies the 2030 GHG emissions reduction goal of Executive Order B-30-15 by requiring CARB to ensure that statewide GHG emissions are reduced to 40 percent below 1990 levels by 2030. Similar to AB 32, a reduction in GHG emissions typically corresponds with a reduction in energy usage as the bulk of GHGs result from the combustion of fossil fuel.

SB 32 was coupled with a companion bill: AB 197 (Garcia, 2016). Designed to improve the transparency of CARB's regulatory and policy-oriented processes, AB 197 created the Joint Legislative Committee on Climate Change Policies, a committee with the responsibility to ascertain facts and make recommendations to the Legislature concerning statewide programs, policies and investments related to climate change. AB 197 also requires CARB to make certain GHG emissions inventory data publicly available on its web site; consider the social costs of GHG emissions when adopting rules and regulations designed to achieve GHG

[22] CEC. 2012. Energy Commission Approves More Efficient Buildings for California's Future. Available online at: http://www.energy.ca.gov/releases/2012_releases/2012-05-31_energy_commission_approves_more_efficient_buildings_nr.html. Accessed: April 2017.
[23] CEC. 2016. California's Energy Efficiency Standards for Residential and Nonresidential Buildings. Available online at: http://www.energy.ca.gov/title24/2016standards/index.html. Accessed November 30, 2016.
[24] CEC. 2015. 2016 Building Energy Efficiency Standards Adoption Hearing. Available online at: http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2015-06-10_hearing/2015-06-10_Adoption_Hearing_Presentation.pdf

emission reductions; and, include specified information in all Scoping Plan updates for the emission reduction measures contained therein.

2.2.2.5 Renewables Portfolio Standard

SB 1078 (Chapter 516, Statutes of 2002) requires retail sellers of electricity, including investor-owned utilities and community choice aggregators, to obtain at least 20 percent of their supply from renewable sources by 2017. SB 107 (Chapter 464, Statutes of 2006) changed the target date to 2010. In November 2008, then-Governor Schwarzenegger signed Executive Order S-14-08, which expands the state's Renewable Portfolio Standard to 33 percent renewable power by 2020. In September 2009, then-Governor Schwarzenegger continued California's commitment to the Renewable Portfolio Standard by signing Executive Order S-21-09, which directs the ARB under its AB 32 authority to enact regulations to help the state meet its Renewable Portfolio Standard goal of 33 percent renewable energy by 2020. In April 2011, Governor Brown signed SB 2X, which legislated the prior Executive Order S-14-08 renewable standard. SB 350 further increases the RPS goals to 50 percent renewables by 2030.

In April 2015, Governor Brown issued Executive Order B-30-15, which established a greenhouse gas reduction target of 40 percent below 1990 levels by 2030. SB 350 (Chapter 547, Statutes of 2015) advanced these goals through two measures. First, the law increases the renewable power goal from 33 percent renewables by 2020 to 50 percent by 2030. Second, the law requires the CEC to establish annual targets to double energy efficiency in buildings by 2030. The law also requires the California Public Utilities Commission (CPUC) to direct electric utilities to establish annual efficiency targets and implement demand-reduction measures to achieve this goal.

2.2.2.6 Mobile Source Regulations

SB 743 (Updates to CEQA Guidelines)

Public Resources Code Section 21099(c)(1), as codified through enactment of SB 743, was enacted with the intent to change the focus of transportation analyses conducted under the California Environmental Quality Act (CEQA). SB 743 reflects a legislative policy to balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of GHG emissions. SB 743 requires the Office of Planning and Research (OPR) to establish "alternative metrics to the metrics used for traffic levels of service for transportation impacts outside transit priority areas." [25] Under SB 743, the new metrics- or significance criteria- must promote the reduction of GHG emissions, the development of multimodal transportation networks, and a diversity of land uses. SB 743 dictates that once the CEQA Guidelines are amended to include new thresholds, automobile delay, as described by level of service or similar measures of vehicular capacity or congestion, shall no longer be considered a significant impact under CEQA in all locations in which the new thresholds are applied. The Legislature gave OPR the option of applying the new thresholds only to transit priority areas, or more broadly to areas throughout the State. OPR has proposed to apply the new thresholds throughout the State.

[25] California Legislative Information. 2013. SB-743 Environmental quality: transit oriented infill projects, judicial review streamlining for environmental leadership development projects, and entertainment and sports center in the City of Sacramento. Accessed July 14, 2016. http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB743

In January 2016, OPR issued its *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA* (Revised SB 743 Proposal). Included in the Revised SB 743 Proposal is proposed new CEQA Guidelines Section 15064.3 and related revisions to Appendix G. Under the proposed new Guidelines, the analysis of transportation impacts in the CEQA context would shift from a levels of service metric to a vehicle miles traveled (VMT) metric. In proposing the new approach, OPR noted the relationship between VMT and GHG emissions. If adopted as issued by OPR in January 2016, application of the new CEQA Guidelines would be mandatory when assessing CEQA transportation impacts two years after adoption, which is anticipated in 2017.

SB 375 (Land Use Planning)

SB 375, the Sustainable Communities and Climate Protection Act of 2008, supports the State's climate action goals to reduce GHG emissions through coordinated transportation and land use planning. SB 375 required ARB to establish GHG emission reduction targets (Regional Targets) for each metropolitan planning region. On September 23, 2010, ARB adopted Regional Targets applying to the years 2020 and 2035. In 2011, ARB adopted Regional Targets of 7% for 2020 and 15% for 2035 for the area under the jurisdiction of the Association of Bay Area Governments (ABAG) jurisdiction, which includes Stanford University.

SB 375 requires Metropolitan Planning Organizations (MPO) including ABAG to incorporate a "sustainable communities strategy" (SCS) in their regional transportation plans (RTPs) that will achieve the GHG emission Reduction Targets set by ARB, primarily by reducing VMT from light-duty vehicles through development of more compact, complete, and efficient communities. ABAG prepared Plan Bay Area to fulfill this requirement.

The **Greenhouse Gas Technical Report** describes how the Project is consistent with Plan Bay Area and thus contributes to regional GHG reductions towards the ABAG's targets. In addition, the VMT Technical Report prepared by Fehr & Peers indicates that the proposed Project would generate VMT per worker and VMT per resident rates that are more than 15% below the regional averages. Reductions in GHG emissions and VMT directly translate to reductions in fossil fuel consumption.

Low Carbon Fuel Standard

The LCFS would reduce greenhouse gas emissions by reducing the carbon intensity of transportation fuels used in California by at least 10% by 2020. The requirements for this regulation are described in more detail in the **Greenhouse Gas Technical Report**.

Clean Cars

In January 2012, CARB approved the Advanced Clean Cars Program, which established an emissions control program for cars and light-duty trucks (such as SUVs, pickup trucks, and minivans) of model years 2017-2025. When the program is fully implemented, new vehicles would emit 75% less smog-forming pollutants than the average new car sold today, and greenhouse gas emissions would be reduced by nearly 35%. The requirements for this regulation are described in more detail in the **Greenhouse Gas Technical Report**.

Commercial Motor Vehicle Idling Regulation

On July 22, 2004, CARB initially adopted an Airborne Toxic Control Measure (ATCM) to limit idling of diesel-fueled commercial motor vehicles (idling ATCM) and subsequently amended it on October 20, 2005, October 19, 2009, and December 12, 2013. This ATCM is set forth in

Title 13, California Code of Regulations (CCR), Section 2485, and requires, among other things, that drivers of diesel-fueled commercial motor vehicles with gross vehicle weight ratings greater than 10,000 pounds, including buses and sleeper berth equipped trucks, not idle the vehicle's primary diesel engine longer than five minutes at any location. This anti-idling regulation helps to reduce fuel consumption by reducing engine usage. The ATCM also requires owners and motor carriers that own or dispatch these vehicles to ensure compliance with the ATCM requirements. The regulation consists of new engine and in-use truck requirements and emission performance requirements for technologies used as alternatives to idling the truck's main engine. Under the new engine requirements, 2008 and newer model year heavy-duty diesel engines need to be equipped with a non-programmable engine shutdown system that automatically shuts down the engine after five minutes of idling or optionally meet a stringent oxides of nitrogen idling emission standard.

In-Use Off-Road Diesel Fueled Fleets Regulation

On May 16, 2008, CARB approved the In-Use Off-Road Diesel Fueled Fleets Regulation (Off-Road Regulation), which was later amended on December 31, 2009, July 16, 2010, and December 14, 2011. The overall purpose of the Off-Road Regulation is to reduce emissions of oxides of nitrogen (NOx) and particulate matter (PM) from off-road diesel vehicles operating within California. The regulation applies to all self-propelled off-road diesel vehicles 25 horsepower (hp) or greater used in California and most two-engine vehicles. The Off Road Regulation:

- Imposes limits on idling (i.e., fleets must limit unnecessary idling to 5 minutes), requires a written idling policy, and requires a disclosure when selling vehicles;
- Requires all vehicles to be reported to CARB (using the Diesel Off-Road Online Reporting System, DOORS) and labelled;
- Restricts the adding of older vehicles into fleets starting on January 1, 2014; and
- Requires fleets to reduce their emissions by retiring, replacing, or repowering older engines, or installing Verified Diesel Emission Control Strategies, VDECS (i.e., exhaust retrofits).

The anti-idling component of this Off-Road Regulation helps to reduce fuel consumption by reducing engine usage.

Tractor-Trailer Greenhouse Gas Regulation

CARB's Tractor-Trailer Greenhouse Gas regulation reduces the energy consumption of large trucks. CARB developed this regulation to make heavy-duty tractors more fuel efficient. Fuel efficiency is improved by requiring the use of aerodynamic tractors and trailers that are also equipped with low rolling resistance tires. The tractors and trailers subject to this regulation must either use United States Environmental Protection Agency SmartWay (SmartWay) certified tractors and trailers, or retrofit their existing fleet with SmartWay verified technologies. The SmartWay certification process is part of their broader voluntary program called the SmartWay Transport Partnership Program. The regulation applies primarily to owners of 53-foot or longer box-type trailers, and owners of the heavy-duty tractors that pull them on California highways. These owners are responsible for replacing or retrofitting their affected vehicles with compliant aerodynamic technologies and low rolling resistance tires. All owners regardless of where their vehicle is registered must comply with the regulation when they operate their affected vehicles on California highways. Besides the owners of

these vehicles, drivers, motor carriers, California-based brokers and California-based shippers that operate or use them also share in the responsibility for compliance with the regulation.

3. EXISTING CONDITIONS AND 2035 PROJECT

3.1 Stanford Energy System Innovations (SESI)

In 2015, Stanford completed a groundbreaking overhaul of its campus heating and cooling system. This overhaul is called the Stanford Energy System Innovations- or SESI. SESI relies on a heat-recovery process that is 70 percent more efficient than the prior cogeneration process for heating and cooling. The new system will meet more than 90 percent of the campus heating demands by capturing almost two-thirds of the waste heat generated by the campus cooling system. To make that exchange possible, Stanford replaced 22 miles of underground pipes and retrofitted 155 buildings to convert the campus from a steam- to hot water- based system. In addition, Stanford now purchases its electricity through a Direct Access program that enables purchase from Electric Service Providers that include renewable resources within their portfolios.

The new CEF includes the following equipment:

- three hot water generators,
- two emergency generators,
- electric-powered chillers, and
- thermal energy storage tanks.

The hot water generators supply hot water for building heating and primarily run on natural gas, with the additional capability to run on diesel fuel in emergencies. The emergency generators run on diesel fuel.

According to Stanford's Office of Sustainability, on-campus solar panels are expected to generate approximately 7,300 megawatt-hour (MWh)/year, while the Stanford Solar Generation Farm is expected to generate 159,000 MWh/year by 2017.

3.1.1 Electricity

Locations on campus acquire electricity from several providers. For the 2014 energy inventory, electricity usage for the 2014 calendar year was provided by Stanford for PGE Commercial customers, direct access customers, imports to the old CEF when the Cardinal Cogen was down, imports to Cardinal Cogen campus service areas when the Cardinal Cogen was down, and commercial non-Stanford accounts. These service providers are described in more detail in the Greenhouse Gas Technical Report Table 3-6-1. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was estimated using California Emissions Estimator Model (CalEEMod®) assumptions. In 2014, the old CEF housed a cogeneration plant that imported natural gas to generate steam and electricity. This analysis presents energy usage based on the raw resource used, in this case, natural gas. The analysis separately highlights electricity used by Stanford that was generated from the natural gas. Total electricity imported by Stanford in 2014 was 15,966 MWh. Total electricity usage in the study area in 2014 was 269,100 MWh. However, 94 percent of that electricity was generated by the Cardinal Cogeneration plant, and the fuel used to generate that electricity is already accounted for in the natural gas usage reported below in **Section 3.1.2**.

For the 2015 energy inventory, electricity usage for July through December 2015 for PG&E Commercial customers, direct access customers, campus, and the new CEF usage (no

longer from the Cardinal Cogen) was provided by Stanford. The July – December usage was doubled to account for an entire year. The entire 2015 calendar year was not used because the new CEF was brought online in April 2015. Thus, doubling the July – December usage is assumed to be representative of a year's worth of electricity usage. It was assumed that the electricity usage for non-Stanford commercial customers would not change from the 2014 inventory. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was again estimated using CalEEMod® assumptions. Total electricity use for 2015 was estimated to be 294,349 MWh.

The Fall 2018 Baseline energy inventory is based on the 2015 inventory with certain subcategories of electricity usage increased. The electricity usage for the campus and new CEF was increased by 8% to account for the increase in academic square footage by Fall 2018. It was assumed that the electricity usage for PG&E Commercial customers and direct access customers would not increase by 2018. Electricity usage for 2014 for non-Stanford commercial customers was provided by Stanford and was not adjusted as it was assumed that electricity consumption for this category would not change significantly. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was estimated using CalEEMod® assumptions. Total electricity use for 2018 was estimated to be 320,952 MWh.

The Fall 2020 inventory is based on the Fall 2018 Baseline inventory with additional electricity consumption calculated for the new Escondido Village Graduate Residences. This annual electricity use is based on the CalEEMod® default for mid-rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). Total electricity use for Fall 2020 was estimated to be 324,870 MWh.

For the Fall 2035 Project energy inventory, electricity usage is based on Fall 2020 usage estimates scaled up to account for development by 2035. Electricity usage from 550 new faculty/staff high density homes to be constructed within the study boundary by 2035 was also added to the inventory. The annual electricity use is based on the CalEEMod® default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24. Total electricity use for 2035 was estimated to be 397,353 MWh.

This conservative estimate of 2035 electricity use would more than offset the anticipated increase in electricity demand due to the turnover to electric vehicles in the Marguerite and Bonair fleets. Based on the annual VMT of the electric portion of each fleet[26] and corresponding electricity conversion,[27] Stanford electric fleet vehicles are expected to

[26] Total fleet VMT for Fall 2035 (Project) can be found in the Greenhouse Gas Technical Report Table 3-6-17, which was then scaled to account for the expected turnover to electric vehicles.

[27] Bonair light duty vehicles used an assumed conversion of 0.25 kWh per mile based on the assumption that the vehicle economy in 2035 will be similar to the most efficient EVs currently available from the following source: US Department of Energy, 2017. Benefits and Considerations of Electricity as a Vehicle Fuel. Available at: http://www.afdc.energy.gov/fuels/electricity_benefits.html. Accessed: April 2017.

Marguerite and Bonair buses used an assumed conversion of 1.8 kWh per mile from the following source: Average of BYD and Proterra fuel economy. Proterra available at: https://www.proterra.com/products/catalyst-

increase demand by 5,770 MWh/year, which amounts to 1% of projected 2035 electricity consumption. This small increase in electricity demand is outweighed by the expected gains in energy efficiency at the Stanford campus, such as those due to Title 24 energy efficiency standards. For example, building energy efficiency improved 25-30% from 2008 Title 24 to 2013 Title 24,[28] while Stanford building electricity efficiency would only need to improve by 8% in new buildings (compared to existing buildings) to offset the electricity demand from campus electric vehicle turnover. In addition, Stanford has a number of ongoing programs targeting energy conservation in existing buildings (as described in Section 4.3.1), further contributing to this offset. For these reasons, changes in electricity demand due to electric vehicle turnover are assumed to be accounted for in 2035 energy use estimates and are considered insignificant.

Additional information and tables regarding electricity usage estimates can be found in the **Greenhouse Gas and Air Quality Technical Reports**.

3.1.2 Natural Gas

Natural gas is imported for both residential and commercial usage (e.g., cooking and heating) and industrial usage (i.e., powering the old CEF for the 2014 energy inventory and powering the new CEF and Replacement Process Steam Plant for the 2015, Fall 2018, and Fall 2035 energy inventories).

For 2014 and 2015 energy inventories, student residential and commercial natural gas usage is provided through PG&E consumption data. Natural gas usage for private faculty/staff housing is estimated using CalEEMod® assumptions, based on averages for the climate zone. Natural gas usage of the old CEF (2014 energy inventory) and the new CEF and Replacement Process Steam Plant (2015 energy inventory) are provided by Stanford. In 2014, the old CEF housed a cogeneration plant that imported natural gas to generate steam and electricity. This analysis presents energy usage based on the raw resource used, in this case, natural gas. The analysis separately highlights electricity used by Stanford that was generated from the natural gas. Due to the overhaul of Stanford's energy facility between 2014 and 2015, total natural gas usage dramatically decreased. Natural gas usage for 2014, including the Cardinal Cogeneration plant, was estimated to be 2,991,873 million British Thermal Units (MMBtu).[29] Natural gas usage for 2015 was estimated to be 537,910 MMBtu.

For the Fall 2018 Baseline energy inventory, natural gas combustion emissions are based on 2015 natural gas consumption data provided by Stanford for residential and commercial categories, scaled up to account for development under the 2000 GUP by 2018; natural gas consumption estimated for the faculty/staff housing in 2018 (assumed equivalent to 2014 and 2015 inventories); and natural gas consumption data by Stanford for 2015 for the new

40ft/. Accessed: May 2017. BYD available at: http://www.byd.com/na/ebus/download/brochure/BYD%2040ft.pdf.

[28] CEC. 2012. Energy Commission Approves More Efficient Buildings for California's Future. Available online at: http://www.energy.ca.gov/releases/2012_releases/2012-05-31_energy_commission_approves_more_efficient_buildings_nr.html. Accessed: April 2017.

[29] Stanford provided the total Cardinal Cogen natural gas consumption for 2014. 69% of this consumption (2,845,743 MMBTU) was used to power the Stanford campus (electricity, steam, and chilled water), while 31% was used to generate electricity or steam that was exported off campus. An additional 146,130 MMBTU of natural gas were used by campus PGE customers, as described further in the GHG Technical Report. The sum of the campus Cogen and PGE natural gas use is calculated as the total 2014 natural gas consumption.

CEF and Replacement Process Steam Plant scaled up to account for development under the 2000 GUP by 2018. Natural gas usage for 2018 was estimated to be 577,799 MMBtu.

For the Fall 2020 inventory, natural gas combustion emissions are based on the Fall 2018 natural gas consumption data described above. Additional residential natural gas consumption is estimated for the new Escondido Village Graduate Residences. Natural Gas usage for Fall 2020 was estimated to be 587,429 MMBtu.

For the Fall 2035 Project inventory, natural gas combustion emissions are based on Fall 2020 natural gas consumption estimates scaled up to account for development by 2035. The majority of PG&E Residential accounts are student housing so the increase in consumption is scaled up by the increase in number of beds from Fall 2020 to 2035. Commercial accounts, hot water generators that are part of the CEF, and the replacement process steam plant natural gas consumption is scaled up by the increase in academic square feet from Fall 2020 to 2035. Natural gas consumption from 550 new faculty/staff high density homes to be constructed within the study boundary by 2035 was also added to the inventory. The annual natural gas use for faculty/staff housing is based on the CalEEMod® default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). Natural gas use for the other scaled categories is assumed to scale linearly, meaning efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings. Natural gas usage for 2035 was estimated to be 718,441 MMBtu.

Additional information and tables regarding natural gas usage estimates can be found in the **Greenhouse Gas and Air Quality Technical Reports**.

3.2 Mobile Fuel

Fuel usage was estimated from on-road VMT by residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford. Fuel usage from the on-campus Valero gasoline station was added for 2014 and 2015. This fuel station was decommissioned in 2016. Activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers. The on-road Campus Fleet can be categorized into the Bonair Fueling Station Fleet, the Peninsula Sanitation Services, Inc (PSSI) Fleet, the Marguerite Bus/Shuttle Fleet, and the Public Safety Fleet. Stanford provided activity data in the form of fuel usage totals for the Bonair Fueling Station Fleet and PSSI Fleet and VMT for the Marguerite Bus/Shuttle Fleet, a portion of the PSSI Fleet, and the Public Safety Fleet. Activity data (fuel consumption) for the off-road Campus Fleet was provided by Stanford. Activity data (number of trips and VMT) for visitors and childcare facilities were calculated by Ramboll Environ based on Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**. Fuel usage was estimated using an average miles per gallon (mpg) obtained from EMFAC2014 for the fleet mix corresponding to the vehicle category and fuel type (gasoline or diesel). **Table 3-2-1** provides more detail on vehicle fuel usage estimates.

Mobile fuel usage was estimated at the totals shown in **Table 3-2-2** below.

Table 3-2-2. Mobile Fuel Totals		
	Mobile Fuel Usage (gallons/year)	
Inventory Year	Gasoline	Diesel
2014	6,879,920	471,767
2015	6,739,443	467,580
Fall 2018 (Baseline)	5,433,619	456,762
Fall 2020	5,456,621	449,893
Fall 2035 (Project)	4,259,978	163,216

Fuel usage was estimated to incrementally decrease from beginning to end of the Project due to increased fuel efficiency, an increase in electric vehicles in the statewide fleet, Stanford's commitment to replacing campus shuttles and vehicles with electric vehicles, and alternative transportation programs that incentivize alternative transportation besides single commuter trips, reducing the VMT in diesel or gasoline vehicles.

3.3 Diesel Fuel (Emergency Generators)

Stanford currently has 90 emergency generators installed on campus. Diesel fuel usage is from diesel combustion resulting from their operation for testing and maintenance and for emergency operation. Activity data (hours of operation, including some emergency usage) for the emergency generators is provided by Stanford for 2014 and 2015. Activity data was scaled up from the 2015 energy inventory based on increased academic square footage of 8% to develop the Fall 2018 Baseline energy inventory. For 2035, activity data from Fall 2018 was scaled up based on the increase in academic square footage from full buildout of the 2000 GUP to full buildout of the 2018 GUP. Fuel usage was estimated based on a default fuel consumption rate. Emergency generators were estimated to consume 32,327 gallons of fuel in 2014, 33,558 gallons in 2015, 36,271 gallons in Fall 2018, 36,271 gallons in Fall 2020, and 44,293 gallons in Fall 2035. **Table 3-3-1** provides details on fuel usage estimates from emergency generators. Additional details on fuel consumption rate and hours of operation can be found in the **Greenhouse Gas and Air Quality Technical Reports**.

3.4 Construction Equipment & Activities

Stanford will continue construction activities at the same rate as the previous 2000 GUP, meaning there is no change in construction existing conditions due to the Project. Additionally, worker, vendor, and hauling trips from construction are included in mobile fuel estimates in **Section 3.2**. A summary of fuel usage from off-road construction equipment and on-road worker, vendor, and hauling trips is shown in **Table 3-4-1**. Off-road fuel calculation details are shown in **Table 3-4-2**. On-road emissions details are shown in mobile **Table 3-2-1**.

Table 3-4-1. Construction Fuel Totals		
	Construction Fuel Usage (gallons/year)	
Inventory Year	Gasoline	Diesel
2014	261,434	77,859

2015	254,987	77,477
Fall 2018 (Baseline)	232,027	76,431
Fall 2020	218,995	75,642
Fall 2035 (Project)	138,338	71,892

Construction fuel usage was estimated to incrementally decrease from beginning to end of the Project due to increased fuel efficiency of on-road truck activity.

4. IMPACT ASSESSMENT AND MITIGATION MEASURES

4.1 Standards of Significance

While no quantitative thresholds related to energy are included in CEQA Guidelines Appendix G, Part I of Appendix F of the CEQA Guidelines states as follows:

"The goal of conserving energy implies the wise and efficient use of energy. The means of achieving this goal include:

1. decreasing overall per capita energy consumption,
2. decreasing reliance on natural gas and oil, and
3. increasing reliance on renewable energy resources."

Appendix F states that an Environmental Impact Report (EIR) should discuss the general energy impacts of a project, with particular emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy. The avoidance of inefficient, wasteful, and unnecessary consumption of energy will be the standard of significance used for this project.

Proposed amendments to the CEQA Guidelines would add significance thresholds for energy impacts; if these proposed thresholds are adopted, Appendix G would recommend that an agency consider, in assessing whether a project's energy impacts are significant, the following factors:

- whether the project would result in the wasteful, inefficient or unnecessary consumption of fuel or energy; and
- whether the project would incorporate renewable energy or energy efficiency measures into building design, equipment use, transportation or other project features.

For purposes of this analysis, impacts to Energy Resources will be considered to be significant if the project would result in the wasteful, inefficient or unnecessary consumption of fuel or energy, and conversely if the project would not incorporate renewable energy or energy efficiency measures into building design, equipment use, transportation or other project features.

4.2 Methodology

The methodology used to evaluate the significance of the Project's energy-related impacts is explained in the context of each impact, as discussed below.

4.3 Environmental Analysis

<u>Impact ER-1:</u> The Project Would Not Result in the Wasteful, Inefficient or Unnecessary Consumption of Fuel or Energy, and Conversely the Project Would Incorporate Renewable Energy and Energy Efficiency Measures into Building Design, Equipment Use, Transportation or Other Project Features (Less than Significant)

4.3.1 Overview

Stanford's Energy and Climate Plan, prepared by the Department of Sustainability and Energy Management (SEM), guides the university in balancing climate action and energy

production with the operation of a large institution.[30] The document provides a vision for the campus' energy future while maintaining flexibility through a comprehensive, long-term approach to reducing campus emissions. In its third edition (2015), it describes the University's three-pronged planning approach for reducing energy consumption and emissions: 1) High-Performance New Building Design, 2) Energy Conservation in Existing Buildings, and 3) the SESI. By implementing energy efficiency standards for new buildings, retrofitting the campus' most inefficient buildings for retrofits, and replacing its aging combined heat and power (CHP) system with a new heating and cooling plant with heat recovery and hot water distribution system, Stanford has been proactive in taking action to reduce wasteful consumption of energy.

High Performance Building Design: In 2008, Stanford set a goal that its new buildings would be 30 percent more efficient than required by the building code in place at that time. That goal proved successful; however it has become outdated. The Stanford Climate and Energy Plan explains:

With the consistent goal of maintaining its leadership in sustainable buildings, in 2015 Stanford replaced the 30 percent-beyond-code energy efficiency goal with a new method for designing energy efficient buildings: wholebuilding energy performance targets derived specifically for each new building. The target will be more stringent than the energy consumption of the newest Stanford buildings of a similar type because the target is set by considering the energy consumption of peer Stanford buildings and peer regional and national buildings, as well as the building's own best possible energy performance.

This new method allows Stanford to continuously improve the energy performance of its buildings by incorporating lessons learned into each new project. Moreover, because the whole building energy targets capture all energy loads of a building, not just those regulated by code, the design team has more flexibility in meeting the target. This way, the operations team has a much better understanding of how much energy the building should be consuming than with the original design goal of 30 percent beyond code. The newest lab building, which will house the Institute for Chemical Biology and the Institute for Neuroscience and is scheduled to come online in 2017, is the first building that will utilize the whole-building energy performance target. The building is being designed to consume 148,000 BTU per square foot annually, 15 percent less than Lokey Stem Cell building, a laboratory building of similar research intensity. National leaders in energy research, such as the National Renewable Energy Laboratory (NREL), are embracing this new method of target setting as the most holistic method for designing high-performance buildings.[31]

[30] Stanford University. 2015. Stanford Energy and Climate Plan. Third Edition. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf.

[31] Stanford University Office of Sustainability. 2015. Stanford Energy and Climate Plan. Third Edition. September. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf. Pg 24.

Energy Conservation in Existing Buildings:

Stanford has also invested in improving energy efficiency and conservation in existing buildings throughout campus. As described in the Stanford Climate and Energy Plan, substantial programs include the following: [32]

- The Energy Retrofit Program, which improves building energy efficiency and has led to cumulative annual energy savings of 300 billion BTU since 1993.
- The Whole Building Retrofit Program, which targets the campus' most inefficient buildings for retrofits. Fourteen projects have been completed as of spring 2015, and 8 more are under way. The program has already achieved $4 million in annual energy savings.
- The Energy Conservation Incentive Program, which targets reductions in energy use through human behavior, rather than technology.
- The Plug Load Energy Consumption Reduction program, which reduces the energy consumption of the biggest "energy hogs" of equipment identified by Stanford's campus-wide plug load inventory. These include IT equipment, lab equipment, and space heaters.

SESI: In 2015, Stanford completed a groundbreaking overhaul of it campus heating and cooling system. This overhaul is called the Stanford Energy System Innovations— or SESI. SESI relies on a heat-recovery process that is 70 percent more efficient than the prior cogeneration process for heating and cooling. The new system will meet more than 90 percent of the campus heating demands by capturing almost two-thirds of the waste heat generated by the campus cooling system. To make that exchange possible, Stanford replaced 22 miles of underground pipes and retrofitted 155 buildings to convert the campus from a steam- to hot water-based system. In addition, Stanford now purchases its electricity through a Direct Access program that enables purchase from Electric Service Providers that include renewable resources within their portfolios.

SESI represents a major transformation of the university's energy supply from 100 percent fossil fuel–based cogeneration to a more efficient heat recovery system, powered by a diverse mix of conventional and renewable energy sources.

4.3.1.1 Electricity

Stanford has made great efforts to be one of the most energy-efficient universities in the world. At the end of 2016, the Stanford Solar Generating Station in Kern County began operations. In addition, solar panels have been added, as feasible, to buildings throughout the campus. On-campus panels and the Solar generating Station are expected to supply 53 percent of Stanford's power, resulting in 65 percent of Stanford's total electricity coming from renewable sources due to additional renewable sources feeding the California grid.[33] On-campus solar panels are expected to generate

[32] Stanford University Office of Sustainability. 2015. Stanford Energy and Climate Plan. Third Edition. September. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf. Pg 4.
[33] Stanford University Office of Sustainability. 2015. Stanford Energy and Climate Plan. Third Edition. September. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf.

approximately 7,300 MWh/year, while the Stanford Solar Generation Station is expected to generate 159,000 MWh/year.

The Project would increase electricity demand by approximately 71,616 MWh per year, although per service population electricity demand would decrease slightly, as shown in **Table 4-3-1**. Electricity demand per service population was estimated to decrease with the Project, from 6.0 MWh per year per service population in Fall 2018 to 5.8 MWh per year per service population in Fall 2035. Additionally, estimated energy demand for Stanford assumes new buildings are constructed to the same energy intensity as existing buildings, excluding Faculty/Staff housing which estimates usage using 2016 Title 24 Standards. This is likely a conservative estimate, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower electricity usage in new buildings and Stanford's wholebuilding targets will promote increased efficiency in each new building constructed on the campus. Therefore, electricity demand per service population is expected to decrease more than is predicted here.

Table 4-3-1. Electricity Consumption per Service Population

Inventory Year	Electricity Consumption (MWh)	Service Population	Electricity per Service Population (MWh/person)
Fall 2018 (Baseline)	320,952	53,268	6.0
Fall 2035 (Project)	397,353	68,781	5.8
Change from Fall 2018 to Fall 2035	76,401	15,513	-0.2

4.3.1.2 Natural Gas

The introduction of the new CEF in 2015 in place of the cogeneration plant increased the efficiency of natural gas usage for the Stanford campus. This overhaul of the energy system, however, altered the balance between natural gas and electricity usage, making it important to demonstrate the Project's impact on combined total energy consumption (natural gas MMBtu + electricity MMBtu equivalent) in order to highlight the increase in natural gas energy efficiency. **Table 4-3-2** shows energy consumption for the 2014, Fall 2018 Baseline, and Fall 2035 Project inventory years. The energy efficiency improvement and reduction in wasteful natural gas usage of the new CEF is clearly demonstrated by the decrease in natural gas and total energy consumption from 2014 to Fall 2018 despite the increase in service population. Total building energy consumption (natural gas plus electricity) per service population would decrease from the 2018 Baseline inventory to the 2035 Project inventory, from 31.4 to 30.2 MMBtu per year per service population. Since 2014, however, total building energy consumption is projected to decrease by 16% with the Project despite a more than 30% projected increase in service population between 2014 and Fall 2035. Between 2014 and 2018, the building energy consumption per service population is projected to fall by about 35%.

Table 4-3-2. Building Energy Consumption per Service Population

Inventory Year	Natural Gas Consumption (MMBtu)	Electricity Consumption (MMBtu equivalent)	Building Energy Consumption Total (MMBtu)	Service Population	Building Energy Consumption per Service Population (MMBtu/person)
2014	1,552,114	918,169	2,470,283	51,443	48.0
Fall 2018 (Baseline)	577,799	1,095,088	1,672,887	53,268	31.4
Fall 2035 (Project)	718,441	1,355,769	2,074,210	68,781	30.2

The Project would increase natural gas demand by approximately 140,642 MMBtu per year, and per service population natural gas demand would slightly decrease, as shown in **Table 4-3-3**. Natural gas demand would decrease from 10.8 MMBtu per year per service population in Fall 2018 to 10.4 MMBtu per year per service population in Fall 2035. Estimated energy demand for Stanford assumes new buildings are constructed to the same energy intensity as existing buildings, excluding Faculty/Staff housing which estimates usage using 2016 Title 24 Standards. This is likely a conservative estimate, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings. Furthermore, Stanford's wholebuilding targets will promote increased efficiency in each new building constructed on the campus and are expected to result in even lower natural gas usage in new buildings. Therefore, natural gas usage per service population is expected to decrease more than is predicted here.

Table 4-3-3. Natural Gas Consumption per Service Population

Inventory Year	Natural Gas Consumption (MMBtu)	Service Population	Natural Gas per Service Population
Fall 2018 (Baseline)	577,799	53,268	10.8
Fall 2035 (Project)	718,441	68,781	10.4
Change from Fall 2018 to Fall 2035	140,642	15,513	-0.4

4.3.2 Transportation Fuel

Stanford will decrease transportation fuel use by incorporating more electric vehicles into the on-campus fleet. Stanford has committed to converting the entire Marguerite shuttle bus fleet to electric vehicles by 2035. Additionally, 70 percent of Bonair on-campus vehicles will be replaced with electric vehicles by 2035. Stanford also provides on-site charging stations to support the expanded use of electric vehicles by students, staff and visitors. As of 2017, there were 40 charging stations with two ports each already on

campus, with additional charging infrastructure planned in the new Escondido Village parking structures. These efforts to reduce fuel use go beyond the current alternative transportation programs that Stanford has been implementing for 16 years.

Stanford's alternative transportation programs incentivize alternative transportation besides single commuter trips, reducing the VMT and fuel usage. Programs include a free comprehensive campus shuttle system connecting the campus to local transit, Caltrain, shopping, and dining options; a free express bus service from the East Bay; transit passes for free use of the many transit systems in the area; bicycle programs to assist with commuting by bicycle; and car/vanpool programs.

As described further in the **SB 743 VMT Analysis**, the VMT generation for Stanford's workers and residents are both substantially lower than the regionwide and countywide average VMT for those populations. The primary reasons the VMT is so low are the Travel Demand Management (TDM) program and the ability for residents to commute to work or class without using personal vehicles due to the density of public transit near and on the campus. In addition, the availability of on-campus housing for students and faculty also reduces VMT from commuting. Lower VMT results in lower mobile fuel use per worker and per resident than the regionwide and countywide average.

Additional information regarding fuel use and mobile impacts can be found in the **Greenhouse Gas and Air Quality Technical Reports** as well as the **SB 743 VMT Analysis Appendices A, B, and C**.

4.3.3 Analysis of Factors Identified in CEQA Guidelines Appendix F

To determine whether a project would result in the wasteful, inefficient or unnecessary consumption of fuel or energy, and conversely whether the project would fail to incorporate renewable energy or energy efficiency measures into building design, equipment use, transportation or other project features, Appendix F of the CEQA Guidelines identifies six categories of potential energy-related environmental impacts, and five categories of potential mitigation measures that may be incorporated into the project. Each impact and mitigation category identified in Appendix F is addressed below.

Based on the analysis of each of these factors, the potential for the Project to result in wasteful, inefficient or unnecessary consumption of fuel or energy, and conversely to fail to incorporate renewable energy or energy efficiency measures into building design, equipment use, transportation or other project features is **less than significant.**

4.3.3.1 Appendix F.II.C.1 Energy Requirements and Energy Use Efficiencies

In section II.C.1, CEQA Guidelines Appendix F states that environmental impacts may include:

The project's energy requirements and its energy use efficiencies by amount and fuel type for each stage of the project including construction, operation, maintenance and/or removal. If appropriate the energy intensiveness of materials may be discussed.

The inventories prepared for this evaluation include energy and fuel used for construction and operation of the Stanford campus, including maintenance of campus facilities and demolition activities. Energy intensiveness of materials is not addressed because the California Governor's Office of Planning and Research has explained that "a full 'lifecycle' analysis that would account for energy in building materials and consumer products will generally not be required." See OPR, Proposed Updates to the CEQA Guidelines

(Preliminary Discussion Draft, Aug.11, 2015), at pp. 77-78. Such an analysis runs a substantial risk of double counting energy use and associated greenhouse gas emissions.

The Project requires energy in the forms of electricity, natural gas, and gasoline and diesel fuel. As described below, the Project energy use is more efficient than the Fall 2018 Baseline energy use on a per-service population basis.

Sections 3.3 and 3.4 above discuss the Project's energy use requirements in detail, including electricity, natural gas, mobile fuel, diesel fuel for emergency generators, and construction equipment and activities. These energy use requirements are summarized in **Table 4-3-4** below for operational activities and in **Table 4-3-5** for construction activities. As construction activities occur annually, they are also included in the operational table.

Table 4-3-4. Operational Energy Use Requirements

Inventory Year	Electricity (MWh)	Natural Gas (MMBtu)	Mobile Fuel (gallons)[a]		Diesel Fuel (Off-Road Construction)[b] (gallons)	Diesel Fuel (Emergency Generators) (gallons)
			Gasoline	Diesel		
Fall 2018 (Baseline)	320,952	577,799	5,433,619	456,762	37,700	36,271
Fall 2035 (Project)	397,353	718,441	4,259,978	163,216	37,700	44,293

Notes:

[a] Mobile fuel includes fuel for on-road construction worker, vendor, and hauling vehicles.

[b] Off-road fuel efficiency is assumed to remain constant for the different calendar years. Therefore, off-road fuel use from construction activity is the same across years.

Table 4-3-5. Construction Energy Use Requirements

Inventory Year	Construction Equipment & Activities (gallons)	
	Gasoline	Diesel
Fall 2018 (Baseline)	232,027	76,431
Fall 2035 (Project)	138,338	71,892

To demonstrate how these energy use totals compare between the 2018 Baseline and 2035 Project years, total energy use requirements have been converted to MMBtu equivalents and resulting MMBtu per service population metrics are presented in **Table 4-3-6** below.

Table 4-3-6. Total Energy Use Requirements, MMBtu per Service Population

Inventory Year	MMBtu Equivalents	Service Population	MMBtu / Service Population

Fall 2018 (Baseline)	2,420,428	53,268	45.4
Fall 2035 (Project)	2,636,532	68,781	38.3

As shown in **Table 4-3-4**, operational electricity and natural gas requirements are projected to increase from the Fall 2018 Baseline to the Fall 2035 Project inventory years due to growth in academic areas and campus populations. Mobile fuel requirements, however, are projected to decrease overall primarily due to Stanford's alternative transportation programs, TDM program, electric vehicle initiatives, and increasing fuel efficiencies of vehicles. Construction energy use requirements (summarized in **Table 4-3-5**) are also projected to decrease, primarily due to increasing fuel efficiency of on-road truck activity.

Despite the projected increase in electricity and natural gas requirements, the overall energy use requirements expressed per service population decrease with the Project (as shown in **Table 4-3-6**). This conclusion is reached even while projecting forward electricity and natural gas demand based on current energy use profiles. This is a conservative estimate because Stanford's continuing programs focus on high performance new building design and energy conservation in existing buildings and will allow for further improvements in efficiency to be realized. Even without incorporating these additional energy efficiency improvements, resulting energy use from Project implementation is not wasteful or unnecessary, and shows efficiencies gained on a per service population basis.

4.3.3.2 Appendix F.II.C.2 Local and Regional Energy Supplies

In section II.C.2, CEQA Guidelines Appendix F states that environmental impacts may include:

The effects of the project on local and regional energy supplies and on requirements for additional capacity.

The Project will not have a substantial impact on the local or regional energy supplies or require additional capacity to be constructed. Through use of renewable energy, energy efficiency standards, and the new CEF, Stanford will minimize impacts on the local and regional energy supply. The transition toward electric fuels for on-site vehicles will result in a small increase in calculated total electricity usage that will not significantly impact overall electricity infrastructure (see **Section 3.1.1** above). This small increase may be offset by gains in energy efficiency at the Stanford campus that are not quantitatively addressed in the energy usage calculations as noted above.

As shown and discussed in **Section 3** above, Stanford relies on electricity, natural gas, and gasoline and diesel consumption associated with mobile operations, emergency generator operations, and construction operations. Total energy use requirements for Fall 2018 Baseline and Fall 2035 Project years are summarized in **Tables 4-3-4** and **4-3-5** above.

Stanford University is supplied both electricity and natural gas through Pacific Gas & Electric (PG&E). Stanford procures additional electricity through Direct Access (wholesale

purchases as opposed to purchasing from a retail utility).[34] As a Direct Access electricity consumer, Stanford is required by state law to comply with the Resource Adequacy requirements. In complying with these requirements, the University has established contracts to assure there is adequate electricity generation capacity to meet its current and future loads.

Stanford has procured substantial amounts of renewable energy, including a new 73 MW off-site solar photovoltaic (PV) plant in southern California and 4.9 MW of on-site rooftop solar photovoltaics. The off-site solar PV plant will meet the University's peak electricity demands of 42 MW.[35]

As of the end of 2016, 65 percent of Stanford's electricity was generated from renewable sources.[36] In addition to these solar resources, Stanford will evaluate geothermal and wind energy opportunities as well.[37] This extensive generation of new renewable energy reduces the strain on electricity production by reducing the demand for electricity generation from the grid resources, particularly during peak times when energy demand is the highest and solar energy potential is also the highest.

To put Stanford's energy use in context, in 2015, Californians consumed 282,896 GWh of electricity, of which Santa Clara County consumed 16,812 GWh.[38] Total in-state generation, not including small-scale solar installations, was 196,195 GWh, and energy imports accounted for 34% of the state-wide power mix.[39] CEC estimates that state-wide energy demand will increase to 322,266 GWh in 2025 with an average annual growth rate of 1.27%.[40] Stanford's anticipated increase in electricity usage to 397,353 MWh by 2035 reflects an average annual increase of 1.26% electricity usage. This is consistent with the state-wide annual growth rate of 1.27%. Stanford electricity use projections are also within range of regional estimates for the Greater Bay Area. The CEC projects a mid-range rate of 1.16% annual consumption growth, with a high estimate of 1.61%.[41] Overall, Stanford's projected electricity growth is consistent with state and regional projections. Therefore, University projects will not require additional generation capacity beyond more general state-wide expansion.

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[34] Stanford University Office of Sustainability. 2015. Stanford Energy and Climate Plan. Third Edition. September. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf.

[35] According to the Stanford Sustainability and Energy Management Department, during commissioning of the new energy system the peak electrical demand varied by month and reached a maximum of 45 MW in 2016. After commissioning was complete and the new model predictive control energy management software was fully enabled for 2017, the expected peak electrical demand on the grid will be approximately 38 MW for calendar year 2017. The University's long term forecast is that the University's peak electrical demand in 2035 will be 48 MW.

[36] Sustainable Stanford. *Fact Sheet: Renewable Energy*. 2017. Available at: https://sustainable.stanford.edu/sites/default/files/Renewable%20Energy_2017_1.pdf

[37] Stanford University Office of Sustainability. 2015. Stanford Energy and Climate Plan. Third Edition. September. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf.

[38] California Energy Commission. 2016. Energy Consumption Data Management Service. Electricity Consumption by County. Available online at: http://www.ecdms.energy.ca.gov/elecbycounty.aspx. Accessed: April 2017.

[39] California Energy Commission. 2016. Total Electricity System Power. Available online at: http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html.

[40] California Energy Commission. 2016. California Energy Demand Updated Forecast, 2017-2027. Available online at: http://docketpublic.energy.ca.gov/PublicDocuments/16-IEPR-05/TN214635_20161205T142341_California_Energy_Demand_Updated_Forecast.pdf

[41] California Energy Commission. 2016. Forecast Zone Results – 2016 California Energy Electricity Forecast Update. Available online at: http://www.energy.ca.gov/2016_energypolicy/documents/2016-12-08_workshop/forecast_zone.php. Accessed: April 2017.

Stanford's annual natural gas consumption is estimated to increase by 140,642 MMBtu over 18 years. In 2035, campus natural gas consumption will reach 718,441 MMBtu/yr, about half of Stanford building consumption in 2014. As described earlier, this is based on scaling up current building natural gas usage and is therefore a conservative estimate. In comparison, it is projected that California natural gas demand will decrease in 2030 to 2,160,800 MMscf/yr, or 2,230 trillion Btu/yr.[42] Stanford's natural gas consumption accounts for less than 0.05% of the projected statewide annual consumption.

Although natural gas is the most common electricity source in California, 90% of the state's natural gas is imported from the Rocky Mountain region, the Southwest, and Canadian basins.[43] The United States produces 20 trillion scf/yr and had 340 trillion scf of proven reserves in 2014.[44] Stanford's natural gas consumption is not substantial in comparison to the national natural gas reserves and comprises only 0.003% of annual national natural gas production.

Gasoline and diesel are provided by California's transportation fuels supplier network, as the majority of gasoline and diesel fuels are used for transportation to and from the Stanford Campus.

Overall, the Project will not have a substantial impact on the local or regional energy supplies or require additional capacity to be constructed.

4.3.3.3 Appendix F.II.C.3 Peak and Base Period Demands

In section II.C.3, CEQA Guidelines Appendix F states that environmental impacts may include:

The effects of the project on peak and base period demands for electricity and other forms of energy.

The Project will not have a substantial impact on the peak and base period demands for electricity or other forms of energy. Further details and reasoning are described below.

As discussed in Stanford's Energy and Climate Plan[45], the Stanford Energy System Innovations (SESI) program was designed to increase Stanford's energy efficiency and allow the CEF to meet both peak and base demand. **Section 3.1** above discuss features of the new CEF in further detail, but specific aspects of the energy system allow for renewable or sustainable options for meeting peak demand. Thermal energy storage, for example, allows for flexibility to run equipment at optimal load settings.

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[42] California Energy Commission. 2015. Draft Staff Report: 2015 Natural Gas Outlook. Available online at: http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-03/TN206501_20151103T100153_Draft_Staff_Report_2015_Natural_Gas_Outlook.pdf. Accessed: April 2017.

[43] U.S. Energy Information Administration. 2016. California State Profile and Energy Estimates: Profile Analysis. Available online at: https://www.eia.gov/state/analysis.cfm?sid=CA. Accessed November 30, 2016.

[44] California Energy Commission. 2015. Draft Staff Report: 2015 Natural Gas Outlook. Available online at: http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-03/TN206501_20151103T100153_Draft_Staff_Report_2015_Natural_Gas_Outlook.pdf.

[45] Stanford University Office of Sustainability. 2015. Stanford Energy and Climate Plan. Third Edition. September. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf.

Stanford's procurement of substantial amounts of renewable energy, including the new 73 MW off-site solar PV plant in southern California and the 4.9 MW of on-site rooftop solar PV, will also help the University meet peak demands. Specifically, the off-site solar PV plant will meet the University's peak electricity demands of 42 MW.[46]

As of the end of 2016, 65 percent of Stanford's electricity was generated from renewable sources.[47] This extensive generation of new renewable energy reduces the strain on electricity production by reducing the demand for electricity generation from the grid resources, particularly during peak times when energy demand is the highest and solar energy potential is also the highest.

In 2016, California's peak grid demand was 46,193 MW. On the same day, PG&E reached a maximum demand of 23,752 MW.[48] In comparison, Stanford University's maximum demand in 2016 was 45 MW. With the implementation of new model-predictive control software at Stanford's CEF, maximum demand is expected to decrease to 38 MW in 2017. The model-predictive-control software used at the CEF is a software system developed and patented by Stanford that optimizes cost and energy efficiency through predicting hourly campus heating, cooling, and grid electricity prices 10 days in advance. This is then used to determine when to use electricity to operate plant heating and cooling equipment as well as how much hot and cold water to store in the thermal storage tanks.[49]

With the proposed Project, Stanford's peak demand is forecasted to increase to 48 MW by 2035. This is similar to peak demand in 2016. The University will have a relatively negligible effect on state-wide peak demands, which will be further lessened by its Kern County solar plant.

4.3.3.4 Appendix F.II.C.4 Existing Energy Standards

In section II.C.4, CEQA Guidelines Appendix F states that environmental impacts may include:

The degree to which the project complies with existing energy standards.

Stanford complies with existing energy standards. During implementation of the Project, Stanford will continue to adhere to State standards designed to minimize use of fuel in construction vehicles, ensure that buildings employ strict energy efficiency techniques, and operate comprehensive transportation demand management programs, as described further below.

<u>Construction Vehicles and Electricity Usage</u>

[46] According to the Stanford Sustainability and Energy Management Department, during commissioning of the new energy system the peak electrical demand varied by month and reached a maximum of 45 MW in 2016. After commissioning was complete and the new model predictive control energy management software was fully enabled for 2017, the expected peak electrical demand on the grid will be approximately 38 MW for calendar year 2017. The University's long term forecast is that the University's peak electrical demand in 2035 will be 48 MW.

[47] Sustainable Stanford. *Fact Sheet: Renewable Energy*. 2017. Available at: https://sustainable.stanford.edu/sites/default/files/Renewable%20Energy_2017_1.pdf

[48] California ISO. 2017. 2016-2017 Transmission Plan. Available online at: http://www.caiso.com/Documents/Board-Approved_2016-2017TransmissionPlan.pdf

[49] Stanford. 2015. Stanford Energy System Innovations. Available at: http://news.stanford.edu/features/2015/sesi/. Accessed: April 2017.

Project construction requires use of on-road trucks for soil hauling and deliveries, and off-road equipment such as excavators, cranes, forklifts, and pavers. Construction projects at Stanford would comply with state requirements designed to minimize idling and associated emissions, which also minimizes use of fuel. Specifically, idling of commercial vehicles and off-road equipment would be limited to five minutes in accordance with the Commercial Motor Vehicle Idling Regulation and the Off-Road Regulation, and the trucks used would be compliant with the requirements of the Tractor-Trailer Greenhouse Gas Regulation.

In addition, electricity used during construction would be provided from the campus supply. As shown and discussed in **Section 3** and **Section 4.3.3.2** above, Stanford meets its campus demands in part by procuring substantial amounts of renewable energy, including a new 75 MW off-site solar photovoltaic plant in Kern County and 4.9 MW of on-site rooftop solar photovoltaics.

Building Efficiency

Stanford's electricity and natural gas use in buildings is shown in the sections above: **Table 4-3-1** shows the University's electricity consumption; and **Table 4-3-2** shows the University's natural gas consumption.

Stanford new building construction is subject to California's Title 24, as discussed in **Section 2.2.2.3** above. California's Title 24 reduces energy use in residential and commercial buildings through progressive updates to both the Green Building Standards Code (Title 24, Part 11) and the Energy Efficiency Standards (Title 24, Part 6). Provisions added over the years include consideration and possible incorporation of new energy efficiency technologies and methods for building features such as space conditioning, water heating, lighting, and whole envelope, as well as construction waste diversion goals. Additionally, some standards focus on larger energy saving concepts such as reducing loads at peak periods and seasons, improving the quality of energy-saving installations, and performing energy system inspections. Past updates to the Title 24 standards have proved very effective in reducing building energy use, with the 2013 update to the energy efficiency standards estimated to reduce energy consumption in residential buildings by 25% and energy consumption in commercial buildings by 30%, relative to the 2008 standards.[50] The 2016 standards are expected to further reduce residential electricity consumption by 28% and non-residential electricity by 5% relative to the 2013 standards.[51]

Stanford often goes beyond Title 24 requirements in construction and operation of new buildings. For example, the high-performance design and construction of the Yang & Yamazaki Environment & Energy Building ("Y2E2"), constructed in 2008, utilizes 42% less energy than a traditional building of comparable size. Similarly, the Jen-Hsun Engineering Center and the Spilker Engineering and Applied Science Building, both constructed in 2010, as well as the Shriram Center for Bioengineering and Chemical

[50] CEC. 2012. Energy Commission Approves More Efficient Buildings for California's Future. Available online at: http://www.energy.ca.gov/releases/2012_releases/2012-05-31_energy_commission_approves_more_efficient_buildings_nr.html. Accessed: April 2017.
[51] CEC. 2015. 2016 Building Energy Efficiency Standards Adoption Hearing. Available online at: http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2015-06-10_hearing/2015-06-10_Adoption_Hearing_Presentation.pdf

Engineering, constructed in 2014, share many of the same design features and ambitious energy and water goals as the Y2E2 building. The William H. Neukom Building, constructed in 2011, uses 30 percent less energy and water than required by the code, and is a LEED-Gold equivalent project. Finally, the Knight Management Center, constructed in 2011, received a LEED-NC Platinum certification,[52] and is equipped with a rooftop solar PV system that generates 12.5% of the center's demand.

Stanford aims to reduce the need for new and existing energy supplies through wholebuilding energy performance targets for new building design as well as various programs focusing on energy conservation in existing buildings. These programs are discussed in **Section 4.3.1** above.

Transportation

Vehicle use at Stanford has been evaluated pursuant to the draft guidelines that the Governor's Office of Planning and Research has published under Senate Bill 743 (Steinberg, 2013), which created a process to change the methods used for transportation impacts analyses under CEQA from focusing on level of service to greenhouse gas reductions through the quantification of VMT.[53] VMT has a direct correlation to fuel usage.

As described further in the **SB 743 VMT Analysis**, the VMT generation for Stanford's workers and residents are substantially lower than the regionwide and countywide average VMT for those populations. The primary reasons the VMT at Stanford is so low are the TDM program and the ability for residents to commute to work or class without using personal vehicles due to the density of public transit near and on the campus. In addition, on-campus housing for faculty and students lowers commuting VMT. Lower VMT results in lower mobile fuel use per worker and per resident than the regionwide and countywide average.

4.3.3.5 Appendix F.II.C.5 Energy Resources

In section II.C.5, CEQA Guidelines Appendix F states that environmental impacts may include:

The effects of the project on energy resources.

Stanford's use of energy will not have a substantial effect on statewide or regional energy resources. Stanford's energy use is discussed in Section 3 above, including electricity, natural gas, and gasoline and diesel consumption associated with mobile operations, emergency generator operations, and construction operations. Total energy use requirements for Fall 2018 Baseline and Fall 2035 Project years are summarized in **Tables 4-3-4** and **4-3-5** above. Programs and measures relevant to energy resources are discussed in detail in **Sections 4.3.3.2 and 4.3.3.3**.

[52] The LEED-NC Platinum rating is the U.S. Green Building Council's highest rating for sustainability in the built environment.

[53] Governor's Office of Planning and Research. Updating Transportation Impacts Analysis in the CEQA Guidelines. August 6, 2014. Available online at: https://www.opr.ca.gov/docs/Final_Preliminary_Discussion_Draft_of_Updates_Implementing_SB_743_080614.pdf

4.3.3.6 Appendix F.II.C.6 Transportation Energy Use

In section II.C.6, CEQA Guidelines Appendix F states that environmental impacts may include:

The project's projected transportation energy use requirements and its overall use of efficient transportation alternatives.

Stanford uses efficient transportation alternatives to reduce its transportation energy use requirements, as described further below.

Stanford's transportation energy use is discussed in **Section 3** above and gasoline and diesel quantities for all inventory years, including the Fall 2018 Baseline and Fall 2035 Project, are presented in **Table 3-2-2**. The quantification of VMT associated with Stanford operations, which feeds into total transportation energy use quantified, is discussed in detail in the **SB 743 VMT Analysis**.

As described further in the **SB 743 VMT Analysis**, the VMT generation for Stanford's workers and residents are substantially lower than the regionwide and countywide average VMT for those populations. The primary reasons the VMT at Stanford is so low are due to the TDM program and the ability for residents to commute to work or class without using personal vehicles due to the density of public transit near and on the campus. In addition, on-campus housing for faculty and students lowers commuting VMT. Lower VMT results in lower mobile fuel use per worker and per resident than the regionwide and countywide average.

Stanford's Transportation Demand Management Programs

Stanford's alternative transportation programs incentivize alternative transportation besides single commuter trips. Programs include a free comprehensive campus shuttle system connecting the campus to local transit, Caltrain, shopping, and dining options; a free express bus service from the East Bay; transit passes for free use of the many transit systems in the area; bicycle programs to assist with commuting by bicycle; and car/vanpool programs.

These programs have resulted in the percentage of sustainable commuters (commuters traveling in modes other than single occupancy vehicles) at Stanford to increase from 31% in 2002 to 51% in 2016.[54]. Figure 5 of the Transportation Impact Analysis, Part 1 presents the mode share of Stanford employees based on the location of their residence. Overall, the mode split for campus commuters in 2016 was 25% transit, 12% bicycling, 9% carpool/vanpool, 2% walk and 3% other. The significant use of transit passes, bicycling, rideshares, and other alternative modes of transportation, demonstrate the efficient use of transportation systems at Stanford.

Marguerite Shuttle System: Stanford's Marguerite Shuttle System provides free transit through campus and connecting Stanford to public transit, a commuter train, shopping, dining, and entertainment. The fleet consists of 47 buses and shuttles running on biodiesel or as diesel-electric hybrid buses. According to the P&TS Annual Report, in

[54] P&TS Annual Report, Stanford Transportation 2016. Available online at: http://transportation-forms.stanford.edu/annual-report-2016/. Accessed: April 2017.

2016, there were 10 new electric buses added, for a total of 23.[55] There are 16 routes, 174 stops, and over 77,000 hours of service annually. The annual ridership of Marguerite in 2016 was 3.1 million.[56]

Parking Program: The high cost of parking at Stanford, approximately $375-$1,032annually in 2016, is a disincentive to commuting by single-occupancy vehicle to campus. Funds from the parking program help fund alternative transportation programs.

Transit Subsidies: Stanford provides transit subsidies, such as the free Caltrain Go Pass, which was extended to commuting graduate students and postdoctoral scholars in 2016.[57] Stanford also purchases VTA Eco Passes for all eligible hospital and university employees to ride for free on VTA buses and light rail, the Dumbarton Express, the Highway 17 Express, and the Monterey-San Jose Express.[58] VTA buses, run by the Santa Clara Valley Transportation Agency, connect the Palo Alto train station to Santa Clara County and provides light rail service in the South Bay. Additionally, AC Transit runs a weekday express shuttle bus service between the East Bay and Stanford's campus, called Line U, which is free for Stanford faculty, staff, students, hospital employees, and SLAC employees.[59] In addition, Stanford offers pre-tax payroll deduction for eligible employees to purchase transit passes, transit parking, and commuter checks. In 2016, surveys showed that 25 percent of employee commuters used transit as their primary commute mode.

Stanford Commute Club: Stanford also has a Commute Club, which rewards sustainable commuters who agree not to drive alone to campus with up to $300 per year in Clean Air Cash or Carpool Credit, free daily parking passes and reserved parking spaces (carpools and vanpools), vanpool subsidies, emergency rides home, and free rental car vouchers and Zipcar driving credit. In 2016, more than 9,500 commuters received this benefit.[60]

Several options are also available for those that do not have a car on campus, including discounted rentals at on-campus Enterprise Rent-A-Car office and discounted rates and bonus credits for the Zipcar car sharing program. In 2008, Stanford was the first university to offer an integrated car sharing and ridematching program through Zipcar and Zimride. Stanford has more than 5,000 Zimride users, who can use the ridematching application to arrange commutes or one-time trips.

Stanford also has a large amount of infrastructure, including bike lanes and paths and approximately 18,000 bike rack spaces, which promotes biking to and from, as well as throughout, campus. In 2011, Stanford was the first university to be recognized as a Platinum Bicycle Friendly University by the League of American Bicyclists, and is the only

[55] P&TS Annual Report, Stanford Transportation 2016. Available online at: http://transportation-forms.stanford.edu/annual-report-2016/. Accessed: April 2017.
[56] Ibid.
[57] Stanford Parking & Transportation Services. About the Caltrain Go Pass. Available online at: https://transportation.stanford.edu/transit/free-transit-incentives/caltrain-go-pass/about-go-pass. Accessed: April 2017.
[58] Stanford Parking & Transportation Services. VTA Eco Pass. Available online at: https://transportation.stanford.edu/transit/free-transit-and-incentives/vta-eco-pass. Accessed: April 2017.
[59] Stanford Parking & Transportation Services. Express Bus. Available online at: https://transportation.stanford.edu/transit/express-bus. Accessed: April 2017.
[60] P&TS Annual Report, Stanford Transportation 2016. Available online at: http://transportation-forms.stanford.edu/annual-report-2016/. Accessed: April 2017.

university to receive a renewal of its Platinum designation for another four years (2015-2019).[61]

Electric Vehicles

Stanford will decrease its fuel use by incorporating more electric vehicles into the on-campus fleet. Stanford has committed to converting the entire Marguerite shuttle bus fleet to electric vehicles by 2035. Additionally, 70 percent of Bonair on-campus vehicles will be replaced with electric vehicles by 2035. Stanford also provides on-site charging stations to support the expanded use of electric vehicles. As of 2017, there were 40 charging stations with two ports each already on campus, with additional charging infrastructure planned in the new Escondido Village parking structures.

Conventional gasoline and diesel vehicles consume gasoline or diesel fuel, whereas electric vehicles (EVs) consume electricity that can be sourced by fossil fuels or renewables. EVs including battery-electric vehicles and plug-in hybrid electric vehicles comprise a growing fraction of the passenger vehicles on the roads in California, and EV adoption is expected to increase over the upcoming decades due in part to improvements in battery technology and public initiatives and goals. Stanford's EV charging stations will reduce fuel use and GHG emissions by assisting Californians in the shift from fossil-fueled vehicles to electric vehicles, while the fossil fuels needed to produce electricity for charging continues to decrease. By 2030, for every mile that is driven in an EV rather than in a gasoline or diesel car, GHG emissions are reduced by over 80% and corresponding fuel use decreases. This is based on the emissions from diesel or gasoline cars using EMFAC2014 in 2030, compared with electricity needed to charge the EV based on an electricity grid that achieves 50% RPS in 2030.

4.3.3.7 Appendix F.II.D.1 Energy Reduction Measures

In section II.D.1, CEQA Guidelines Appendix F states that mitigation measures (including those already incorporated into the project) may include:

Potential measures to reduce wasteful, inefficient and unnecessary consumption of energy during construction, operation, maintenance and/or removal. The discussion should explain why certain measures were incorporated in the project and why other measures were dismissed.

Stanford implements a number of ongoing programs to reduce the consumption of energy. Existing programs such as use of the new Central Energy Facility, procurement of solar power from Stanford's offsite Kern County facility and travel demand management, reasonably can be expected to continue given Stanford's investment in its ongoing capital improvements and programs. New measures, such as conversion of Marguerite shuttles and campus fleets to electric vehicles, are identified in the project description that Stanford submitted with its application.

On-Campus Energy System

[61] Stanford Parking & Transportation Services. Stanford receives its second Platinum Bicycle Friendly University aware (2015-2019). Available online at: http://transportation-forms.stanford.edu/bike-platinum/. Accessed: April 2017.

As discussed in **Section 3.1** above, in 2015, Stanford switched its base energy system on-campus from a district energy system comprised of a gas-fired CHP and power, steam, and chilled water distribution systems to a grid and heat recovery system, now referred to as SESI. The SESI energy system is 70% more efficient than the previous CHP plant, and therefore uses less overall energy, due to significant heat recovery and lower heat losses from hot water distribution compared to the previous steam distribution system.

Renewable Energy

As discussed in **Section 4.3.3.2** above, Stanford's procurement of substantial amounts of renewable energy, including the new 73 MW off-site solar PV plant in southern California and the 4.9 MW of on-site rooftop solar PV, will also help the University reduce its dependence on fossil-fuel derived energy use.

Transportation Demand Management Programs

Stanford's alternative transportation programs incentivize alternative transportation besides single commuter trips. Programs include a free comprehensive campus shuttle system connecting the campus to local transit, Caltrain, shopping, and dining options; a free express bus service from the East Bay; transit passes for free use of the many transit systems in the area; bicycle programs to assist with commuting by bicycle; and car/vanpool programs. These programs and TDM program elements are described in detail in **Section 4.3.3.6** above.

Electric Vehicles

Stanford will further decrease fuel use by incorporating more electric vehicles into the on-campus fleet. Stanford has committed to converting the entire Marguerite shuttle bus fleet to electric vehicles by 2035 and converting 70 percent of Bonair on-campus vehicles to electric vehicles by 2035. Stanford also provides on-site charging stations to support the expanded use of electric vehicles. Additional details regarding electric vehicles at Stanford is discussed in detail in **Section 4.3.3.6** above.

4.3.3.8 Appendix F.II.D.2 Siting, Orientation, and Design

In section II.D.2, CEQA Guidelines Appendix F states that mitigation measures (including those already incorporated into the project) may include:

The potential of siting, orientation, and design to minimize energy consumption, including transportation energy, increase water conservation and reduce solid waste.

A number of Stanford initiatives and programs, as well as general features of the campus itself, utilize siting, orientation, or design elements to minimize energy consumption, as discussed further below.

On-Campus Energy System (Siting, Design)

The Stanford Energy System Innovations (SESI) program was designed to increase Stanford's energy efficiency and allow the CEF to meet both peak and base demand. The SESI energy system is 70% more efficient than the previous CHP plant, and specific aspects of the energy system allow for renewable or sustainable options for meeting peak demand. Thermal energy storage, for example, allows for flexibility to run equipment at optimal load settings. Additional details of the energy system are discussed in **Section 3.1** above.

Renewable Energy (Siting, Orientation, Design)

Stanford has positioned itself toward energy sustainability by converting the campus from gas to electricity, and by procuring renewable sources in its electricity portfolio. As discussed in **Section 4.3.3.2** above, Stanford has procured substantial amounts of renewable energy, including a new 73 MW off-site solar photovoltaic (PV) plant in southern California and 4.9 MW of on-site rooftop solar photovoltaics. Onsite solar rooftop areas were selected based on aesthetic and historical impact to campus also with orientation, roof size and slope, and construction.

Transportation (Siting)

Stanford is well positioned to take advantage of the many public transit options in the Bay Area. In general, development near transit rich areas is good for reducing energy use and greenhouse gases from a project. According to the California Air Pollution Control Officers Association (CAPCOA) Quantifying Greenhouse Gas Mitigation Measures document (2010),[62] "[l]ocating a project with high density near transit will facilitate the use of transit by people traveling to or from the Project site. The use of transit results in a mode shift and therefore reduced VMT."

Building Energy Efficiency (Siting, Orientation)

Stanford's high-performance design and construction of new buildings on campus take advantage of Stanford's solar energy potential by siting new buildings in order to accommodate solar PV technology. For example, the Knight Management Center, constructed in 2011, received a LEED-NC Platinum certification,[63] and is equipped with a rooftop solar PV system that generates 12.5% of the center's demand. Additional projects that utilized siting and orientation opportunities for solar installations are discussed in Appendix B of Stanford's Energy and Climate Plan. [64]

4.3.3.9 Appendix F.II.D.3 Reducing Peak Energy Demand

In section II.D.3, CEQA Guidelines Appendix F states that mitigation measures (including those already incorporated into the project) may include:

The potential for reducing peak energy demand.

Stanford's new energy system, combined with use of renewable energy, help reduce the University's peak energy demand, and will continue to do so throughout the Project life.

On-Campus Energy System

As discussed in Stanford's Energy and Climate Plan[65], the Stanford Energy System Innovations (SESI) program was designed to increase Stanford's energy efficiency and allow the CEF to meet both peak and base demand. **Section 3.1** above discuss features of the new CEF in further detail, but specific aspects of the energy system allow for

[62] California Air Pollution Control Officers Association (CAPCOA). 2010. Quantifying Greenhouse Gas Mitigation Measures. August. Available online at: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf.
[63] The LEED-NC Platinum rating is the U.S. Green Building Council's highest rating for sustainability in the built environment.
[64] Stanford University Office of Sustainability. 2015. Stanford Energy and Climate Plan. Third Edition. September. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf.
[65] Ibid.

renewable or sustainable options for meeting peak demand. Thermal energy storage, for example, allows for flexibility to run equipment at optimal load settings. Additionally, the newly commissioned energy management software will further reduce draw from the grid during peak hours.

Renewable Energy

Stanford has procured substantial amounts of renewable energy, including a new 73 MW off-site solar photovoltaic (PV) plant in southern California and 4.9 MW of on-site rooftop solar photovoltaics. The off-site solar PV plant will meet the University's peak electricity demands of 42 MW.[66] As of the end of 2016, 65 percent of Stanford's electricity was generated from renewable sources.[67] This extensive generation of new renewable energy reduces the strain on electricity production by reducing the demand for electricity generation from the grid resources, particularly during peak times when energy demand is the highest and solar energy potential is also the highest.

4.3.3.10 Appendix F.II.D.4 Alternative Fuels

In section II.D.4, CEQA Guidelines Appendix F states that mitigation measures (including those already incorporated into the project) may include:

Alternative fuels (particularly renewable ones) or energy systems.

Stanford has pursued the use of alternative fuels or energy systems for heating, cooling, electricity, and transportation, as discussed below.

On-Campus Energy System (Heating, Cooling, Electricity)

As discussed in **Section 3.1** above, Stanford completed SESI in 2015, a groundbreaking overhaul of its campus heating and cooling system. SESI represents a major transformation of the university's energy supply from 100 percent fossil fuel–based cogeneration to a more efficient heat recovery system, powered by a diverse mix of conventional and renewable energy sources. In addition, Stanford now purchases its electricity through a Direct Access program that enables purchase from Electric Service Providers that include renewable resources within their portfolios.

Renewable Energy

As discussed in **Section 4.3.3.2** above, Stanford's has installed a substantial amount of renewable energy, including the new 73 MW off-site solar PV plant in southern California and the 4.9 MW of on-site rooftop solar PV. On-campus panels and the Solar Generating Station are expected to supply 53 percent of Stanford's power, resulting in 65 percent of Stanford's total electricity coming from renewable sources due to additional renewable sources feeding the California grid.[68] According to Stanford's Office of Sustainability, on-

[66] According to the Stanford Sustainability and Energy Management Department, during commissioning of the new energy system the peak electrical demand varied by month and reached a maximum of 45 MW in 2016. After commissioning was complete and the new model predictive control energy management software was fully enabled for 2017, the expected peak electrical demand on the grid will be approximately 38 MW for calendar year 2017. The University's long term forecast is that the university's peak electrical demand in 2035 will be 48 MW.

[67] Sustainable Stanford. *Fact Sheet: Renewable Energy*. 2017. Available at: https://sustainable.stanford.edu/sites/default/files/Renewable%20Energy_2017_1.pdf

[68] Stanford University Office of Sustainability. 2015. Stanford Energy and Climate Plan. Third Edition. September. Available at: https://sustainable.stanford.edu/sites/default/files/E%26C Plan 2016.6.7.pdf.

campus solar panels are expected to generate approximately 7,300 megawatt-hour (MWh)/year, while the Stanford Solar Generation Farm is expected to generate 159,000 MWh/year by 2017.

Electric Vehicles

Stanford has committed to converting the entire Marguerite shuttle bus fleet to electric vehicles by 2035 and converting 70 percent of Bonair on-campus vehicles to electric vehicles by 2035. Stanford also provides on-site charging stations to support the expanded use of electric vehicles. Additional details regarding electric vehicles at Stanford is discussed in detail in **Section 4.3.3.6** above.

4.3.3.11 Appendix F.II.D.5 Recycling Efforts

In section II.D.5, CEQA Guidelines Appendix F states that mitigation measures (including those already incorporated into the project) may include:

Energy conservation which could result from recycling efforts.

California has a statewide goal of 75% waste diversion by 2020; thus, Stanford has implemented several policies in order to achieve that goal. In Fiscal Year 2014, 65% of Stanford's waste was already diverted from the landfill.[69] In order to increase this diversion amount, Stanford has implemented the Deskside Recycling and Mini Trash Bin Program in more than 80 buildings.[70] This program provides a small blue paper recycling bin paired with a mini black trash bin to every desk in each campus building. Additionally, no plastic liners are used in the mini trash bins in order to reduce waste. The program also provides template emails and flyers explaining the program components for outreach purposes.[69]

Stanford has also launched two programs related to composting. First, over 120 individuals are currently participating in a Voluntary Compost Program, where individuals collect compostable materials including food from break rooms and kitchens within their building or department and take them to nearby compostable-collection bins. Building-wide level composting has also been launched through the Customer Funded Compostables Collection Program.

Finally, Stanford staff and student groups partner with Stanford's recycling and waste management service provider, Peninsula Sanitary Service, Inc. (PSSI), to conduct waste audits across campus. The audits provide useful data to PSSI about the campus landfill bin contents and help Stanford to focus its programs for the best results.

In sum, based on the analysis of each of the factors identified in CEQA Guidelines Appendix F, the potential for the Project to result in wasteful, inefficient or unnecessary consumption of fuel or energy, and conversely to fail to incorporate renewable energy or energy efficiency measures into building design, equipment use, transportation or other project features is **less than significant.**

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[69] Sustainable Stanford. 2015. *How to… Participate in the Deskside Paper Recycling Program.* Available online at: https://sustainable.stanford.edu/sites/default/files/Deskside_%20Recycling_%20How_To_12.15.pdf. Accessed: April 2017.

[70] Sustainable Stanford. Waste. Available online at: https://sustainable.stanford.edu/waste. Accessed: April 2017.

TABLES

Table 3-2-1
Mobile Fuel Consumption
Stanford University
Stanford, CA

Year	Mobile Category	Quantity Provided (VMT or fuel)	Unit	Percent Gasoline Vehicle Miles[7]	Gasoline Miles per Gallon	Percent Diesel Vehicle Miles[7]	Diesel Miles per Gallon	Fuel Consumption (gallons of gasoline)	Fuel Consumption (gallons of diesel)
2014	Worker + Resident[1]	90,460,288	VMT	99.2%	23	0.5%	32	3,832,059	15,406
	Construction Worker[1]	6,148,856	VMT	99.2%	23	0.5%	32	260,476	1,047
	Public Safety[2]	15,743	fuel in gallons					15,743	-
	Other Trips[1]	37,790,238	VMT	99.2%	23	0.5%	32	1,600,862	6,436
	Construction Vendor Trucks[3]	62,123	VMT	6.3%	6.9	93.7%	6.1	570	9,566
	Construction Haul Trucks[4]	159,740	VMT	1.0%	4.2	99.0%	5.4	388	29,546
	Off Road[2]	20,169	fuel in gallons					2,687	17,482
	Marguerite[5]	1,983,931	VMT			100%	5.1	-	309,244
	Bonair[5]	161,852	fuel in gallons					153,270	8,582
	PSSI[5]	74,458	fuel in gallons					-	74,458
	Valero Fuel Station[2]	1,013,866	fuel in gallons					1,013,866	-
							Total Gallons	**6,879,920**	**471,767**
2015	Worker + Resident (VMT)[1]	90,460,288	VMT	99.0%	24	0.6%	33	3,737,521	16,444
	Construction Worker[1]	6,148,856	VMT	99.0%	24	0.6%	33	254,050	1,118
	Public Safety[2]	15,743	fuel in gallons					15,743	-
	Other Trips (VMT)[1]	37,790,238	VMT	99.0%	24	0.6%	33	1,561,368	6,870
	Construction Vendor Trucks[3]	62,123	VMT	6.4%	7.0	93.6%	6.1	564	9,500
	Construction Haul Trucks[4]	159,740	VMT	1.0%	4.3	99.0%	5.4	373	29,159
	Off Road[2]	20,169	fuel in gallons					2,687	17,482
	Marguerite[5]	1,983,931	VMT			100%	5.2	-	303,968
	Bonair[5]	161,852	fuel in gallons					153,270	8,582
	PSSI[5]	74,458	fuel in gallons					-	74,458
	Valero Fuel Station[2]	1,013,866	fuel in gallons					1,013,866	-
							Total Gallons	**6,739,443**	**467,580**
Fall 2018	Worker + Resident (VMT)[1]	93,761,631	VMT	98.3%	26	0.7%	36	3,524,339	19,147
	Construction Worker[1]	6,148,856	VMT	98.3%	26	0.7%	36	231,125	1,256
	Public Safety[2]	15,743	fuel in gallons					15,743	-
	Other Trips[1]	40,257,635	VMT	98.3%	26	0.7%	36	1,513,216	8,221
	Construction Vendor Trucks[3]	62,123	VMT	6.7%	7.5	93.3%	6.2	556	9,288
	Construction Haul Trucks[4]	159,740	VMT	1.0%	4.5	99.0%	5.6	347	28,187
	Off Road[2]	20,169	fuel in gallons					2,687	17,482
	Marguerite[5]	2,144,233	VMT			100%	5.4	-	290,570
	Bonair[5]	153,759	fuel in gallons					145,606	8,153
	PSSI[5]	74,458	fuel in gallons					-	74,458
							Total Gallons	**5,433,619**	**456,762**
Fall 2020	Worker + Resident (VMT)[1]	102,777,102	VMT	97.2%	27	0.8%	38	3,645,610	21,593
	Construction Worker[1]	6,148,856	VMT	97.2%	27	0.8%	38	218,106	1,292
	Public Safety[2]	15,743	fuel in gallons					15,743	-
	Other Trips[1]	40,257,635	VMT	97.2%	27	0.8%	38	1,427,980	8,458
	Construction Vendor Trucks[3]	62,123	VMT	6.9%	7.8	93.1%	6.3	551	9,127
	Construction Haul Trucks[4]	159,740	VMT	1.0%	4.7	99.0%	5.7	337	27,523
	Off Road[2]	20,169	fuel in gallons					2,687	17,482
	Marguerite[5]	2,144,233	VMT			100%	5.6	-	281,808
	Bonair[5]	153,759	fuel in gallons					145,606	8,153
	PSSI[5]	74,458	fuel in gallons					-	74,458
							Total Gallons	**5,456,621**	**449,893**
Fall 2035[6]	Worker + Resident[1]	132,334,620	VMT	90.2%	40	0.9%	50	2,958,507	24,095
	Construction Worker[1]	6,148,856	VMT	90.2%	40	0.9%	50	137,465	1,120
	Public Safety[2]	15,743	fuel in gallons					15,743	-
	Other Trips[1]	47,774,911	VMT	90.2%	40	0.9%	50	1,068,068	8,699
	Construction Vendor Trucks[3]	62,123	VMT	7.3%	8.3	92.7%	6.9	541	8,384
	Construction Haul Trucks[4]	159,740	VMT	1.0%	5.0	99.0%	6.4	332	24,688
	Off Road[2]	20,169	fuel in gallons					2,687	17,482
	Marguerite[5]	2,618,108	VMT			0%	N/A	-	0
	Bonair[5]	80,926	fuel in gallons					76,635	4,291
	PSSI[5]	74,458	fuel in gallons					-	74,458
							Total Gallons	**4,259,978**	**163,216**

Notes:

1. Vehicle miles travelled provided by Fehr & Peers in the SB 743 VMT Analysis Appendices A, B, and C. EMFAC fuel economy for the specified fleet mix and inventory year was used to estimate fuel consumption.
2. For Public Safety fleet, Stanford provided raw data of fuel consumption from non-University sources (the remainder of fuel is included in the "Bonair" category for fuel obtained from the on-campus Bonair fueling station). Stanford also provided annual fuel consumption for the Valero fuel station. The 'Off Road' category includes fuel for off-road equipment serviced by the Bonair fueling station and fuel for the golf course equipment.
3. Vendor VMT is based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year, with a 50/50 split of medium- and heavy-duty trucks. This VMT was subtracted from the 'Other Trips' VMT because these trips would be counted in the Fehr & Peers analysis.
4. Hauling VMT is based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average demolition and excavation quantities. This consists of 7,987 total trips of 20 miles each, all heavy-heavy duty vehicles. This VMT was subtracted from the 'Other Trips' VMT because these trips would be counted in the Fehr & Peers analysis.
5. For Marguerite fleet, Stanford provided vehicle miles travelled. Mileage was used to estimate fuel consumption using EMFAC fuel economy for the specified fleet mix and inventory year. For Bonair and PSSI fleets, Stanford provided fuel usage. Bonair and Marguerite fleets incorporate more electric vehicles over time (with Marguerite fully electric by Fall 2035). For the Marguerite fleet, fuel usage will decrease over time due to the increased number of electric vehicles in the fleet but this fleet turnover will not affect VMT, so VMT is scaled up based on academic square footage. Diesel fuel usage is set to zero in Fall 2035 because all Marguerite buses are assumed to be electric by then. For the Bonair fleet, fuel usage was adjusted to reflect decrease in fuel usage due to electric vehicles being incorporated into the fleet.
6. Miles per gallon calculated from the fuel consumption and vehicle miles travelled using 2030 as the inventory year in the EMFAC database. The 2030 emissions inventory is used to allow for conservative comparisons of project buildout with adopted 2030 regulatory measures. Only vehicle types within the specified mobile category fleet mix were used for calculating fuel economy.
7. Percentage of gasoline or diesel vehicle miles calculated by taking the ratio of vehicle miles driven by a specific fuel-type vehicle over total miles for that vehicle classification (for all fuel types) in EMFAC.

Abbreviations:

EMFAC - EMission FACtors
gal - gallon
PS – Public Safety
PSSI – Peninsula Sanitary Service, Inc.
VMT - Vehicle miles travelled

Table 3-3-1
Generator Fuel Consumption
Stanford University
Stanford, CA

Year	Generator Hours of Operation (hrs)	Fuel Consumption[1] (gallons of diesel)
2014[2]	932	32,327
2015[2]	967	33,558
Fall 2018 and Fall 2020[3]	1,045	36,271
Fall 2035[4]	1,276	44,293

Notes:

1. Fuel consumption rate information was not available for all units. Therefore, fuel consumption shown here was estimated assuming 34.7 gal/hr from a representative engine (Cummins, QSX15-G9 NR 2, @ 1800 RPM) with a horsepower (HP) of 755.
2. Hours of operation in 2014 and 2015 are based on actual non-emergency and emergency run hours in 2014 and 2015, respectively.
3. For Fall 2018, it is assumed that the hours of operation will increase proportional to the increase in academic square footage (approximately 8%). Fall 2020 was assumed to be consistent with 2018.
4. It is assumed that the hours of operation will increase proportional to the increase in academic square footage over Fall 2018 (approximately 22%). Fuel consumption estimates are based on full project buildout.

Abbreviations:

gal - gallon
hrs - hours

Table 3-4-2
Construction Off-Road Equipment Fuel Consumption
Stanford University
Stanford, CA

Phase	Off-Road Equipment Type	Total Equipment Use[1] (bhp-hr)	Conversion Factor[2] (bhp-hr/gal)	Fuel Consumption (gallons of diesel)
Demolition	Concrete/Industrial Saws	9,461	19.58	483
	Excavators	29,549		1,509
	Rubber Tired Dozers	32,640		1,667
Paving	Pavers	16,800		858
	Paving Equipment	14,976		765
	Rollers	9,728		497
Site Preparation	Rubber Tired Dozers	24,480		1,251
	Tractors/Loaders/Backhoes	11,485		587
Grading	Excavators	9,850		503
	Graders	11,414		583
	Rubber Tired Dozers	16,320		834
	Tractors/Loaders/Backhoes	17,227		880
Building Construction	Cranes	105,519		5,390
	Forklifts	98,256		5,019
	Generator Sets	114,374		5,843
	Tractors/Loaders/Backhoes	173,349		8,855
	Welders	38,088		1,946
Architectural Coating	Air Compressors	4,493		230
Total	-	-	-	**37,700**

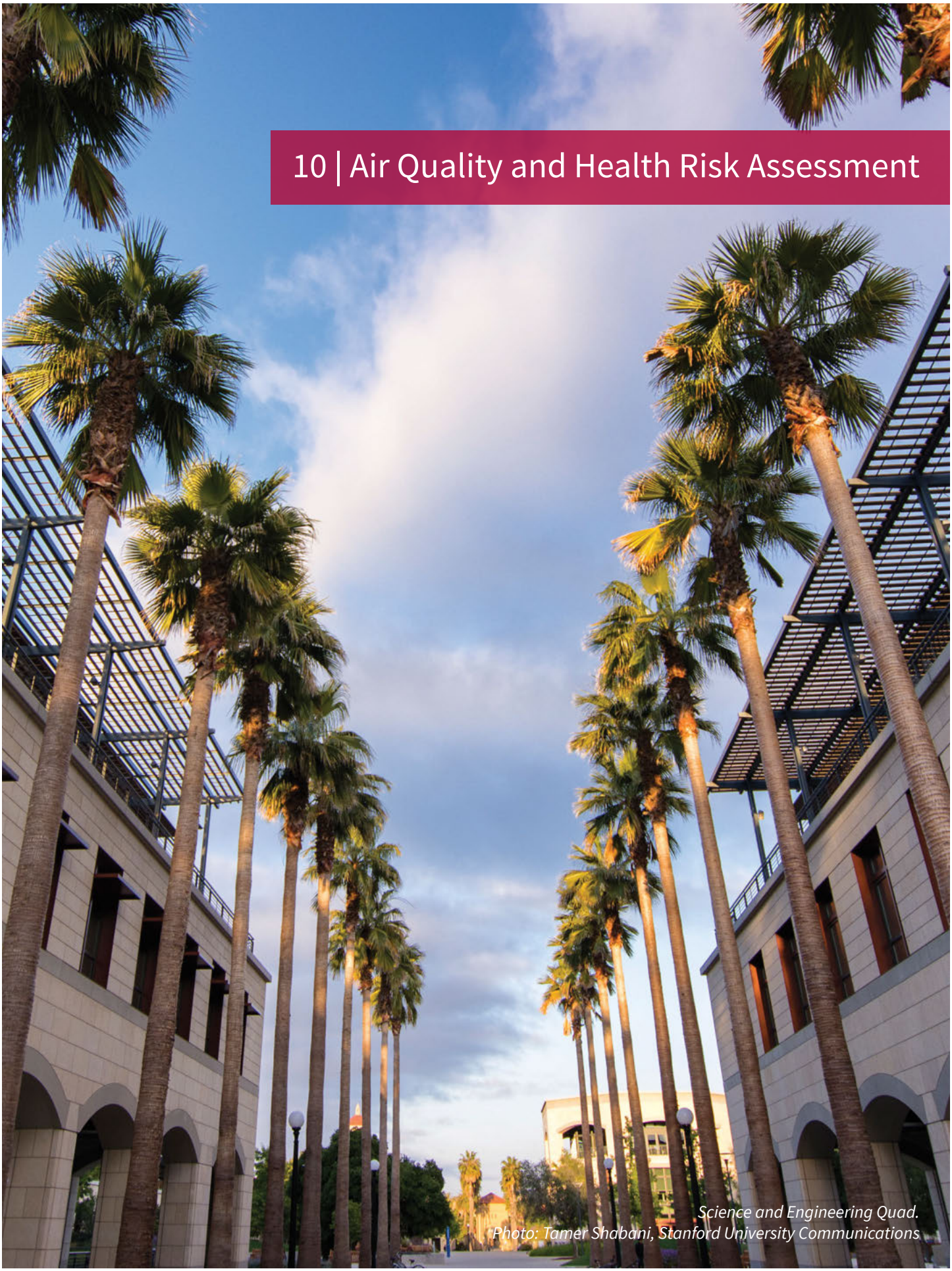
Notes:

1. Equipment use is based on CalEEMod® 2013.2.2 model runs for the annual average construction activity at Stanford. The construction schedule, off-road equipment lists and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 sqft,demolition of 50,306 sqft of buildings, and excavation of 62,062 cubic yards of soil per year, with the schedules set such that all construction occurs within one year. Methodology is described further in the GHG Technical Report section 3.4, and CalEEMod® output files are provided in the GHG Technical Report, Appendix B.
2. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES). Off-road equipment fuel efficiency is assumed to remain constant for the different calendar years. Therefore, off-road fuel use from construction activity is the same across inventory years.

Abbreviations:

bhp-hr - brake-horsepower hours
gal - gallon
hrs - hours

10 | Air Quality and Health Risk Assessment



Science and Engineering Quad.
Photo: Tamer Shabani, Stanford University Communications

Prepared for
Stanford University
Stanford, California

Prepared by
Ramboll Environ US Corporation

San Francisco, California

Project Number
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Date
August 2, 2017

STANFORD 2018 GENERAL USE PERMIT: AIR QUALITY TECHNICAL REPORT

STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ABAG	Association of Bay Area Governments
ARB	California Air Resources Board
ATCM	Air Toxic Control Measure
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
Bay Area Basin	San Francisco Bay Area Air Basin
BDT	Best Demonstrated Technology
CAAQS	California Ambient Air Quality Standards
CalEEMod®	California Emissions Estimator Model
CAP	criteria air pollutant
CARE	Community Air Risk Evaluation
CCAA	California Clean Air Act of 1988
CEF	Central Energy Facility
CEQA	California Environmental Quality Act
CO	carbon monoxide
CY	Cubic yards
DPM	diesel particulate matter
FCAA	Federal Clean Air Act
GHG	greenhouse gas
GUP	General Use Permit
HAP	hazardous air pollutant
HRA	health risk assessment
MACT	Maximum Achievable Control Technology
MMBTU	million British Thermal Units
MTC	Metropolitan Transportation Commission
MWh	megawatt-hour
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutant
NO	nitric oxide
NO_2	nitrogen dioxide

NO_X	nitrogen oxides
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	ozone
OEHHA	Office of Environmental Health Hazard
OPR	Office of Planning and Research
Pb	lead
PGE	Pacific Gas & Electric
PM	particulate matter
PSSI	Peninsula Sanitary Service, Inc.
RLMP	Responsible Laboratory Management Practices
ROG	reactive organic gas
SB	Senate Bill
SESI	Stanford Energy System Innovations
SIP	State Implementation Plan
SMOP	Synthetic Minor Operating Permit
SO_2	sulfur dioxide
SO_X	sulfur oxides
sq ft	square feet
TAC	toxic air contaminant
TBACT	Best Available Control Technology for Toxics
TOG	total organic gas
ug/m^3	microgram per cubic meter
USEPA	United States Environmental Protection Agency
VMT	vehicle miles traveled
VOC	volatile organic compound

1. INTRODUCTION

Please note that this report replaces the Air Quality Technical Report dated May 12, 2017. This updated report incorporates updates to the traffic data that result in minor changes to mobile emissions.

1.1 Project Description

Stanford University's contiguous lands occupy over 8,000 acres, with 4,017 of those acres in unincorporated Santa Clara County. The development of the Stanford land in unincorporated Santa Clara County currently is subject to conditions of approval in the 2000 General Use Permit (GUP). The 2000 GUP authorized the development of 2.035 million square feet of net new academic space and 3,018 net new housing units. In March 2016 the Santa Clara County Planning Commission authorized an additional 1,450 housing units. As of December 2015, 769,354 square feet of academic buildings remain to be built under the 2000 GUP allocation. Stanford is proposing a 2018 General Use Permit that would authorize 2.275 million net new academic space and 3,150 net new housing units. Stanford estimates that the new development authorized by the proposed 2018 General Use Permit would occur between 2018 and 2035.

1.2 Emissions Inventory Years

This report evaluates the criteria air pollutant (CAP) and toxic air contaminant (TAC) emissions inventories associated with the buildings and energy sources for existing conditions and the development proposed for the 2018 GUP (the "Project"). Inventories presented here represent the following existing conditions years: 2014, 2015, annualized emissions for Fall 2018, and emissions for the completion of the development proposed for the 2018 GUP, anticipated to occur by 2035.

1.2.1 Study Area Boundaries

Stanford anticipates that the 2018 GUP will continue to cover all of its lands in unincorporated Santa Clara County. However, the GUP does not apply to land uses within those areas that are permitted as of right. The single-family and two-family residences in the faculty/staff subdivision are permitted as of right, and therefore are not included in the study area for this existing conditions report. In addition, Stanford does not propose development under the 2018 General Use Permit in areas zoned for medium-density faculty and staff housing (the Peter Coutts, Pearce Mitchell, and Olmsted Terrace housing areas). Nor does Stanford propose development outside the Academic Growth Boundary, including on the Stanford Golf Course. Therefore, these areas similarly are not included in the study area boundary for this Air Quality Technical Report

The study area boundary includes all of the Academic Campus and Campus Open Space lands, including the Stanford Driving Range, which Stanford proposes to designate as Academic Campus rather than medium-density residential. Thirty-eight faculty and staff housing units are included in the study area in the Searsville and Olmsted staff rental subdivisions. The study area within which the emissions are analyzed is shown on Figure 1-2.

1.2.2 Existing Conditions Analysis Years

This document contains the evaluation of three scenario years to represent existing conditions. A more complete description of the existing condition years and the recent history of Stanford's emissions profile is provided in Section 3.1. The scenario years are:

- 2014, which represents the actual historic campus emissions prior to the implementation of the Stanford Energy System Innovations (SESI), and also includes the operations of the Valero Service Station. This period uses data from 2014. A major feature of SESI was the replacement of the steam-based heating system with a hot-water based heating system, and replacement of the cogeneration plant with a new more efficient Central Energy Facility (CEF). A fuller description of the SESI and a comparison of the old and new CEF is provided in Section 3.1. The 2014 information is provided to aid in understanding the degree to which historic emissions have been reduced.
- 2015, which represents the current campus emissions after implementation of SESI. This period uses data from 2015. Natural gas and electricity usage is based on July – December 2015, after SESI is implemented. This scenario also reflects year 2015 emission factors.
- Fall 2018, which represents the annualized campus emissions that are expected to exist immediately prior to commencement of operations under the proposed 2018 GUP. This includes buildings that would be expected to be permitted and occupied during implementation of the 2000 GUP, and also reflects emission factors consistent with 2018. The Fall 2018 scenario assumes that the Escondido Village Graduate Residences Project is under construction, but not yet occupied and operational.

1.2.3 Project Analysis

This document evaluates the emissions inventory for complete buildout of the 2018 GUP. This scenario is called “Fall 2035” because it consists of the full Project operations. However, the mobile source emissions are conservatively calculated using 2030 emission factors.[1] If 2035 mobile source emission factors were used instead of 2030, the total CAP emissions would be lower than reported here. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions.

[1] 2030 mobile source emission factors are used to be consistent in comparison with the 2030 GHG emissions threshold.

2. AIR QUALITY ENVIRONMENTAL AND REGULATORY OVERVIEW

2.1 Existing Air Quality

Air quality depends upon both the rate and location of pollutant emissions. Atmospheric conditions such as wind speed, wind direction, and air temperatures interact with features of the landscape to determine the movement and dispersal of air pollutants and consequently affect air quality. This section describes the physical setting for Stanford through a discussion of regional and local information related to climate, meteorology, and air pollution conditions.

2.1.1 Air Quality Background

Stanford is located in Santa Clara County, as part of the nine-county San Francisco Bay Area. It is located within the San Francisco Bay Area Air Basin (Bay Area Basin) under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD). The Bay Area Basin includes all of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara Counties, the southern portion of Sonoma County, and the southwest portion of Solano County. The Bay Area Basin covers approximately 5,540 square miles of terrain consisting of coastal mountain ranges, inland valleys, and the San Francisco Bay. The Bay Area Basin is generally bounded on the west by the Pacific Ocean, on the north by the Coast Ranges, and on the east and south by the Diablo Range.

In the Bay Area Basin, marine air traveling through the Golden Gate, as well as across San Francisco and through the San Bruno Gap, is a dominant weather factor.

Two surface meteorological stations are in the vicinity of Stanford: one is an onsite station maintained by Stanford located approximately 650 feet south of the intersection of Stock Farm Road and Sand Hill Road. The other station is a National Climate Data Center station located at the Palo Alto airport (WMO ID 724937) approximately 5 kilometers northeast from the Stanford campus.

2.1.2 Topography, Meteorology, and Climate

The Bay Area Basin climate is dominated by a strong, semi-permanent, subtropical high-pressure cell over the northeastern Pacific Ocean. Climate is also affected by the moderating effects of the adjacent oceanic heat reservoir. Mild summers and winters, moderate rainfall and humidity, and daytime onshore breezes characterize regional climatic conditions in the San Francisco Bay Area (Bay Area). In summer, when the high-pressure cell is strongest and farthest north, fog forms in the morning and temperatures are mild. In winter, when the high-pressure cell is weakest and farthest south, occasional rainstorms occur.

Ambient concentrations of air pollutant emissions are determined by the amount of emissions released by pollutant sources and the atmosphere's ability to transport and dilute such emissions. Natural factors that affect transport and dilution include terrain, wind, atmospheric stability, and the presence of sunlight. Existing air quality conditions in the Stanford area are determined by such natural factors as topography, meteorology, and climate in addition to the amount of emissions that the existing sources of air pollutants release. The environmental factors that affect ambient air pollutant concentrations are discussed separately.

2.1.2.1 Temperature Inversions

Temperature inversions, also called thermal inversions, describe areas where the normal decrease in air temperature with increasing altitude is reversed, and air at higher altitudes is warmer than the air below it. Inversion layers can range from less than 100 feet to over thousands of feet in thickness. Thermal inversions limit the vertical dispersion of air pollutants, and can trap pollutants close to the ground. These inversions occur most often when a warmer, less dense air mass flows over a colder, denser air mass close to the ground. The highest air pollutant concentrations in the Bay Area generally occur during such inversions, of which there are two types: 1) subsidence inversions – a regional phenomenon that is most common in the Bay Area during summer and fall, when descending warmer air from the subtropical high pressure cell centered over the Pacific Ocean caps the cooler marine air layer closer to the surface; and 2) radiation inversions – which are more localized and more typical of winter nights in interior parts of the Bay Area where air in contact with the ground cools more rapidly than the air layer above it.

2.1.2.2 Topography and Its Effect on Wind Speeds and Patterns

Low wind speed conditions limit horizontal air dispersion, and can result in the buildup of air pollutant concentrations. Poor air quality under low wind speed conditions can be especially pronounced in interior valleys, where the topography also contributes to the restriction of air movement and pollutant dispersion.

2.1.2.3 Solar Radiation and Its Impact on Photochemical Pollutants

The higher intensity and longer duration of solar radiation during the Bay Area's summer months provide ultraviolet light and warm temperatures that promote the formation of secondary photochemical pollutants (e.g., ozone [O_3]). Because sunlight intensity and summer temperatures are much higher in many of the Bay Area's inland valleys than near the coast, these inland areas are especially prone to photochemical air pollution.

As a consequence of these factors, the parts of the Bay Area with the highest air pollution potential tend to be the inland areas, which experience higher temperatures in the summer and lower temperatures in the winter, and which are sheltered from the higher winds and more frequent fog episodes that affect the coastal areas. Also, because air pollutant levels depend on the amount of pollutants emitted locally or from upwind sources, ambient levels in inland areas are higher because they are subject to emissions transported by the prevailing winds from populous upwind areas.

2.1.2.4 Climate Subregion for Stanford

The peninsula region extends from northwest of San Jose to the Golden Gate. The Santa Cruz Mountains run up the center of the peninsula, with elevations exceeding 2,000 feet at the southern end and decreasing to 500 feet in South San Francisco. Coastal towns experience a high incidence of cool, foggy weather in the summer. Cities in the southeastern peninsula experience warmer temperatures and fewer foggy days because the marine layer is blocked by the ridgeline to the west. San Francisco lies at the northern end of the peninsula. Because most of San Francisco's topography is below 200 feet, marine air is able to flow easily across most of the city, making its climate cool and windy.

The blocking effect of the Santa Cruz Mountains results in variations in maximum summertime temperatures in different parts of the peninsula. For example, in coastal areas and San Francisco, the mean maximum summer temperatures are in the mid-60's, while in Palo Alto the mean maximum summer temperatures are in the high 70's and low-80's. Mean

minimum temperatures during the winter months in Palo Alto are in the high-30's to low-40's, whereas on the coast, minimum temperatures are in the low 40's.

Two important gaps in the Santa Cruz Mountains occur on the peninsula. The larger of the two is the San Bruno Gap, extending from Fort Funston on the ocean to the San Francisco Airport. Because the gap is oriented in the same northwest to southeast direction as the prevailing winds, and because the elevations along the gap are less than 200 feet, marine air is easily able to penetrate into the Bay. The other gap is the Crystal Springs Gap, between Half Moon Bay and San Carlos. As the sea breeze strengthens on summer afternoons, the gap permits maritime air to pass across the mountains, and its cooling effect is commonly seen from San Mateo to Redwood City.

Annual average wind speeds range from 5 to 10 mph throughout the peninsula, with higher wind speeds usually found along the coast. Winds on the eastern side of the peninsula are often high in certain areas, such as near the San Bruno Gap and the Crystal Springs Gap.

The prevailing winds along the peninsula's coast are from the west, although individual sites can show significant differences. For example, Fort Funston in western San Francisco shows a southwest wind pattern while Pillar Point in San Mateo County shows a northwest wind pattern. On the east side of the mountains, winds are generally from the west, although wind patterns in this area are often influenced greatly by local topographic features.

Air pollution potential is highest along the southeastern portion of the peninsula. This is the area most protected from the high winds and fog of the marine layer. Pollutant transport from upwind sites is common. In the southeastern portion of the peninsula, air pollutant emissions are relatively high due to motor vehicle traffic as well as stationary sources. At the northern end of the peninsula in San Francisco, pollutant emissions are high, especially from motor vehicle congestion. Localized pollutants, such as carbon monoxide, can build up in "urban canyons." Winds are generally fast enough to carry the pollutants away before they can accumulate.

2.1.3 Existing Regional and Local Air Quality

Regional air quality is tracked for purposes of monitoring and either maintaining or achieving compliance with applicable air quality laws and regulations.

The legal framework for regulating air emissions is divided into two general categories of pollutants, and then further divided based on the nature of the activity or "source" of air pollution. The first category of pollutants is "criteria air pollutants" (CAPs), for which ambient air quality standards based on the protection of public health have been established under State and federal law. The criteria air pollutant standards, the types of sources that emit criteria air pollutants, and the region's status in complying with these standards are described in the next section.

The second category of pollutants is "toxic air contaminants" (TACs), which comprise a wide variety of compounds determined to pose an actual or potential risk to public health, either by increasing cancer risks or increasing other health risks such as respiratory diseases like asthma.

2.1.3.1 Criteria Air Pollutants

Federal and State air quality laws identify CAPs as particulate matter (PM), ground-level O_3, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_X), and lead (Pb). Additional details regarding the federal and State regulations pertaining to CAPs is in Section 2.2.

Bay Area Criteria Air Pollutant Attainment Status

Attainment of ambient air quality standards is demonstrated with mandatory monitoring of regional air quality. BAAQMD operates a regional monitoring network that measures the ambient concentrations of six criteria air pollutants. The major pollutants of concern in the San Francisco Bay Area are O_3, PM less than 10 µm in diameter (PM_{10}), PM less than 2.5 µm in diameter ($PM_{2.5}$), CO, NO_X, and sulfur oxide (SO_X). Within Santa Clara County, the BAAQMD operates or receives criteria air pollutant data from a number of local monitoring stations. The monitoring stations and the pollutants measured are described in **Table 2-1-1** below.

Based on this monitoring data, the Bay Area Basin is currently designated as an air quality attainment area under federal National Ambient Air Quality Standards (NAAQS) for all pollutants except for O_3 (for which the region is designated as a marginal nonattainment area) and CO (for which the region is designated as a moderate maintenance area).[2,3] Under the California State standards, the region is a nonattainment area for O_3, PM_{10}, and $PM_{2.5}$; and as an attainment area for all other pollutants.

Table 2-1-1 BAAQMD Criteria Pollutant Monitoring Stations Operating in Santa Clara County

Santa Clara County Monitoring Station	Criteria Pollutants Monitored	Operation Schedule
Gilroy	O_3, $PM_{2.5}$	Continuous
Los Gatos	O_3	Continuous
Redwood City	O_3, $PM_{2.5}$, CO, NO_X	Continuous
Reid-Hillview Airport	Lead	1 in 6 days
Palo Alto Airport	Lead	Closed December 19, 2014
San Jose – Knox (near road)	$PM_{2.5}$, CO, NO_X	Continuous
San Martin	O_3	Continuous
San Jose – Jackson	O_3, $PM_{2.5}$, PM_{10}, CO, NO_X, SO_2, Lead	O_3, $PM_{2.5}$, CO, NO_2, SO_2: Continuous, PM_{10}: 1 in 3 days, Lead: 1 in 6 days

Note:
Operating schedule based on 2015 Air Monitoring Network Plan information.

Source:
BAAQMD. 2015.[4]

Of the six criteria air pollutants, O_3 is the only one that is not emitted directly to the air from emission sources. Instead, ground-level O_3 is formed from a chemical reaction between NO_X

[2] USEPA. 2016. Green Book Nonattainment Areas. Criteria Pollutant Nonattainment Summary Report. June. 2016. Available online at: https://www3.epa.gov/airquality/greenbook/ancl3.html#Notes

[3] As of September 27, 2010 all carbon monoxide nonattainment areas have been redesignated as “maintenance” areas.

[4] BAAQMD. 2016. 2015 Air Monitoring Network Plan. July. 2016. Available online at: http://www.baaqmd.gov/~/media/files/technical-services/2015_network_plan-pdf.pdf?la=en

and volatile organic compounds (VOCs), often referred to as precursors, in the presence of sunlight. NO_X collectively refers to two oxides of nitrogen, namely nitric oxide (NO) and nitrogen dioxide (NO_2). VOCs refer to a general class of carbon-containing compounds that exhibit photochemical reactivity (i.e., can undergo a chemical reaction in air and in the presence of sunlight). Different regulatory agencies (i.e., United States Environmental Protection Agency [USEPA], California Air Resources Board [ARB] and BAAQMD) have established different nomenclature and definitions for photochemically reactive organic compounds (i.e., VOCs, reactive organic compounds [ROGs], and precursor organic compounds). However, these definitions are very similar and generally include the same organic compounds, with only minor differences in specific chemicals that are excluded (i.e., exhibit negligible photoreactivity, as determined by the specific regulatory agency). Although not defined by photoreactivity, total hydrocarbons is another term that is used by the USEPA to denote airborne organic compounds.

2.1.3.2 Monitoring Data

As mentioned above, ambient concentrations of pollutants are determined by regional pollutant emissions, pollutant emissions in a given area, and wind patterns and meteorological conditions for that area. As a result, ambient concentrations can vary among different locations within an area. The closest and most representative monitoring station locations to Stanford are the Redwood City and San Jose – Jackson monitors. The Redwood City monitor is sited closer to the Project, but does not gather data for all CAPs. The San Jose monitor has data for all CAPs and can be used to supplement the Redwood City data.

Table 2-1-2 shows a 5-year (2011-2015) summary of maximum concentration monitoring data collected from the Redwood City (O_3, $PM_{2.5}$, CO, NO_2) and San Jose - Jackson (PM_{10}, SO_2) stations, along with the number of exceedances of state and national Ambient Air Quality Standards (AAQS). The monitoring data show that O_3, PM_{10}, and $PM_{2.5}$ periodically exceeded the AAQS during this period.

Table 2-1-2 Summary of Ambient Air Quality in the Project Vicinity

Air Pollutants Monitored at San Mateo County Monitoring Station – Redwood City and Santa Clara County Monitoring Station – San Jose - Jackson	Year				
	2011	2012	2013	2014	2015
Ozone (Redwood City)					
Maximum 1-hour concentration measured	0.076 ppm	0.063 ppm	0.083 ppm	0.086 ppm	0.086 ppm
Days exceeding State 0.09 ppm 1-hour standard	0	0	0	0	0
Maximum 8-hour concentration measured	0.061 ppm	0.054 ppm	0.075 ppm	0.065 ppm	0.071 ppm
Days exceeding national 0.075 ppm 8-hour standard	0	0	0	0	1[a]
Days exceeding State 0.07 ppm 8-hour standard	0	0	1	0	1
Fine Particulate Matter ($PM_{2.5}$) (Redwood City)					

Table 2-1-2 Summary of Ambient Air Quality in the Project Vicinity

Air Pollutants Monitored at San Mateo County Monitoring Station – Redwood City and Santa Clara County Monitoring Station – San Jose - Jackson	Year				
	2011	2012	2013	2014	2015
Maximum 24-hour concentration measured	39.7 µg/m^3	33.3 µg/m^3	39.0 µg/m^3	35.0 µg/m^3	34.6 µg/m^3
No. of days exceeding national 35 µg/m^3 24-hour standard	1	0	3	0	0
Annual average concentration	8.7 µg/m^3	8.5 µg/m^3	10.7 µg/m^3	7.1 µg/m^3	5.7 µg/m^3
Exceeds State 12 µg/m^3 annual standard?	No	No	No	No	No
Carbon Monoxide (CO) (Redwood City)					
Maximum 8-hour concentration measured	1.7 ppm	1.8 ppm	1.6 ppm	1.6 ppm	1.6 ppm
Number of days exceeding national and State 9.0 ppm 8-hour standard	0	0	0	0	0
Nitrogen Dioxide (NO_2) (Redwood City)					
Maximum 1-hour concentration measured	0.056 ppm	0.060 ppm	0.054 ppm	0.055 ppm	0.048 ppm
Days exceeding State 0.18 ppm 1-hour standard	0	0	0	0	0
Respirable Particulate Matter (PM_{10}) (San Jose)					
Maximum 24-hour concentration measured (national)[b]	44 µg/m^3	60 µg/m^3	58 µg/m^3	55 µg/m^3	58 µg/m^3
No. of days exceeding national 150 µg/m^3 24-hour standard [b]	0	0	0	0	0
Days exceeding State 50 µg/m^3 24-hour standard [b]	0	1	5	1	1
Annual average concentration	19.2 µg/m^3	18.8 µg/m^3	22.3 µg/m^3	19.9 µg/m^3	22.0 µg/m^3
Exceeds State 20 µg/m^3 annual standard?	No	No	Yes	No	Yes
Sulfur Dioxide (SO_2) (San Jose)					
Maximum 1-hour concentration measured [b]	0.0072 ppm	0.0079 ppm	0.0025 ppm	0.0030 ppm	0.0031 ppm
Maximum 24-hour concentration measured [b]	0.0024 ppm	0.0028 ppm	0.0014 ppm	0.0009 ppm	0.0011 ppm
Days exceeding national 0.075 ppm 1-hr standard [b]	0	0	0	0	0

Table 2-1-2 Summary of Ambient Air Quality in the Project Vicinity

Air Pollutants Monitored at San Mateo County Monitoring Station – Redwood City and Santa Clara County Monitoring Station – San Jose - Jackson	Year				
	2011	2012	2013	2014	2015
Days exceeding State 0.04 ppm 24-hour standard [b]	0	0	0	0	0

Notes:
[a.] The national 8-hour standard for ozone was lowered from 0.075 ppm to 0.070 ppm on December 28, 2015.
[b.] PM_{10} monitoring was discontinued on June 30, 2008 at Redwood City and is not available. Redwood City does not monitor SO2. PM10 and SO2 summaries were gathered from the San Jose monitoring station.
Abbreviations:
ppm = parts per million of air by volume
$\mu g/m^3$ = micrograms per cubic meter

Source:

BAAQMD annual air quality summaries, http://www.baaqmd.gov/about-air-quality/air-quality-summaries, 2016.

Criteria Pollutant Emissions—Santa Clara County

Table 2-1-3 summarizes the emissions inventory for CAPs within Santa Clara County and within the entire Bay Area Basin for various source categories. According to Santa Clara County's 2015 emissions inventory, total mobile sources (on-road and off-road) are the largest contributor to the estimated annual average air pollutant levels of ROG, CO, and NO_X, accounting for approximately 49%, 87%, and 74%, respectively, of the total inventory.

Area-wide sources (e.g., solvent evaporation from equipment cleaning operations; on-site fuel combustion for space and water heating (e.g., hot water heaters); and landscape maintenance equipment such as lawnmowers and leaf blowers) account for approximately 81% of Santa Clara County's PM_{10} emissions and 73% of the County's $PM_{2.5}$ emissions.[5]

Although mobile source emissions constitute the majority of the 2015 criteria air pollutant inventory both statewide and in Santa Clara County, emissions from this source category have decreased greatly since the 1970s due to more stringent federal and state emission controls on mobile sources and fuels. Examples of vehicle emissions standards include ARB's low-emission vehicle standards, ARB's heavy-duty engine standards, and USEPA's corporate average fuel economy standards for passenger cars and light duty trucks. Examples of cleaner fuel standards include the elimination of lead from gasoline, and lowering of sulfur content in fuels.[6]

[5] ARB. 2013. Almanac Emission Projection Data. Accessed June 30, 2016. Available online at: http://www.arb.ca.gov/app/emsinv/2013/emssumcat.php

[6] USEPA. 2016. Gasoline Standards. Accessed June 30, 2016. https://www.epa.gov/gasoline-standards.

Table 2-1-3 2015 Estimated Criteria Pollutant Emissions Inventories by Source (County and Air Basin) (Tons/Day Based on Annual Average)

Source	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Santa Clara County [tons/day]						
Mobile	28.2	247.6	43.0	0.3	3.6	2.0
Stationary	12.9	8.7	11.3	2.7	1.4	0.6
Area	17.5	27.3	3.8	0.1	21.0	6.9
Total	**58.6**	**283.6**	**58.1**	**3.1**	**26.0**	**9.5**
San Francisco Bay Area Air Basin [tons/day]						
Mobile	103.3	946.6	215.6	2.3	16.0	9.4
Stationary	61.1	32.6	39.6	20.8	6.3	2.9
Area	71.6	128.4	16.4	0.5	96.5	31.7
Total	**236.0**	**1107.6**	**271.6**	**23.6**	**118.8**	**44.0**

Notes:
ROG = reactive organic gases; CO = carbon monoxide; NO_X = oxides of nitrogen; SO_X = oxides of sulfur; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter.

Totals in table may not add exactly because of rounding.

Source:
ARB. 2013.

Criteria pollutant emissions from mobile sources are projected to continue decreasing with vehicle fleet turnover to newer, cleaner models. However, while emissions from gasoline- and diesel-fueled mobile sources are both decreasing, a greater reduction in emissions from gasoline-fueled vehicles relative to diesel-fueled vehicles has resulted in an increase in the relative contribution of diesel sources to CAP from mobile sources. As a result, current regulatory development is focusing on reducing emissions from diesel vehicles.

Criteria Pollutant Emissions Sources in Palo Alto and Surrounding Areas

Local CAP sources (in Menlo Park, Palo Alto, and Mountain View) include industrial activity, a landfill and a water treatment plant in the vicinity of Stanford, as well as vehicle emissions from nearby roadways, including US Route 101 and Interstate 280. **Table 2-1-4** below summarizes estimated 2011 emissions from point sources at major facilities surrounding Stanford. This year represents information that is readily available to the public. None of these facilities are within 1,000 feet of the study area and would not be expected to be included in a cumulative emissions assessment.

Table 2-1-4 Summary of 2011 Criteria Air Pollutant Emissions for Major Facilities Emitting 0.01 Tons/Day or More of Criteria Air Pollutants (CAPs) in Project Vicinity (Tons/Year)

Plant Number	Plant Name	PM_{10}	$PM_{2.5}$	ROG	NO_X	SO_2	CO
11668	Gas Recovery Systems, Inc.	--	--	--	32.85	--	7.3
3011	IPT SRI Cogeneration Inc.	--	--	7.3	18.25	--	25.55
2740	City of Mountain View (Shoreline Landfill)	3.65	3.65	18.25	18.25	3.65	47.45
15982	Google Inc.	--	--	3.65	7.3	--	25.55
617	Palo Alto Regional Water Quality	--	--	3.65	21.9	--	--

Note:
BAAQMD facilities emissions data was presented in tons/day. Conversion assumed 365 days in a year.

Source:
Bay Area Emissions Inventory Summary Report: Criteria Air Pollutants, 2011

2.1.3.3 Toxic Air Contaminants

This section presents ambient air toxics monitoring data for the Stanford vicinity, as well as information regarding regional, local, and Facility emissions.

TAC Chemicals and Their Sources

Table 2-1-5 presents source and health effect information for the ten TACs posing the greatest known health risks in California, based on ambient air quality data.

Ambient air monitoring data for TACs near Stanford are measured at multiple locations throughout Northern California and the Bay Area. The closest monitoring stations are located at San Francisco-Arkansas Street, San Jose-4th Street, and San Jose-Jackson Street, approximately 35 miles north (San Francisco station) and 20 miles southeast of Stanford (San Jose stations). The facilities monitor approximately 30 volatile organic compounds and 35 metals, including the ten TACs listed below in **Table 2-1-5**.

TAC Emission Sources in Stanford Vicinity

Major local TAC sources include industrial activity in the vicinity of Stanford, landfills, technology companies in Silicon Valley, and emissions from cars, trucks and trains using the area's highway, parkway, and rail transportation network. Similar to CAP emissions, TAC emissions result from the operation of factories and other "stationary" facilities, as well as "mobile sources" such as passenger automobiles and light-duty trucks; other mobile equipment such as portable diesel generators; ships and harbor craft such as tugboats; cargo handling equipment, heavy duty trucks, and other construction equipment; and rail locomotives.

Table 2-1-5 Summary of Sources and Health Effects of 10 TACs That Pose Highest Cancer Risk and Diesel PM in California

TAC	Sources	Example Non-Cancer Chronic and Acute Effects
Acetaldehyde	Mobile engine exhaust Agricultural burning and wildfires Stationary source fuel combustion	Eye, skin, respiratory tract irritation
Benzene	Fugitive emissions from gasoline Gasoline engine exhaust Crude oil and natural gas mining Petroleum refining Industrial sources Residential fuel combustion Natural petroleum seeps	Reduced blood cell production Central nervous system effects Headache, dizziness, nausea
1,3-Butadiene	Mobile engine exhaust (incomplete combustion) Boilers, heaters, and internal combustion engines exhaust Agricultural waste burning Residential wood burning Oil/gas extraction Petroleum refining, synthetic material manufacturing	Neurological effects Eye, mucous membrane irritation
Carbon Tetrachloride	Chemical product manufacturing Petroleum refining Pesticide and grain fumigant usage	Central nervous system effects Liver and kidney damage
Hexavalent Chromium	Industrial uses: corrosion inhibitor in cooling towers, chrome plating, glass furnace firebrick lining Gasoline motor vehicles Oil and coal combustion	Gastrointestinal hemorrhaging Respiratory irritation and skin reactions
Ethylbenzene	Manufacture of styrene Cleaning products, paints, and other chemicals produced using Ethylbenzene	Respiratory effects Irritation of the eyes Neurological effects
Formaldehyde	Motor vehicle exhaust (complete combustion) Oil refineries emissions	Respiratory symptoms Eye, nose, throat irritation
Methylene Chloride	Plastic product and synthetics manufacturing Aircraft and parts manufacturing	Bone marrow, liver, kidney effects Central nervous system effects

Table 2-1-5 Summary of Sources and Health Effects of 10 TACs That Pose Highest Cancer Risk and Diesel PM in California

TAC	Sources	Example Non-Cancer Chronic and Acute Effects
	Paint stripping operations	
Chloroform	Manufacture of refrigerants and pharmaceuticals Chemical production Chlorination of water	Nervous system effects Liver and kidney damage
Perchloroethylene	Dry cleaning operations Fabricated metal product manufacturing Consumer products (e.g. brake cleaners, tire sealants)	Liver toxicity Kidney dysfunction Neurological effects Skin and eye irritation
Diesel Particulate Matter	Diesel fuel combustion	Reduced lung function Cardio and respiratory disease

Note:
All compounds in this list have been identified as carcinogens by the State of California.

Sources:
Toxic Air Contaminant Identification Reports, CARB, 2010

Facilities in the Stanford vicinity (Palo Alto, Mountain View, Atherton and Menlo Park) emit TACs in addition to those emitted at Stanford. Typical emitters of TACs in the region include large office buildings with emergency generators, data farms with emergency generators, research companies and institutions, water quality plants, gasoline fuel stations, and small manufacturing operations.

2.1.3.4 Sensitive Receptors

For the purposes of air quality, public health, and noise analyses, sensitive receptors are generally defined as land uses with population concentrations that would be particularly susceptible to disturbance from dust, noise, vibration, air pollutant concentrations, or other disruptions associated with project construction and/or operation. These location types generally include schools, day care centers, libraries, hospitals, residential care centers, parks, churches, and residents. Some receptors are considered more sensitive than others to air pollutants. The reasons for greater than average sensitivity include pre-existing health problems, proximity to emissions sources, or duration of exposure to air pollutants. Schools, hospitals, and convalescent homes are considered to be relatively sensitive to poor air quality because children, elderly people, and the infirm are more susceptible to respiratory distress and other air quality-related health problems than the general public. Residential areas are considered sensitive to poor air quality because people usually stay home for extended periods of time, which is associated with longer exposure to ambient air. Recreational uses are also considered sensitive due to the greater exposure to ambient air because vigorous exercise places a high demand on the human respiratory system. There are a number of different types of sensitive receptors located within one mile of Stanford, including community clinics, elementary schools, and assisted living centers, as shown in

Figure 2-1. Residential areas where children may live are also in the vicinity of Stanford and constitute additional sensitive receptors.

2.2 Regulatory Overview

2.2.1 Regulation of Criteria Air Pollutants

2.2.1.1 Federal and State Ambient Air Quality Standards

The Federal Clean Air Act (FCAA) required the USEPA to establish NAAQS, which set limits on pollutants in ambient air to protect public health and welfare. In response, the USEPA established both primary and secondary standards for six pollutants (called "criteria" pollutants), which come from numerous and diverse sources. These six criteria pollutants are: O_3; CO; NO_2; SO_2; Pb; and PM—including PM_{10} and $PM_{2.5}$. Primary standards are designed to protect human health including the health of "sensitive" populations, such as those with asthma, children and the elderly. Secondary standards are designed to protect property and public welfare, including protection against visibility impairment and damage to animals, crops, vegetation, and buildings, from air pollutants in the atmosphere. **Table 2-2-1**, includes a summary of the sources and health effects of the various criteria pollutants.

The FCAA allows states to adopt ambient air quality standards and other regulations, provided that they are at least as stringent as federal standards. ARB has established the more stringent California Ambient Air Quality Standards (CAAQS) for the six criteria pollutants through the California Clean Air Act of 1988 (CCAA), and also has established CAAQS for additional pollutants, including sulfates, hydrogen sulfide, vinyl chloride and visibility-reducing particles.

Table 2-2-1 Criteria Pollutants, Their Precursors, Sources, and Related Health Effects

Pollutant	Sources and Health Effects
$PM_{2.5}$ and PM_{10}	PM_{10} and $PM_{2.5}$ pose a serious health hazard, individually or in combination with other pollutants. More than half of the smallest particles inhaled get deposited in the lungs and can cause permanent lung damage. Respirable particles have been found to increase morbidity and mortality via the following adverse health effects: decreased lung function, aggravated asthma, exacerbation of lung and heart disease symptoms, chronic bronchitis and irregular heartbeat. In addition, respirable particles can act as a carrier of absorbed toxic substances. Particulate matter in the atmosphere results from many kinds of dust- and fume-producing industrial and agricultural operations, fuel combustion, and atmospheric photochemical reactions. Some sources of PM, such as demolition and construction activities, are local in nature, while others, such as vehicular traffic, have a more regional effect. Very small particles of certain substances (e.g., sulfates and nitrates) can cause lung damage directly, or can contain adsorbed gases (e.g., chlorides or ammonium) that may be injurious to health. Particulates also can damage materials and reduce visibility. In addition to directly emitted particulates, NO_X and SO_X are precursors of $PM_{2.5}$ and PM_{10}.

Table 2-2-1 Criteria Pollutants, Their Precursors, Sources, and Related Health Effects

Pollutant	Sources and Health Effects
Ozone (O_3)	Ozone is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving VOCs and NO_X. Because VOC and NO_X in the atmosphere can cause O_3, these chemicals are known as precursor compounds for O_3. Significant O_3 production generally requires O_3 precursors to be present in a stable atmosphere with strong sunlight for approximately 3 hours. Ozone concentrations tend to be higher in the late spring, summer, and fall, when the long sunny days combine with regional subsidence inversions to create conditions favorable to the formation and accumulation of secondary photochemical compounds, like O_3. Elevated O_3 concentrations have been shown to induce airway irritation and inflammation, result in wheezing and difficulty breathing, aggravate pre-existing respiratory conditions such as asthma, and may lead to permanent lung damage after repeated exposure to elevated concentrations.
Carbon Monoxide (CO)	Carbon monoxide is a colorless and odorless gas that is known to cause aggravation of various aspects of coronary heart disease, dizziness, fatigue, impairment to central nervous system functions, and possible increased risk to fetuses. CO is a non-reactive pollutant that is a product of incomplete combustion, and is mostly associated with motor vehicle traffic. High CO concentrations develop primarily during the winter when periods of light winds combine with the formation of ground level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates in cold weather.
Sulfur Dioxide (SO_2)	Sulfur dioxide is known to cause irritation of the respiratory tract, shortness of breath, and can injure lung tissue when combined with fine PM. SO_2 is a combustion product of sulfur or sulfur-containing fuels such as coal, which are restricted in the Bay Area. SO_2 is also a precursor to the formation of atmospheric sulfate and PM (PM_{10} and $PM_{2.5}$), and contributes to potential atmospheric sulfuric acid formation that could become acid rain downwind.
Lead (Pb)	Lead has a range of adverse neurotoxin health effects, and was formerly widely released into the atmosphere primarily via leaded gasoline. Other sources of lead include Pb smelters, and Pb battery manufacturing. The phase-out of leaded gasoline in California resulted in decreasing levels of atmospheric lead.

Table 2-2-1 Criteria Pollutants, Their Precursors, Sources, and Related Health Effects

Pollutant	Sources and Health Effects
Nitrogen Dioxide (NO_2)	Nitrogen dioxide is a reddish-brown gas that is a by-product of combustion processes. Automobiles and industrial operations are the main sources of NO_2. NO_2 may be visible as a coloring component of a brown cloud on high pollution days, especially in conjunction with high O_3 levels. Long-term exposure to NO_2 has the potential to decrease lung function, and worsen chronic respiratory symptoms and diseases in sensitive populations. It has also been associated with cardiopulmonary mortality and emergency room asthma visits.

Abbreviations:
NO_x = oxides of nitrogen
SO_x = oxides of sulfur
VOC = volatile organic compound
Sources:
USEPA. Criteria Air Pollutants, 2016, 2015a

ARB and USEPA designate an area's attainment status with respect to the CAAQS and NAAQS, respectively. The purpose of these designations is to identify areas with air quality problems and thereby initiate planning efforts for improvement. The three basic designation categories are "nonattainment," "attainment," and "unclassified." The "unclassified" designation is used in an area that cannot be classified on the basis of available information as meeting or not meeting the standards.

Table 2-2-2 includes the NAAQS and CAAQS currently in effect for each of the criteria pollutants, and the most recent attainment designations with respect to the Bay Area Basin.

Table 2-2-2 Ambient Air Quality Standards

Pollutant	Avg. Period	California Standard	Federal Standard	Bay Area Basin Attainment Status Under California Standard	Bay Area Basin Attainment Status Under Federal Standard
Ozone (O_3)	1-hour	0.09 ppm (180 µg/m^3)	Revoked	Nonattainment	--
	8-hour[a]	0.070 ppm (137 µg/m^3)	0.070 ppm (137 µg/m^3)	Nonattainment	Marginal Nonattainment
Respirable Particulate Matter (PM_{10})	24-hour	50 µg/m^3	150 µg/m^3	Nonattainment	Unclassified
	Annual	20 µg/m^3	Revoked	Nonattainment	--
Fine Particulate	24-hour	--	35 µg/m^3	--	Nonattainment

Table 2-2-2 Ambient Air Quality Standards

Pollutant	Avg. Period	California Standard	Federal Standard	Bay Area Basin Attainment Status Under California Standard	Bay Area Basin Attainment Status Under Federal Standard
Matter ($PM_{2.5}$)	Annual[b]	12 µg/m^3	12 µg/m^3	Nonattainment	Unclassifiable/ attainment
Carbon Monoxide (CO)	1-hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	Attainment	Attainment
	8-hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	Attainment	Attainment
Nitrogen Dioxide (NO_2)	1-hour[c]	0.18 ppm (339 µg/m^3)	0.100 ppm (188 µg/m^3)	Attainment	Unclassified
	Annual	0.030 ppm (57 µg/m^3)	0.053 ppm (101 µg/m^3)	--	Attainment
Lead	Rolling 3-Mo. Average	--	0.15 µg/m^3	--	Attainment
	Calendar Quarter	--	1.5 µg/m^3	--	Attainment
	30-Day Average	1.5 µg/m^3		Attainment	--
Sulfur Dioxide (SO_2)[e]	1-hour	0.25 ppm (655 µg/m^3)	0.075 ppm (196 µg/m^3)	Attainment	Attainment
	3-hour[f]	--	0.5 ppm (1310 µg/m^3)	--	Attainment
	24-hour	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3)	Attainment	Attainment
	Annual Arithmetic Mean	--	0.030 ppm (80 µg/m^3)	--	Attainment
Hydrogen Sulfide (H_2S)	1-hour	0.03 ppm (42 µg/m^3)	--	Unclassified	--
Vinyl Chloride	24-hour	0.01 ppm (26 µg/m^3)	--	--	--
Sulfates	24-hour	25 µg/m^3	--	Attainment	--

Table 2-2-2 Ambient Air Quality Standards

Pollutant	Avg. Period	California Standard	Federal Standard	Bay Area Basin Attainment Status Under California Standard	Bay Area Basin Attainment Status Under Federal Standard
Visibility-Reducing Particles	8-hour	Extinction coefficient of 0.23 per kilometer (visibility of less than10 miles due to particles when relative humidity is less than 70%)	--	Unclassified	--

Notes:
[a] On October 1, 2015, the 8-hour national O_3 standard was lowered from 0.075 ppm to 0.07 ppm. This standard is expressed as the annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
[b] The USEPA revised the primary standard on December 14, 2012 from 15 µg/m^3 to 12 µg/m^3. States are required to submit their area designation recommendations under the revised standard by December 13, 2013. The secondary standard is 15 µg/m^3.
[c] The 1-hour national standard for NO_2 was promulgated on January 22, 2010. To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 0.100 ppm.
[d] The national standard for Pb was revised on October 15, 2008 to a rolling 3-month average. The 1978 Pb standard (1.5 µg/m^3 as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
[e] On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 0.075 ppm. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.
[f] This is a secondary standard.
Abbreviations:
ppm = parts per million
µg/m^3 = micrograms per square meter
Sources:
BAAQMD. Air Quality Standards and Attainment Status. 2015

The following sections summarize criteria pollutant-related plans, programs and regulations at the federal, state, regional and local levels that are relevant to the Facility.

2.2.1.2 Air Quality Plans

The FCAA and the CCAA require State Implementation Plans (SIPs) to be developed for areas designated as nonattainment (with the exception of areas designated as nonattainment for the State PM_{10} standard). The SIP must integrate federal, state, and local actions and regulations to identify specific control measures to reduce pollution to attain the NAAQS by the required compliance date. Plans are also required under federal law for areas designated as "maintenance" for national standards. The FCAA Amendments of 1990 added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. Air quality plans usually define control strategies to reduce air pollutant emissions from industrial facilities, commercial processes, motor vehicles, and other sources. Control strategies are typically implemented through a combination of regulations adopted and enforced by the air district, grant and incentive programs, public education and outreach, and partnerships with other agencies and stakeholders.

The responsibility for developing plans and programs for each air basin has been delegated to the regional air district responsible for attaining and maintaining air quality standards in that air basin. ARB is the agency responsible for developing the SIP in California. The SIP is periodically modified to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their regional air districts. The USEPA has responsibility to review all state SIPs to determine conformation to the mandates of the FCAA Amendments, and to determine if implementation will achieve air quality goals. If the USEPA determines a SIP to be inadequate, a Federal Implementation Plan may be prepared for the nonattainment area that imposes additional control measures. Failure to submit an approvable SIP or to implement the plan within the mandated timeframe may result in sanctions being applied to transportation funding and stationary air pollution sources in the air basin.

Currently, there are three plans for the Bay Area:

- Ozone Attainment Plan for the 1-Hour National Ozone Standard (2001), which was developed to meet federal O_3 air quality planning requirements.[7] BAAQMD prepares O_3 attainment plans for the national O_3 standard, and clean air plans for the California standard, both in coordination with the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG). The most recent O_3 attainment plan was submitted in 2001 and was approved by the USEPA in 2004. The USEPA determined that the Bay Area Basin had attained the national 1-hour O_3 standard; this standard has since been replaced by an 8-hour standard.
- Bay Area 2005 Ozone Strategy, adopted by the BAAQMD in cooperation with the MTC and ABAG, reviews the region's progress over the years in reducing O_3 levels; describes current conditions and charts a course for future actions to further reduce O_3 and O_3 precursor levels in

[7] Association of Bay Area Governments (ABAG), 2001. Revised San Francisco Bay Area 2001 Ozone Attainment Plan Staff Report. Accessed July 20, 2016. http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Plans/2001%20Ozone%20Attainment%20Plan/staff_report_2001.ashx

the Bay Area and achieve compliance with the State 1-hour O_3 Standard.[8] The control strategy includes stationary source measures, mobile source measures and transportation control measures.

- Clean Air Plan (2010), which serves to update the 2005 Bay Area Ozone Strategy and also provides an integrated, multi-pollutant strategy to improve air quality, protect public health, and protect the climate.[9]

With respect to applicable air quality plans, BAAQMD prepared the 2010 Clean Air Plan to address nonattainment of the national 8-hour O_3 standard and nonattainment of the CAAQS in the Bay Area Basin. The purpose of the 2010 Clean Air Plan is to:

- Update the Bay Area 2005 Ozone Strategy in accordance with the requirements of the CCAA to implement all feasible measures to reduce O_3;
- Consider the impacts of O_3 control measures on PM, air toxics, and greenhouse gases (GHGs) in a single, integrated plan;
- Review progress in improving air quality in recent years; and
- Establish emission control measures to be adopted or implemented in the 2009-2012 timeframe.

The Clean Air Plan describes current conditions, reviews the progress in reducing Bay Area Basin O_3 levels to attain State 1-hour and 8-hour O_3 standards, and describes how the proposed control strategy for the Bay Area Basin will fulfill the CCAA planning requirements for the State 1-hour O_3 standard and mitigation requirements for transport of O_3 and O_3 precursors to neighboring air basins. The control strategies include stationary source control measures to be implemented through BAAQMD regulations; mobile source control measures to be implemented through incentive programs and other activities; and transportation control measures to be implemented through programs in cooperation with the MTC, local governments, transit agencies, and others.

The 2010 Clean Air Plan is currently being updated by the BAAQMD. In partnership with the ABAG, MTC, and the Bay Conservation and Development Commission, the BAAQMD is preparing the 2016 Clean Air Plan/Regional Climate Protection Strategy. Drafts of the 2016 Plan and Environmental Impact Report were released in July 2016, and a proposed final draft of the 2016 Plan and Environmental Impact Report are scheduled to be released in November 2016. The 2016 Plan is an integrated multi-pollutant plan that aims to reduce air pollution from a variety of stationary and mobile sources located in the Bay Area Basin. The 2016 Plan is required by the CCAA to identify control measures and strategies for the BAAQMD to implement in order to meet state ambient air quality standards for O_3. Furthermore, the 2016 Plan will encompass measures and programs to reduce particulate matter and toxic air contaminant emissions, as well as include the Bay Area's first Regional

[8] BAAQMD. 2006. Bay Area 2005 Ozone Strategy. Accessed July 20, 2016.
www.baaqmd.gov/~/media/.../2005%20Ozone%20Strategy/adoptedfinal_vol1.ashx
www.baaqmd.gov/~/media/files/communications-and.../adoptedfinal_vol2.pdf

[9] BAAQMD. 2010. Bay Area Clean Air Plan, Volumes I and II. Accessed July 20, 2016.
http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2010-clean-air-plan/cap-volume-i-appendices.pdf?la=en
http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Plans/2010%20Clean%20Air%20Plan/CAP%20Volume%20II_Sections%20A-F.ashx

Climate Protection Strategy, which will identify control measures and strategies for the Air District to reduce GHG emissions in the Bay Area.

The draft control measures proposed to be included in the 2016 Plan are aimed at protecting public health, fulfilling state air quality attainment requirements, and serving as a regional climate protection strategy through reducing emissions of O_3 precursors, particulate matter, toxic air contaminants, and GHGs. Analyses of the different pollutants will be conducted via an integrated control strategy that will identify co-benefits and disbenefits of the control strategy used for each individual pollutant. There are nine proposed control measures in the 2016 Plan that will supplement existing federal, state, regional, and local regulation, spanning the areas of agriculture, buildings, energy, Natural Working Lands, short-lived climate pollutants, stationary sources, transportation, waste control, and water control.

Title V Operating Permit (40 CFR Part 70) / Synthetic Minor Operating Permit

Title V of the 1990 FCAA Amendments requires all major sources and some minor sources of air pollution to obtain an operating permit. A Title V permit grants a source permission to operate, and includes all air pollution requirements that apply to the source, including emissions limits and monitoring, record keeping, and reporting requirements. It also requires that the source report its compliance status with respect to permit conditions to the permitting authority. The applicability threshold for a major source is dependent on whether the area is in attainment or nonattainment, and is based on the potential to emit criteria pollutants. Title V permits are typically issued by state or local agencies, although a small number of permits are issued by the USEPA.[10]

Title V permits in the Bay Area are issued by the BAAQMD. In the Bay Area, Title V requirements are implemented by Regulation 2 Rule 6 of the BAAQMD Rules and Regulations. In the BAAQMD, any source that emits or has the potential to emit 100 tons per year (tons/yr) or more of any CAP, 100,000 tons/yr of GHGs, 10 tons/yr of a single hazardous air pollutant (HAP), or 25 tons/yr of all HAPs combined is a major source and must obtain a Title V operating permit.

A facility that has a potential to emit that exceeds the above applicability thresholds may apply to accept federally enforceable limitations to keep emissions below such levels. Such facilities are called synthetic minor sources. Synthetic minor operating permits (SMOP) are issued by the BAAQMD and are implemented by Regulation 2 Rule 6 of the BAAQMD Rules and Regulations. Stanford applied for a SMOP in 2014 and it is expected to be issued in the near future.

New Source Performance Standards (40 CFR Part 60)

The USEPA promulgated New Source Performance Standards (NSPS) for major and minor sources on a category-by-category basis. NSPS are national emission standards that are progressively tightened over time to achieve a steady rate of air quality improvement without unreasonable economic disruption. The NSPS imposes uniform requirements on new and modified sources based on the best demonstrated technology (BDT). BDT refers to the best system of continuous emissions reduction that has been demonstrated to work in a given industry, considering economic costs and other factors, such as energy use. In other words, any new source of air pollution must install the best control system currently in use

[10] EPA. 2013. Operating Permits Issued under Title V of the Clean Air Act. Accessed July 22, 2016. https://www.epa.gov/title-v-operating-permits

within that industry. The NSPS program is implemented by the BAAQMD. **Table 2-2-3** summarizes NSPS regulations that are applicable to Stanford.

Table 2-2-3 Summary of Subparts under 40 CFR Part 60 (New Source Performance Standards) Listed in the Facility's Title V Operating Permit

40 CFR Part 60 Subpart	Description	Summary
A	General Provisions	Generally applies to any stationary source for which construction or modification is commenced after applicable date. Includes requirements for performance testing; compliance with standards and maintenance; monitoring; modification and reconstruction; general control device and work practice; and notification, recordkeeping and reporting.
Dc	Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units	Generally applies to steam generating units for which construction, modification, or reconstruction commenced after June 9, 1989, and that has a maximum design heat input capacity greater than or equal to 10 MMBTU/hour but less than or equal to 100 MMBTU/hour. Includes SO_2 and PM emission limits, but does not have limits for units fired exclusively on natural gas. Also covers compliance and performance test methods and procedures for SO_2 and PM; emission monitoring requirements for SO_x and PM; and reporting and recordkeeping requirements.
IIII	Standards of Performance for Stationary Compression Ignition Internal Compression Engines	Applies to stationary compression ignition internal compression engines for which construction, modification, or reconstruction commenced after July 11, 2005. Includes emission standards based on model year, maximum engine power, and emergency or non-emergency engine status; fuel requirements; monitoring requirements; compliance requirements; testing requirements; notification, reporting, and recordkeeping requirements; and emission standards for special fuels.

Abbreviations:
MMBTU = million British Thermal Units
VOC = volatile organic compound
gr/dscf = grains per dry standard cubic foot

2.2.1.3 State Programs and Regulations

ARB is the State agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the CCAA. The CCAA, which was adopted in 1988, requires that all air districts in the State endeavor to achieve and maintain the CAAQS by the earliest practical date. The CCAA specifies that districts should

focus particular attention on reducing the emissions from transportation and area-wide emission sources, and provides districts with the authority to regulate indirect sources.

ARB is primarily responsible for developing and implementing air pollution control plans to achieve and maintain the NAAQS and produces a major part of the SIP. In addition, ARB is primarily responsible for statewide pollution sources, although local air districts are still relied upon to provide additional strategies for sources under their jurisdiction.

Control of Particulate Matter—Senate Bill 656

ARB and regional air districts are responsible for implementing the provisions of Senate Bill (SB) 656, which seeks to reduce PM_{10} and $PM_{2.5}$ air pollution.[11] As a first step, ARB developed and approved a list of readily available, feasible, and cost-effective control measures based on existing California rules, regulations, and programs for stationary, area-wide, and mobile sources. The regional air districts then identified schedules for implementation of selected measures, prioritizing measures based on the extent of the PM problem in their jurisdiction, as well as based on the cost-effectiveness of the selected measures. Currently, air districts are working on evaluating and adopting rules in their specific implementation schedules. These schedules, along with ARB's other programs, are designed to continue progressing towards reducing the public's exposure to PM and towards attaining the state and federal ambient air quality standards.

CARB Air Toxic Control Measure for Stationary Compression Ignition Engines (17 CCR 93115)

The ARB Air Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines was adopted in 2004 and amended in May 2011, with the goal of reducing criteria pollutant and DPM emissions from diesel-fueled stationary compression ignition engines. The ATCM outlines emission standards, fuel use requirements, and operational hour limitations for prime and emergency back-up engines. The 2011 amendments harmonized many of the ATCM requirements with the 2006 USEPA Standards of Performance for Stationary Compression-Ignition Internal Combustion Engines (NSPS Subpart IIII); however, some ATCM emission standards and other requirements are more stringent than the NSPS.

Regulation of Other Stationary Sources

Other diesel-fueled stationary combustion sources such as boilers are regulated in the state of California through regional air district rules. For Stanford, the regulating air district is the BAAQMD. The BAAQMD rules applicable to stationary diesel combustion sources are discussed in this section.

State Mobile Source Regulations

Similar to the USEPA, California has adopted an array of regulations aimed to reduce emissions from mobile fuel combustion sources, including both fuel and source-specific emissions standards such as emissions control technologies. State regulations demonstrating both types of emissions reduction strategies are detailed below.

Diesel Fuel Regulations (Title 13, CCR, Section 2281, 2282, 2284, 2299; Title 17, CCR, Section 93114)

In 1988, ARB proposed an initial diesel fuel regulation limiting the sulfur content and aromatic hydrocarbon content of diesel fuel for motor vehicles. In 1998, ARB identified

[11] State of California. Senate Bill No. 656. 2003, ch. 738.

particulate emissions from diesel-fueled engines (DPM) as a TAC. ARB developed the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles and the Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines and approved these documents in September 2000. These documents proposed to reduce diesel particulate emissions and the associated health risk by 75% in 2010 and by 85% in 2020, and to require the use of catalyzed diesel particulate filters and ultra-low sulfur diesel fuel. The 1988 initial diesel fuel regulation was subsequently amended, and additional regulations were passed. The Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines was also amended. The current standards for diesel fuel in California are listed below.

- Sulfur Content of Diesel Fuel – This standard prohibited the sale of vehicular diesel fuel with a sulfur content exceeding 500 ppm by weight after 1993. Starting in 2006, the sulfur limit was reduced to 15 ppm to be phased in over June through September 2006.
- Aromatic Hydrocarbon Content of Diesel Fuel – This standard prohibited the sale or supply of any diesel fuel after 1993 if the aromatic hydrocarbon content exceeds 10% by volume. Starting in December 2004, section 93114 of the CCR required that air quality management districts apply the same standards to encompass non-vehicular diesel fuel.
- Lubricity of Diesel Fuel– This standard prohibits the sale or supply of any diesel fuel after January 1, 2005 unless the fuel meets minimum lubricity level.

These California regulations establish the same fuel sulfur content limits as the federal diesel fuel regulations described in Section 2.2.1.1 above (15 ppm (0.0015%) for all non-ocean going vessel diesel-fueled engines); however, the California fuel regulations accelerate the effective dates of the requirements for non-highway applications within California by 3 to 5 years.

ARB Statewide Truck and Bus Regulation

ARB adopted the Statewide Truck and Bus Regulation in December 2008 and amended it in December 2011 and December 2014. The regulation requires heavy-duty vehicles to be retrofitted with PM filters beginning January 1, 2012, and requires older vehicles to be replaced starting January 1, 2015. By January 1, 2023, nearly all trucks and buses must have 2010 model year engines or equivalent. The 2014 amendment extended concessions for the timeline of retrofitting PM filters to small fleets, owners that were financially unable to comply with PM filter requirements in 2014, and other groups with special circumstances, in addition to making other minor changes to the regulation.

ARB Off-Road Emissions Regulation for Compression-Ignition Engines and Equipment

Engines designated as nonroad engines by USEPA are known as off-road engines in California state regulations implemented by ARB. Similar to the USEPA Nonroad Diesel Rule, the Off-Road Emissions Regulation for New Compression-Ignition Engines and Equipment applies to diesel engines such as those found in construction, general industrial, and terminal equipment. Initially adopted in 2000 and amended in 2004, the regulation establishes Tier emission standards, test procedures, and warranty and certification requirements. For some model years and engine size, the ARB Tier emission standards are more stringent than the USEPA standards.

ARB In-Use Off-Road Diesel Vehicle Regulation

In July 2007 ARB adopted the In-Use Off-Road Diesel Vehicle Regulation and amended it in December 2011. The regulation requires owners of off-road mobile equipment powered by diesel engines 25 HP or larger to meet the fleet average or best available control technology (BACT) requirements for NO_X and PM emissions by January 1 of each year. The regulation also establishes idling restrictions, limitations on buying and selling older off-road diesel vehicles (Tier 0), reporting requirements, and retrofit and replacement requirements. The requirements and compliance dates vary by fleet size, with performance requirements for large fleets beginning in 2014, medium fleets in 2017, and small fleets in 2019. Requirements regarding idling, disclosure, reporting, and labeling took effect in 2008 and 2009. The Diesel Off-road On-line Reporting System is an online tool designed to help fleet owners report their off-road diesel vehicle inventories and actions taken to reduce vehicle emissions to the ARB, as required by the In-Use Off-Road Diesel Vehicle Regulation.

2.2.1.4 Regional (BAAQMD) and Local Plans, Programs, and Regulations

The BAAQMD attains and maintains air quality conditions in the Bay Area Basin. The BAAQMD's jurisdiction encompasses all of seven counties – Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara and Napa, and portions of two others – southwestern Solano and southern Sonoma.

The BAAQMD regulates air quality through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the public's understanding of air quality issues. The clean air strategy of BAAQMD includes the preparation of plans for the attainment of ambient air quality standards, adoption and enforcement of rules and regulations concerning sources of air pollution, and issuance of permits for stationary sources of air pollution. BAAQMD is the agency with permit, regulatory, and enforcement authority over most types of stationary emission sources in the Bay Area.

Regulation 9-7 (Boilers)

Regulation 9-7 provides standards for the control of NOx and CO from industrial, institutional, and commercial boilers, steam generators, and process heaters greater than 2 million British thermal unit [MMBTU]/hr. It has standards for NO_X and CO concentrations, depending on the rate heat limit. The regulation also has requirements for insulation, stack gas temperature, testing, monitoring, and recordkeeping. Stanford's hot water generators of the new CEF and the boilers of the Replacement Process Steam Plant are subject to Regulation 9-7.

Regulation 9-8 (Internal Combustion Engines)

Regulation 9-8 provides standards for the control of NO_X and CO from internal combustion engines. Emissions standards of the regulation do not apply to emergency generators. However, emergency generators are limited to up to 50 hours of reliability-related activities within a calendar year. The regulation also requires recordkeeping.

2.2.2 Regulation of Toxic Air Contaminants

Air quality regulations also focus on TACs (or in federal terminology, HAPs). In California, TACs are defined by the ARB as those air pollutants that "may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health". There are currently over 200 substances that have been identified by the ARB as TACs. While most TACs originate from human sources such as fossil fuel combustion

or dry cleaning facilities, natural sources such as forest fires and volcanic eruptions also contribute TACs to ambient air.

The nature and magnitude of the potential health effects of TACs depends on the substance, concentration, and period of exposure. Some TACs cause effects in response to short-term (acute) exposure; others cause effects only after sustained exposures over weeks, months, or years. The effects of acute exposure may be minor, such as watery eyes or respiratory irritation, or they may be extensive, such as damage to the reproductive system or nervous system. If exposure to a sufficient concentration occurs for a sufficient period, individuals may have an increased risk of developing cancer, or a greater likelihood of experiencing non-carcinogenic chronic adverse effects. These chronic non-carcinogenic health effects may be minor, such as nasal rhinitis or respiratory irritation; or they may involve long-term damage to the immune, neurological, reproductive, respiratory, or other systems.

While some natural sources such as forest fires and volcanic eruptions contribute TACs to ambient air, most TACs originate from anthropogenic sources. Industrial facilities and mobile sources are significant sources of TACs. Various common urban facilities also produce TAC emissions, such as gasoline stations (benzene), hospitals (ethylene oxide), and dry cleaners (perchloroethylene). Automobile exhaust also contains TACs such as benzene and 1,3-butadiene. Most recently, DPM was identified as a TAC by ARB. DPM is a complex mixture of hydrocarbons, particulates, gases, and other compounds. DPM is emitted by diesel-fueled internal combustion engines, and the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emission control system is present. Both California's Office of Environmental Health Hazard (OEHHA) and the USEPA consider DPM to be a carcinogen. Both agencies also recognize that exposure to DPM may cause non-cancer effects such as change(s) in lung function and airway inflammation. DPM is a component of PM, and recent scientific data have linked prolonged exposure to PM to premature mortality, respiratory effects, and cardiovascular disease.

For TACs that do not cause cancer, threshold levels of chemicals are established by OEHHA, which are thought to be safe. However, in general, for those TACs that may cause cancer, even the smallest concentrations of chemicals may present some risk of cancer. In other words, from a regulatory point of view, there is no threshold level below which adverse health risks, although potentially small, may not be estimated to occur for carcinogenic chemicals. This is in contrast with the CAPs, for which acceptable levels of exposure can be determined and for which ambient standards have been established (refer to **Table 2-1-1**). The USEPA and ARB regulate TACs through statutes and regulations that generally require the use of the maximum or best available control technology for toxics (Maximum Achievable Control Technology [MACT] and Best Available Control Technology for Toxics [TBACT], respectively) to limit emissions. These, in conjunction with additional rules set forth by BAAQMD, establish the regulatory framework for TACs.

An example of a chronic, non-carcinogenic disorder exacerbated by air pollutants is asthma, which has been the focus of a number of recent studies. While there is only limited evidence that air pollution is the causative factor in asthma onset, there are considerable data that link air pollution to worsening of the disease. For example, living near traffic sources has been associated with both asthma occurrence and aggravation of the disease,[12] and others

[12] Salam, M., T. Islam, and F. Gilliland. 2008. Recent Evidence for Adverse Effects of Residential Proximity to Traffic Sources on Asthma. Current Opinion in Pulmonary Medicine, 14:3–8.

reported a significant increase in hospital visits as exposure to traffic increased.[13] Proximity to heavy traffic has also been linked to impaired lung development in children.[14]

Unlike criteria pollutants, TACs do not have region-wide ambient concentration limits such as NAAQS or CAAQS; there is no equivalent to "attainment status" for TACs. Concentrations of TACs may be regulated indirectly based on results from a health risk assessment (HRA). An HRA is a scientifically based tool used to determine if exposure to chemicals(s) pose a significant risk (cancer risk or non-cancer hazards) to human health. The effects of air toxic emissions are relatively localized, with concentrations tending to decrease markedly with distance from the source due to dilution and/or degradation. Due to this localized nature, HRAs tend to focus on receptors in the immediate vicinity of the point of release.

2.2.2.1 Federal Regulations

National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61 and 40 CFR Part 63)

The FCAA Amendments of 1970 required the USEPA to identify and list all air pollutants (not already identified as criteria pollutants) that "may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible or incapacitating reversible illness." The standards for TACs were considerably strengthened under the FCAA Amendments with the listing of 189 HAPs. For each HAP identified, the USEPA was to then promulgate National Emissions Standards for Hazardous Air Pollutants (NESHAPs) at levels that would ensure the protection of the public health with an ample margin of safety and to prevent any significant and adverse environmental effects, which may reasonably be anticipated, on wildlife, aquatic life, or other natural resources. The NESHAPS can set different requirements for major and area sources. Major sources are defined as stationary sources with potential to emit more than 10 tons/yr of any HAP or more than 25 tons/yr of any combination of HAPs; all other sources regulated under Title III of the FCAA Amendments are considered area sources. Issuance of the emission standards occurs in two phases. The first phase consists of technology-based emission standards designed to produce a high level of emission reductions for major sources of HAPs, which are referred to as MACT standards. For area sources, the standards may be different, based on generally available control technology. In the second phase, the USEPA must issue health risk-based emissions standards where such standards are deemed necessary to address risks remaining after implementation of the technology-based NESHAPs. These second-phase standards are generally referred to as "residual MACT" standards.

The FCAA Amendments also required the USEPA to issue vehicle or fuel standards containing reasonable requirements to control HAP emissions, applying at a minimum to benzene and formaldehyde. Performance criteria were established to limit mobile source emissions of toxics, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 of the FCAA Amendments also required the use of reformulated gasoline in selected U.S. cities (those with the most severe O_3 nonattainment conditions) to further reduce mobile-source emissions, including air toxics.

[13] Chang, J., R. Delfino, D. Gillen, T. Tioa, B. Nickerson, and D. Cooper. 2009. Repeated Respiratory Hospital Encounters Among Children with Asthma and Residential Proximity to Traffic. Occup. Environ. Med 66(2):90-98.

[14] Gauderman, W. J., H. Vora, R. McConnell, K. Berhane, F. Gilliland, D. Thomas, F. Lurmann, E. Avol, N. Kunzli, M. Jerrett, and J. Peters. 2007. Effect of Exposure to Traffic on Lung Development from 10 to18 Years of Age: A Cohort Study. Lancet. 369. pp. 571-577.

The federal hazardous air pollutant regulations that are applicable to Stanford are described in **Table 2-2-4**.

Table 2-2-4 Summary of Federal HAPs Regulations Applicable to Stanford

CFR Part	Subpart	Description	Details
40 CFR Part 63	A	General Provisions	Establishes applicability determination for stationary sources; prohibits circumvention and fragmentation of sources; includes definitions and requirements for preconstruction review and notification, performance testing, monitoring, recordkeeping and reporting, to which subparts can incorporate by reference or override.
40 CFR Part 63	ZZZZ	National Emission Standards for Hazardous Air Pollutants For Stationary Reciprocating Internal Combustion Engines	Start-up requirements for Reciprocating Internal Combustion Engines (RICE) at area sources; management practices (air/filter replacement schedule, inspection schedule) listed in this regulation (or in conjunction with an alternative management program administered by State permitting authorities), for stationary emergency RICE; and recordkeeping requirements.

Notes:
RICE = Reciprocating Internal Combustion Engines

2.2.2.2 State Regulations

Tanner Air Toxics Act

TACs in California are primarily regulated through the Tanner Air Toxics Act (Assembly Bill [AB] 1807) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588, or the Hot Spots Act). AB 1807 sets forth a formal procedure for ARB to designate substances as TACs. Research, public participation, and scientific peer review are necessary before ARB can designate a substance as a TAC. To date, ARB has adopted the USEPA's list of HAPs as TACs and has identified more than 20 additional TACs.

Once a TAC is identified, ARB then adopts an ATCM for sources that emit that particular TAC. If there is a safe threshold at which there is no toxic effect from a substance, the control measure must reduce exposure below that threshold. If there is no safe threshold, the measure must incorporate BACT to minimize emissions.

Proposition 65

The Safe Drinking Water and Toxic Enforcement Act of 1986, Proposition 65, was passed as a ballot initiative in 1986 and is intended to protect citizens and the State's drinking water from chemicals known to cause cancer or reproductive toxicity (including birth defects), as well as to notify citizens about their exposure to such chemicals.

Diesel Risk Reduction Plan

In August 1998, the ARB identified DPM (i.e., PM from diesel-fueled engines) as a TAC. Following this, ARB adopted a comprehensive Risk Reduction Plan in 2000. Pursuant to this Plan, ARB adopted diesel-exhaust control measures and stringent emission standards for various on-road mobile sources of emissions, including transit buses and off-road diesel equipment (e.g., tractors, generators). In 2001, ARB adopted the Public Transit Bus Fleet Rule and Emissions Standards for New Urban Buses, which established emissions limits on 1985 and subsequent model year heavy-duty bus engines and vehicles for NO_X, CO, nonmethane hydrocarbons, PM, and formaldehyde. The emissions standards apply to all heavy-duty urban buses, including diesel-fueled buses. Therefore, the rule limits the emissions of two TACs identified by ARB: DPM and formaldehyde. In 2007, a low-sulfur diesel fuel requirement and tighter emission standards for heavy-duty diesel trucks was put into effect, followed in 2011 by the same standards being applied to off-road diesel equipment.

Over time, the replacement of older vehicles will result in a fleet that produces substantially lower levels of TACs than the replaced vehicles. Mobile-source emissions of TACs (e.g., benzene, 1,3-butadiene, DPM) decreased significantly over the last decade and will be reduced further in California through a progression of regulatory measures (e.g., Low-Emission Vehicle/Clean Fuels and Phase II reformulated gasoline regulations) and control technologies.

With implementation of ARB's Risk Reduction Plan, DPM concentrations are expected to be reduced by 75% in 2010 and 85% in 2020 from the estimated year-2000 level. As emissions are reduced, it is expected that risks associated with exposure to these emissions will also be reduced. Emissions from heavy-duty diesel equipment associated with Stanford would be required to comply with the rules outlined above. Details regarding the regulations adopted pursuant to the ARB's Risk Reduction Plan are also discussed in Section 2.2.1.3.

Air Quality and Land Use Handbook

The ARB provides guidance concerning land-use compatibility with TAC sources. Although not a law or adopted policy, the handbook offers recommendations for the siting of sensitive receptors (e.g., proposed residential units) near uses associated with TACs to help limit the exposure of children and other sensitive populations to TACs.

2.2.2.3 Regional (BAAQMD) and Local Plans, Programs, and Regulations

BAAQMD CARE Program

Under the Community Air Risk Evaluation (CARE) program, BAAQMD aims to identify areas (referred to in this context as "priority" or "impacted" communities) with high TAC emissions and sensitive populations that could be affected by them, and to use this information to establish policies and programs to reduce TAC emissions and exposures.[15] The impacted communities are located in Concord, Richmond/San Pablo, San Jose, eastern San Francisco, western Alameda County, Vallejo, San Rafael, and Pittsburg/Antioch.

The main objectives of the program are to:

[15] Bay Area Air Quality Management District (BAAQMD). 2016. CARE Program. Accessed July 1, 2016. http://www.baaqmd.gov/plans-and-climate/community-air-risk-evaluation-care-program.
BAAQMD. 2014. Identifying Areas with Cumulative Impacts from Air Pollution in the San Francisco Bay Area. Accessed July 1, 2016. http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CARE%20Program/Documents/ImpactCommunities_2_Methodology.ashx?la=en

- Evaluate potential health risks associated with exposure to TACs from both stationary and mobile sources;
- Assess potential exposures to sensitive receptors and identify impacted communities;
- Prioritize TAC reduction measures for significant TAC sources in impacted communities; and
- Develop and implement mitigation measures - such as grants, guidelines, or regulations - to improve air quality, focusing initially on priority communities.

BAAQMD Planning Healthy Places

The purpose of the Planning Healthy Places guidelines is to promote efficient and sustainable land use development while ensuring clean and healthy air for residents. Planning Healthy Places was developed on the premise that regional ambient air emissions and health risk control programs do not account for localized impacts to communities located in close proximity to busy roadways, factories, airports, and other sources of air pollution.

BAAQMD prepared these guidelines outside the California Environmental Quality Act (CEQA) context to assist developers and land use planners with addressing potential land use compatibility issues associated with locating people close to localized sources of air pollution, specifically PM and TACs. The BAAQMD identifies a list of “best practices” to reduce emissions or exposure to sensitive receptors who are in close proximity to development projects. Through Planning Healthy Places, the BAAQMD denotes regions in the Bay Area located close to highways and busy roadways where “best practices” are recommended to reduce exposure and emissions, as well as regions situated close to large and complex emissions sources (such as ports, refineries, and gas stations) where further study is required to assess air pollution levels. There are a number of further study areas located in the vicinity of Stanford, which correspond to gas stations, dry cleaners, and back-up generators.

BAAQMD Rules and Regulations

BAAQMD has implemented specific rules and regulations that limit emissions from various sources, and that identify specific pollution reduction measures. Some emissions sources are further subject to legal requirements imposed through BAAQMD’s permitting process.

Under BAAQMD Rule 2-1 (General Permit Requirements), Rule 2-2 (New Source Review [NSR]), and Rule 2-5 (NSR of TACs), all sources that have the potential to emit TACs are required to obtain permits from BAAQMD. Permits may be granted if the sources are constructed and operated in accordance with applicable regulations, including NSR standards and ATCMs. BAAQMD prioritizes TAC-emitting stationary sources based on the quantity and toxicity of the TAC emissions, and on the proximity of the facilities to sensitive receptors. BAAQMD analyzes sources that require a permit (e.g., performs health risk assessments) based on their potential to emit TACs. If it is determined that a project’s emissions would exceed BAAQMD’s threshold of significance for TACs, as identified below, the source has to implement BACT for TACs (TBACT) to reduce emissions. BAAQMD’s TBACT measures apply to individual facility sources, such as storage tanks, boilers, and emergency generators. If a source cannot reduce the risk below the threshold of significance even after implementing TBACT, then BAAQMD will deny the permit. BAAQMD permit requirements help to reduce emissions and related health impacts from new emissions sources, as well as from existing emissions sources by requiring them to apply new technology when retrofitting.

A number of laboratory sources and operations are exempt from the "authority to construct" and "permit to operate" authorizations detailed in BAAQMD Rule 2-1, provided that Responsible Laboratory Management Practices (RLMP) are followed. RLMP include the incorporation of information about the emissions of volatile TACs into training for laboratory personnel, avoidance of open container storage of volatile TACs and hazardous chemical waste, the periodic monitoring of fume hoods, and proper disposal of hazardous chemical waste containing TACs. If Responsible Laboratory Management Practices are followed, then the following laboratory sources are exempt from permitting requirements:

- Teaching laboratories used exclusively for classroom experimentation and/or demonstration;
- Laboratories located in a building where the total laboratory floor space is less than 25,000 square feet or the total number of fume hoods is less than 50. In addition, laboratory units for which the owner or operator can demonstrate that there will not be any TAC emissions (except under accidental conditions) are not included in the floor space or fume hood calculations;
- Bench scale laboratory equipment or processes (excluding pilot plants) used exclusively for experimentation, quality control testing, or research and development;
- Vacuum producing devices in laboratory operations which are used exclusively with other equipment that are also exempt from permitting, and which do not remove or transfer air contaminants from another source;

BAAQMD's permitting process applies to stationary sources. Properties that are exposed to elevated levels of TACs from nonstationary sources, and the nonstationary sources themselves (e.g., on-road vehicles), are not subject to air quality permits. Emissions controls on mobile sources are subject to regulations implemented at the federal and State levels by USEPA and ARB, respectively.

3. CRITERIA POLLUTANT EMISSIONS INVENTORIES

This section describes the methodology that Ramboll Environ US Corporation (Ramboll Environ) used to develop the existing conditions and project conditions criteria air pollutant emission inventories, which include both construction and operational emissions. Sub-categories of criteria air pollutant operational emissions include: natural gas combustion, mobile sources, emergency generators, laboratories, and the fuel stations. Full details on the calculation methodology for the existing conditions and Project inventories are provided in **Appendix A**.

3.1 Existing Conditions Inventories Description

There are three scenario years presented in this Air Quality Technical Report to evaluate existing conditions:

- 2014
- 2015
- Fall 2018

The Fall 2018 scenario year presented in this technical report represents the annualized emissions expected to exist immediately prior to commencement of operations under Stanford's proposed 2018 General Use Permit. This includes additional buildings that would be expected to be permitted during implementation of the 2000 General Use Permit but does not include occupancy of the new Escondido Village Graduate Residences. This scenario also takes into account changes in the motor vehicle fleet anticipated in 2018. For example, mobile sources are expected to have lower emissions in 2018 based on existing regulatory standards. Also importantly, the Fall 2018 scenario reflects Stanford's existing commitment to acquire electricity from a solar farm in Kern County and to build new solar systems on Stanford's campus. The Kern County solar farm will be a 68-megawatt peak solar plant generating 159,000 megawatt-hours per year (MWh/year). In addition, several Stanford building complexes feature solar panels, including the Science and Engineering Quad and the Knight Management Center. Installation began in May 2016 on rooftop panels for an additional 16 campus buildings to provide an additional 5 megawatts (MW), which will generate up to 7,300 MWh/year. These two solar systems are expected to provide up to 53 percent of Stanford's total electricity use. While these projects do not impact CAP or TAC emissions at Stanford, this does impact GHG emissions, and is therefore an important aspect to consider in presenting scenario years.

The 2014 and 2015 scenarios demonstrate the effects of the recently completed changes at Stanford that have significantly changed its CAP and TAC emissions profile. Previously, in 2014, Stanford produced electricity, steam and chilled water at its on-campus Cardinal cogeneration plant and its prior Central Energy Facility (old CEF). These facilities employed what was previously considered a state-of-the-art process of generating electricity through a gas-fired plant, and using the steam (a by-product of electricity generation) to heat campus buildings. Stanford used onsite chillers to create cold water to cool the buildings. In addition, the old CEF provided process steam for use in kitchens and laboratories. Excess electricity produced by the old CEF that was not used by Stanford was sold back to Pacific Gas & Electric Company (PG&E). Emitting equipment for the old CEF was comprised of four boilers, a gas turbine, duct burners, and three emergency generators. The old CEF (including the Cardinal Cogeneration plant) was decommissioned in April 2015.

In 2015, Stanford completed a groundbreaking overhaul of its campus heating and cooling system. This overhaul is called the Stanford Energy System Innovations-- or SESI. SESI relies on a heat-recovery process that is 70 percent more efficient than the prior cogeneration process for heating and cooling. The new system will meet more than 90 percent of the campus heating demands by capturing almost two-thirds of the waste heat generated by the campus cooling system. To make that exchange possible, Stanford replaced 22 miles of underground pipes and retrofitted 155 buildings to convert the campus from a steam- to hot water- based system. In addition, Stanford now purchases its electricity through a Direct Access program that enables purchase from Electric Service Providers that include renewable resources within their portfolios.

The new CEF includes the following equipment:

- three hot water generators,
- two emergency generators,
- electric-powered chillers (non-emitting), and
- thermal energy storage tanks (non-emitting).

The hot water generators supply hot water for building heating and primarily run on natural gas, with the additional capability to run on diesel fuel in emergencies. The emergency generators run on diesel fuel.

In addition to the change in emissions profiles due to the SESI, there were also changes in 2015 due to two other types of emissions sources:

- Stanford installed a steam processing plant that provides process steam for sterilization purposes (e.g., for kitchens and laboratory autoclaves). This is referred to as "Replacement Process Steam."
- Stanford installed individual boilers at a few campus locations to provide steam for heating and hot water services at campus buildings that will not be converted from steam to hot water within a reasonably foreseeable timeframe. This category of sources is referred to as the "Individual Replacement Boilers."

Both pre-SESI (2014) and post-SESI (2015) inventories are provided here to provide context for the Fall 2018 inventory. 2014 represents the historic actual campus emissions prior to implementation of the SESI, and also includes the operations of the Valero Service Station. 2015 represents the current campus emissions after implementation of SESI and still includes operation of the Valero Service Station. The 2015 emissions inventory was then used to develop the Fall 2018 inventory by incorporating assumptions on growth in certain categories, such as an increase in academic square footage and residential beds, and the removal of the Valero Service Station. A comparison of the 2014, 2015, and Fall 2018 inventories is provided in **Table 3-1-1**, illustrating the effect of SESI (between 2014 and 2015), the impact of removing the Valero Service Station, and the remaining growth of the campus under the 2000 General Use Permit (Fall 2018).

3.2 Project Inventory Description

This document evaluates the emissions inventory for complete buildout of the 2018 GUP. The Fall 2018 emissions inventory was used to develop the Project inventory by incorporating assumptions on growth in certain categories, such as an increase in academic square footage and residential beds. This scenario is called "Fall 2035" because it consists of the full Project

operations, which are anticipated to occur in 2035. However, the mobile emissions are conservatively calculated using 2030 emission factors. If 2035 emission factors were used instead of 2030, the total CAP emissions would be lower than reported here. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions. **Table 3-1-1** summarizes the Project inventory.

3.3 Construction Emissions: Existing Conditions and 2035 Project

This section describes the estimation of CAP and TAC emissions from construction activities within the study area. Average annual construction and demolition square footage from fiscal year 2001 through fiscal year 2015 were used to estimate the annual emissions from construction and demolition for all existing conditions and Project inventory years. Detailed information on the construction emissions calculations are provided in **Appendix A**, and detailed emission inventory from the California Emissions Estimator Model (CalEEMod®) output files are included in **Appendix B**. The major construction phases included in this analysis are:

- Demolition: involves demolishing/removing existing buildings.
- Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- Paving: involves the laying of concrete or asphalt such as in parking lots or roads.
- Building Construction: involves the construction of structures and buildings.
- Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

CAP and TAC emissions from these construction activities are largely attributable to fuel use from off-road construction equipment and vendor vehicles. VOCs can be emitted from architectural coating activities. CAP and TAC emissions from construction worker, vendor, and hauling vehicles are already included as separate line items in the mobile emissions section. All PM_{10} is assumed to be DPM for purposes of health risk calculations.

Ramboll Environ used CalEEMod® version 2013.2.2 to quantify the construction emissions. The construction schedule, off-road equipment lists, and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 square feet (sq ft), demolition of 50,306 sq ft of buildings per year, and excavation of 62,062 cubic yards (CY) of soil, with the default start and end dates of the phases moved such that all construction occurs within one year while maintaining total default number of equipment-hours. This is intended to mirror the average construction year that occurred during the 2000 GUP. Ramboll Environ understands based on communications with Stanford's construction project managers that the majority of construction equipment used by contractors building projects at Stanford meets final Tier 4 emissions standards. Construction equipment is all assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment. Emissions are shown in **Table 3-1-1** and detailed mobile source tables.

3.4 Operational Emissions- Existing Conditions and 2035 Project

3.4.1 Natural Gas

CAP emissions from natural gas combustion are generated from residential and commercial usage (e.g., cooking and heating) and industrial usage (i.e., powering the old CEF for the 2014 inventory and powering the new CEF and Replacement Process Steam Plant for the 2015 and Fall 2018 inventories).

For the 2014 and 2015 inventories, student residential and university commercial natural gas usage is provided through PGE consumption data. Natural gas usage for private faculty/staff housing is estimated based on averages for the climate zone. Natural gas usage of the old CEF (2014 inventory) and the new CEF and Replacement Process Steam Plant (2015 inventory) are provided by Stanford.

The Fall 2018 inventory is based on the 2015 inventory for the above subcategories (except for private faculty/staff housing), scaled up for the remainder of the development of the existing 2000 GUP by 2018. Private faculty/staff housing natural gas usage for the Fall 2018 inventory is assumed to remain constant from the 2015 inventory.

The Fall 2035 inventory is based on the Fall 2018 inventory for the above subcategories, scaled up for the development of the proposed 2018 GUP by 2035 and with the addition of the new Escondido Village Graduate Residences. New private faculty/staff housing natural gas usage is based on averages for the climate zone assuming compliance with the 2016 Building Energy Efficiency Standards. Natural gas consumption, emission factors, and emissions for all scenario years are summarized in **Tables 3-4-1, 3-4-2, 3-4-3, 3-4-4**, and **3-4-5.**

3.4.2 Mobile Sources

CAP emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford. Mobile source emissions include running exhaust emissions, idle exhaust emissions, start exhaust tailpipe emissions, diurnal evaporative hydrocarbon emissions, resting evaporative losses, hot soak evaporative hydrocarbon emissions, running loss evaporative hydrocarbon emissions, tire wear particulate matter emissions, and brake wear PM emissions. Running exhaust, tire wear particulate matter, and brake wear particulate emissions are dependent on VMT. Starting exhaust, hot soak evaporative, and running loss evaporative emissions are dependent on the number of starts or trips that a vehicle makes. Idle exhaust, resting evaporative, and diurnal evaporative emissions are dependent on the number vehicles. Assumptions and calculations used to determine emissions are described in detail in **Appendix C**.

For 2014 and 2015, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers with the exception of the on-campus fleet. The on-road Campus Fleet can be categorized into the Bonair Fueling Station Fleet, the Peninsula Sanitary Service, Inc (PSSI) Fleet, the Marguerite Bus/Shuttle Fleet, and the Public Safety Fleet. Stanford provided activity data in the form of fuel totals for the Bonair Fueling Station Fleet and PSSI Fleet, and VMT for the Marguerite Bus/Shuttle Fleet, portions of the PSSI Fleet, and the Public Safety Fleet. Activity data (fuel consumption) for the off-road

Campus Fleet and golf course fleets (Siebel Varsity Golf Training Complex and Red Barn)[16] was provided by Stanford. Activity data (number of trips and VMT) for visitors and childcare facilities was calculated by Ramboll Environ based on Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**.

For Fall 2018, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, visitors, and vendors corresponding to 2015 were scaled up based on additional academic square footage, and additional number of residents housed on campus. Activity data for the Public Safety Fleet is assumed to be the same as for 2015. The 10 oldest vehicles from the Marguerite fleet will be replaced with electric vehicles by Fall 2018, so only tire and brake wear particulate matter emissions will be considered from those 10 vehicles. The Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, while reducing the total number of vehicles. This fleet reduction program is assumed to reduce emissions from Bonair vehicles by 5%.

For 2035, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers. On-road Campus Fleet emissions incorporate the Stanford commitments that all Marguerite buses will be electric vehicles by 2035 and 70% of Bonair vehicles will be electric vehicles by 2035. Activity data (number of trips and VMT) for campus visitors and travel associated with the childcare facilities was calculated by Ramboll Environ based on Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**.

The mobile source criteria pollutant emission factors were generated with the most recent approved version of ARB's EMission FACtor model (EMFAC2014), approved by the USEPA on December 14, 2015. Mobile emissions were estimated for the following pollutants: ROG, CO, NO_X, PM_{10}, $PM_{2.5}$, SO_X. Full calculation details can be found in **Appendix A**.

Emissions for all scenario years are summarized in **Tables 3-4-6, 3-4-7, 3-4-8,** and **3-4-9.**

3.4.3 Emergency Generators

Stanford currently has 90 emergency generators installed on campus. CAP emissions are from diesel combustion in their operation for both testing and maintenance and for emergency operation. Activity data (hours of operation) for the emergency generators is provided by Stanford for 2014 and 2015. Activity data was scaled up from the 2015 inventory based on increased academic square footage to develop the Fall 2018 inventory. For 2035, activity data from Fall 2018 was scaled up based on the increase in academic square footage from Fall 2018 to full buildout of the 2018 GUP. Full calculation details are provided in **Appendix A**.

Emissions for all scenario years are summarized in **Tables 3-4-10** and **3-4-11.**

[16] Although the Stanford golf course (and fuel tanks at the golf course) is located outside of the study area boundary, some of the off-road equipment that fuel at the golf course also service parts of the campus within the study area boundary. To be conservative, emissions were included from equipment activity at the Siebel Varsity Golf Training Complex and Red Barn, which are both within the study area boundary.

3.4.4 Laboratories

Laboratory emissions are estimated for 93 chemicals, the list of which was approved in BAAQMD protocols as described in **Appendix A**.[17] Chemicals include those regulated by BAAQMD TAC Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments. For the 2014 inventory, Ramboll Environ first estimated chemical usage for the 93 chemicals based on the total number of fume hoods on campus and Stanford-provided inventory data for 2001 for the ChemBio building usage quantities or 2015 chemical inventories of the Lokey Laboratory Building (ChemBio), the Shriram Center (BioE/ChemE), Mudd (Seeley G) Chemistry, and the Environment and Energy building. Then, ROG emissions are calculated based on the chemical type and volatility. The 2015 inventory is assumed to be the same as 2014, as laboratory activities are assumed to be the same. The Fall 2018 inventory is based on the 2015 inventory but including 8% growth to account for an expected increase in academic square footage. The Fall 2035 inventory is based on the Fall 2018 inventory but including 22% growth to account for an expected increase in academic square footage. Full calculation details are provided in **Appendix A**.

Emissions for all scenario years are summarized in **Tables 3-4-12, 3-4-13, 3-4-14, and 3-4-15.**

3.4.5 Fuel Stations

In 2014, the Valero and Bonair fuel stations were in operation. The Valero fuel station was accessible to the public prior to its closure in 2016. The Bonair fuel station is still operational and is used to fuel campus vehicles. For the 2014 inventory, annual gasoline throughput for 2014 or 2015 for all stations was provided by Stanford and was used to estimate evaporative VOC emissions from gasoline. For the 2015 inventory the same throughput as in 2014 was used for the Bonairi and Valero fuel stations. For the Fall 2018 inventory, the 2015 inventory throughput for Bonair was used, and decreased by 5% to represent the switch to a hub-based system that will reduce VMT and therefore fuel consumption. The Valero fuel station, which ceased operations in 2016, was not included in the Fall 2018 inventory.

For 2035, Project emissions from the Bonair fuel station was based on the Fall 2018 inventory and subsequently decreased (by 50%) by the growing number of electric vehicles that will be part of the Stanford on-campus fleet.

In all scenario years, a controlled VOC emission factor from the source specific guidance for gasoline dispensing facilities from BAAQMD Permit Handbook was used.[18]

Emissions for all scenario years are summarized in **Tables 3-4-16, 3-4-17, 3-4-18,** and **3-4-19.**

3.5 Criteria Pollutant Inventories in Context

A category-by-category comparison of emissions between the three existing conditions inventories and the Project inventory is shown in **Table 3-1-1**. Even with growth in population and building square footage, total mass emissions of CAPs decrease significantly from 2014 to 2015 to Fall 2018 and to Fall 2035.

[17] ARB. Bay Area Air Quality Management District Regulation 2. Accessed July 22, 2016. http://www.arb.ca.gov/drdb/ba/suphtml/r2-1.htm

[18] BAAQMD. Engineering Division Permit Handbook. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en

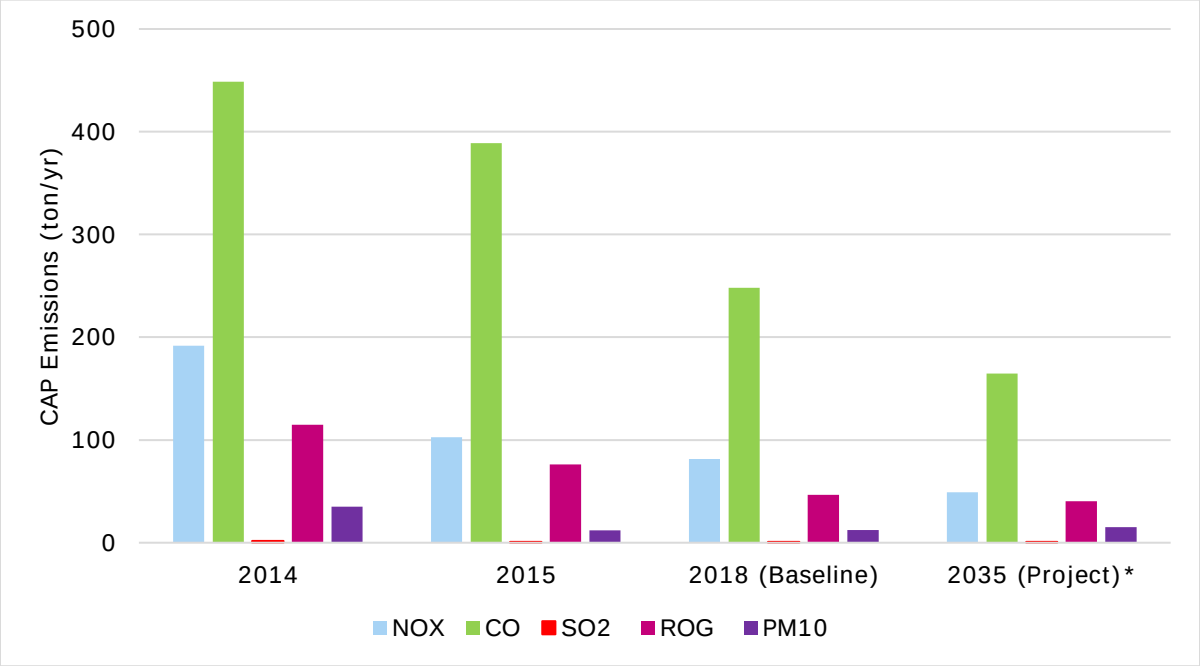
The decrease from 2014 to 2015 is due to the decommissioning of the Cardinal Cogen plant, and conversion to the SESI, which uses heat recovery for building heating and cooling.

The continued decreases through Fall 2018 and Fall 2035 are due to lower emissions from mobile sources subject to a progression of regulatory measures. As described in Section 1.2.3, the 2035 Project inventory is the developed using 2030 emission factors. This is conservative, as the mobile emission factors are expected to continue to decrease after 2030. A summary of total emissions over time is shown in **Table 3-5-1** and **Figure 3-5**.

Table 3-5-1. Stanford CAP Emissions

	CAP Emissions (ton/yr)				
Inventory Year	NO_X	CO	SO_2	ROG	PM_{10}
2014	192	449	1.7	115	35
2015	103	389	0.79	76	12
2018 (Baseline)	82	248	0.75	47	12
2035 (Project)	49	165	0.69	40	15

Figure 3-5. Stanford CAP Emissions



*As described in Section 1.2.3, the 2035 Project inventory is based on 2030 emission factors. This is conservative, as the mobile emission factors are expected to continue to decrease after 2030.

4. TOXIC AIR CONTAMINANT EMISSIONS INVENTORIES

This section describes the methodology that Ramboll Environ used to develop the existing conditions and project conditions TAC emission inventories, which include operational emissions. Construction activities also result in the emissions of DPM, a recognized TAC in California. Since DPM is assumed to be all PM_{10}, and PM_{10} is discussed and calculated in the CAP section, the methodology for calculating construction emissions is not further discussed here. Sub-categories of TAC operational emissions include: natural gas combustion, mobile sources, emergency generators, laboratories, and fuel stations. Full details on the calculation methodology for inventory development are provided in **Appendix A**.

Section 3.1 describes the context for the three existing conditions inventory years and Project inventory year presented in this technical report.

4.1 Operational Emissions – Existing Conditions and 2035 Project

4.1.1 Natural Gas

TAC emissions from natural gas combustion are generated from residential and commercial usage (e.g., cooking and heating), and also from powering the old CEF (for the 2014 inventory) or the new CEF and Replacement Process Steam Plant (for the 2015, Fall 2018, and Fall 2035 inventories). The same activity data (natural gas usage) used for estimating CAP emissions, as described in Section 3.4.1, are also used for calculating TAC emissions.

Benzene, formaldehyde, and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion. TAC emissions from natural gas sources are summarized in **Tables 4-1-1, 4-1-2, 4-1-3, 4-1-4,** and **4-1-5**.

4.1.2 Mobile Sources

TAC emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford.

DPM, benzene, and 1,3-butadiene emissions were estimated from fuel combustion of mobile sources. BAAQMD CEQA Guidelines indicate that these three pollutants represent a substantial portion of the ambient background risk from TACs in the Bay Area Basin.[19] DPM emissions were assumed to be equivalent to PM_{10} emissions from diesel-powered mobile sources. The methodology for calculating PM_{10} emissions are presented in Section 3.4.2 and in **Appendix A**. Benzene and 1,3-butadiene are components of ROG and total organic gas (TOG) emissions (presented in Section 3.4.2), so emissions from total ROG (for diesel mobile sources) or TOG emissions (for gasoline mobile sources) were speciated to determine the benzene and 1,3-butadiene emissions. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 of the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011). Therefore, only those two compounds are included for gasoline TAC calculations.

The same activity data (i.e., VMT, vehicle trips, brake horsepower per hour) used to calculate CAP emissions, as described in Section 3.4.2, are used to calculate TAC emissions.

[19] BAAQMD California Environmental Quality Act: Air Quality Guidelines (Updated May 2012). http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/baaqmd-ceqa-guidelines_final_may-2012.pdf?la=en

TAC emissions from mobile sources are summarized in **Tables 4-1-6, 4-1-7, 4-1-8, and 4-1-9**.

4.1.3 Emergency Generators

DPM emissions were conservatively assumed to be equivalent to PM_{10} emissions from emergency generators. Methodology for calculating PM_{10} emissions are presented in Section 3.4.3 above, and described in detail in **Appendix A**.

Emissions estimates for DPM from emergency generators are shown in **Tables 3-3-10** and **3-3-11**, under PM_{10} emissions.

4.1.4 Laboratories

The methodology for the calculation of TAC emissions from laboratories is described in Section 3.4.4 above, and described in detail in **Appendix A**.

Emissions estimates are shown in **Tables 3-4-12, 3-4-13, 3-4-14,** and **3-4-15**.

4.1.5 Fuel Stations

ROG emissions estimated in Section 3.4.5 were speciated to assume that 0.3% of total emissions are benzene.[20] The calculation methodology is described in detail in **Appendix A.**

Emissions estimates are shown in **Table 4-2.**

4.2 Toxic Air Contaminant Inventories in Context

A category-by-category comparison of TAC emissions between the three existing conditions inventories and the Project inventory is shown in **Table 4-2**. The TACs shown in this summary table are those evaluated by the BAAQMD for natural gas combustion and fuel combustion for mobile sources, which represent a substantial portion of ambient background risk from TACs in the Bay Area. Therefore, this report focuses on these five TACs. The other 89 laboratory chemicals for which emissions were calculated are shown in **Tables 3-4-12, 3-4-13, 3-4-14,** and **3-4-15**. Even with growth in population and building square footage, total mass emissions of four out of the five TACs that are tracked in the emissions inventory decrease from 2014 to Fall 2035. A summary of TAC emissions over time is shown in **Table 4-2-2** and **Figure 4-2**.

The decrease from 2014 to 2015 is due to the decommissioning of the Cardinal Cogen plant, and conversion to the SESI for heating and cooling.

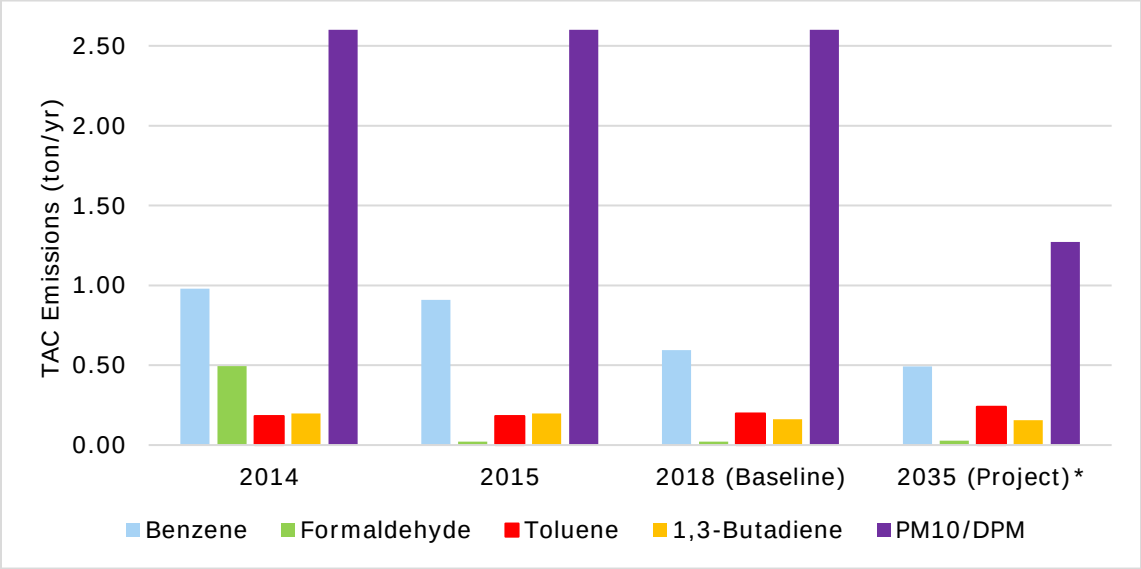
Continued decreases through Fall 2018 and Fall 2035 are due to lower emissions from mobile sources subject to a progression of regulatory measures. As described in Section 1.2.3, the 2035 Project inventory is the developed using 2030 emission factors. This is conservative, as the mobile emission factors are expected to continue to decrease after 2030.

[20] Speciation from Table 1 in CAPCOA Air Toxics "Hot Spots" Program: Gasoline Service Station Industrywide Risk Assessment Guidelines. http://www.arb.ca.gov/ab2588/rrap-iwra/gasiwra.pdf.

Table 4-2-2. Stanford TAC Emissions

	TAC Emissions (ton/yr)				
Inventory Year	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM
2014	0.99	0.50	0.18	0.20	2.8
2015	0.92	0.020	0.18	0.20	2.8
2018 (Baseline)	0.60	0.022	0.20	0.16	2.7
2035 (Project)*	0.49	0.027	0.24	0.16	1.3

Figure 4-2. Stanford TAC Emissions



* As described in Section 1.2.3, the 2035 Project inventory is based on 2030 emission factors. This is conservative, as the mobile emission factors are expected to continue to decrease after 2030.

5. IMPACT ASSESSMENT AND MITIGATION MEASURES

5.1 Standards of Significance

This section discusses the criteria and general methods used to evaluate the Project's significance with respect to air quality impacts under CEQA. It also discusses the BAAQMD 2010 thresholds of significance, which are used to evaluate the Project. Methodology for the calculation of emissions is discussed in more detail in Section 3 above.

5.1.1 CEQA Guidelines Appendix G Thresholds

Appendix G of the State CEQA Guidelines requires evaluating whether the project under consideration would:

- Conflict with or obstruct implementation of an applicable air quality plan;
- Violate any air quality standard, or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any CAP for which the project region is non-attainment under an applicable federal or State ambient air quality standard (including increasing emissions which exceed quantitative thresholds for O_3 precursors);
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

Lead agencies may rely on the CEQA significance criteria established by the local air pollution control agency (for the Bay Area, BAAQMD) to determine the significance of a project's air emissions under the Appendix G thresholds.

5.1.2 BAAQMD Significance Thresholds

The BAAQMD presents its thresholds of significance along with methods for evaluating compliance in its guidance document entitled California Environmental Quality Act Air Quality Guidelines (updated May 2011).[21] The BAAQMD significance thresholds are summarized in **Table 5-1-1**. The BAAQMD significance thresholds are divided between CAPs and TACs, and

[21] On March 5, 2012 the Alameda County Superior Court issued a judgment, in California Building Industry Association v. Bay Area Air Quality Management District, finding that the BAAQMD had failed to comply with CEQA when it adopted its significance thresholds in 2010. The Court ruled that the adoption of the significance thresholds (including new significance thresholds for TACs and fine particulate matter or $PM_{2.5}$) is considered a "project" under CEQA, and, thus, the BAAQMD should have prepared the required CEQA review and documentation. The court issued a writ of mandate ordering the BAAQMD to set aside the 2010 significance thresholds and cease dissemination of them until the BAAQMD had complied with CEQA. On August 13, 2013, the California First District Court of Appeal reversed the Superior Court's decision, ruling that adoption of CEQA significance thresholds does not constitute a "project" under CEQA. The CBIA then sought review of this decision in the California Supreme Court, which narrowed the scope of review to the question: under what circumstances does CEQA require an analysis of how existing environmental conditions will impact future residents or receptors of a proposed project? On December 17, 2015, the California Supreme Court held that CEQA does not generally require an agency to consider the effects of existing environmental conditions on a proposed project's future users or residents. On August 16, 2016, the California First District Court of Appeal concluded that a local agency might permissibly apply the thresholds for existing environmental conditions to an environmental review of the agency's own project conducted under CEQA, even though the thresholds cannot be used to require an environmental impact report or the implementation of mitigating measures for a privately initiated project based solely on the impact the existing environment will have on future users or occupants of a project.
Because the vacation of the proposed significance thresholds did not affect their validity from a scientific perspective and the BAAQMD's thresholds are supported by substantial evidence, and because the County of Santa Clara does not have alternative numeric thresholds for evaluating air quality impacts under CEQA, the thresholds from the BAAQMD CEQA Guidelines will be used in this analysis.

are set for evaluating a project's short-term construction emissions, long-term operational emissions, and contributions to cumulative impacts to determine whether such contributions are cumulatively considerable. Generally, the BAAQMD significance thresholds for CAPs address the first three Appendix G air quality CEQA thresholds and the TAC thresholds address the fourth Appendix G threshold. Finally, BAAQMD has established a threshold for odors, consistent with the fifth Appendix G threshold.

The 2011 BAAQMD CEQA Guidelines explain that criteria pollutant thresholds based on mass emission rates (e.g., NO_X, ROGs, PM_{10} exhaust, $PM_{2.5}$ exhaust) or ambient air concentrations (e.g., CO) are designed to maintain ambient air concentrations of criteria air pollutants below State and federal standards, or to prevent a "cumulatively considerable contribution" to regional nonattainment with ambient air quality standards.

Table 5-1-1 BAAQMD CEQA Air Quality Thresholds of Significance

Air Pollutants (and Precursors)	Construction-Related Average Daily Emissions (lbs/day)	Operational-Related	
		Average Daily Emissions (lbs/day)	Maximum Annual Emissions (tons/year)
ROGs	54	54	10
NO_X	54	54	10
PM_{10}	82 (exhaust only)	82	15
$PM_{2.5}$	54 (exhaust only)	54	10
$PM_{10}/PM_{2.5}$ (fugitive dust)	Best Management Practices	None	
CO (local concentration)	None	9.0 ppm (8-hour average) 20.0 ppm (1-hour average)	
Risks and Hazards for New Sources and Receptors (Individual Project)	Same as Operational Thresholds	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 HI (chronic or acute) Ambient $PM_{2.5}$ increase: > 0.3 µg/m^3 annual average, a concentration that would not result in significant health impacts. Zone of Influence: 1,000-foot radius from fence line of source or receptor	

Table 5-1-1 BAAQMD CEQA Air Quality Thresholds of Significance

Air Pollutants (and Precursors)	Construction-Related Average Daily Emissions (lbs/day)	Operational-Related	
		Average Daily Emissions (lbs/day)	Maximum Annual Emissions (tons/year)
Risks and Hazards for New Sources and Receptors (Cumulative Threshold)	Same as Operational Thresholds	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >100 in a million (from all local sources) Increased non-cancer risk of >10 HI (from all local sources) (chronic) Ambient $PM_{2.5}$ increase: > 0.8 µg/m^3 annual average (from all local sources) Zone of Influence: 1,000-foot radius from fence line of source or receptor	
Odors	None	Complaint History – five confirmed complaints per year averaged over 3 years	

Abbreviations:
BMP = best management practices
MT of CO_2e/yr = metric tons of carbon dioxide equivalent per year
MT CO_2e/SP/yr = metric tons carbon dioxide equivalent per service population per year
HI = hazard index; µg/m^3 = micrograms per cubic meter.

To assist the lead agency in evaluating air quality impacts at the community scale, thresholds of significance have been established for local community risks and hazards associated with TACs and $PM_{2.5}$ with respect to siting a new source and/or receptor, as well as for assessing both individual source and cumulative multiple source impacts. These thresholds of significance focus on $PM_{2.5}$ and TACs because these more so than other emission types may pose significant adverse health impacts at the local level as discussed separately below.

TACs and $PM_{2.5}$ are evaluated based on the health impacts that may result from the emissions of TACs and $PM_{2.5}$. The health impacts associated with TACs are quite diverse and generally are assessed locally, rather than regionally. TACs (and $PM_{2.5}$) can cause, depending on the specific TAC, long-term health impacts such as cancer, birth defects, neurological damage, asthma, bronchitis, or genetic damage; or short-term acute affects such as eye watering, respiratory irritation (a cough), running nose, throat pain, and headaches.

For evaluation purposes, TACs are separated into carcinogens and non-carcinogens based on the nature of the physiological impacts associated with exposure to the pollutant. Carcinogens are assumed to have no safe threshold below which health impacts would not occur, and cancer risk is expressed as excess cancer cases per one million exposed individuals, typically over a lifetime of exposure. Non-carcinogenic substances differ in that

there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis. Acute and chronic exposure to non-carcinogens is expressed as a hazard index (HI), which is the ratio of expected exposure levels to an acceptable reference exposure levels.

The thresholds of significance for local community risk and hazard impacts are identified below. Local community risk and hazard impacts are associated with TACs and $PM_{2.5}$ because emissions of these pollutants can have significant adverse health impacts at the local level. If Project-related emissions of TACs or $PM_{2.5}$ exceed any of the following thresholds, the Project would result in a significant adverse impact:

- An excess cancer risk level of more than 10-in-1 million, or a non-cancer (i.e., chronic or acute) hazard index greater than 1.0 would be a significant cumulatively considerable contribution;
- An incremental increase of greater than 0.3 microgram per cubic meter ($\mu g/m^3$) annual average $PM_{2.5}$ from a single source would be a significant cumulatively considerable contribution.

Cancer risks, and acute and chronic hazard indices, are calculated from the estimated concentrations of pollutants in the air and the potential for exposure of people to these pollutants. That process is known as risk assessment. Concentrations in the air are calculated from TAC emissions using air dispersion modeling. Air dispersion modeling is the mathematical estimation of pollutant impacts from emissions sources within a study area. Information on factors that affect the fate and transport of pollutants in the atmosphere, including meteorological conditions, site configuration, emission release characteristics, and surrounding terrain, is used in the dispersion model. Once concentrations are calculated using air dispersion modeling, the risks are calculated using information on how much air people breathe and the toxicity of the chemical considered. The resulting cancer risks and chronic and acute hazard index, as described above, are compared to the BAAQMD significance thresholds to assess significance.

With respect to odors, the significance threshold used is the odor nuisance complaint approach in BAAQMD Regulation 7. The 2010 BAAQMD CEQA Guidelines also provide guidance in the form of screening distances, to help evaluate potential odor impacts.

5.2 Environmental Analysis

5.2.1 Construction Impacts

Impact AQ-1-: Project Construction Would Not Result in Emissions of NOx, PM, and ROGs above BAAQMD Significance Thresholds.

The proposed project would generate construction emissions from a variety of sources, including the following: off-road construction equipment; and on-road worker, vendor, and hauling vehicles. Because construction can fluctuate from year to year, emissions from construction activity are shown for both an average construction year scenario and a "peak" construction scenario.[22] A summary of emissions and comparison to thresholds is shown in **Table 5-2-1.** Note that construction emissions under the 2000 GUP also occurred during the

[22] The "peak" construction scenario for the proposed project was identified to begin in year 2023, five years after commencement of the 2018 GUP. Given the time that it will take to complete the ongoing Escondido Village Graduate Residences and to permit another large project, this year is assumed to be the earliest year construction of a peak project might begin.

baseline year as discussed in Section 3.3 and as presented in the baseline emissions inventory (such average annual emissions are estimated to be equivalent to those presented here for the 2018 GUP). Under the 2000 General Use Permit, peak construction emissions are estimated to exceed the peak levels presented here for the 2018 GUP. To be conservative, construction emissions associated with the 2018 GUP are evaluated as new emissions here, without subtracting the baseline emissions. Details on CAP emission calculations for the annual average construction scenario are shown in Appendix A. Peak construction emissions are calculated consistent with the assumptions used in the health risk analysis in terms of the scope and size of the largest construction project built at Stanford under the 2000 GUP. CalEEMod® 2013.2.2 output files for all construction runs are included in Appendix B.[23]

Table 5-2-1: Average Daily Construction Emissions

	Average Daily Emissions (pounds/day)[1]			
	ROG	**NOx**	**Exhaust PM_{10}[2]**	**Exhaust $PM_{2.5}$[2]**
Project Average Construction Scenario - Off-Road Equipment + On-Road Trips (Worker + Vendor + Hauling)	14.9	22.0	2.8	1.3
Significance Threshold	54	54	82	54
Above Threshold?	No	No	No	No
Project Peak Construction Scenario - Off-Road Equipment + On-Road Trips (Worker + Vendor + Hauling)	51.3	41.8	1.1	1.0
Significance Threshold	54	54	82	54
Above Threshold?	No	No	No	No

[1] Construction emissions in lbs/day were calculated by dividing the total CAP emissions by the number of working days. For the annual average scenario, this was the annual emissions divided by 260 days. For the peak construction scenario, this was the total emissions divided by 780 days, since the peak construction project is modeled over three years.

[23] On-road worker, vendor, and hauling emissions for the annual average scenarios are calculated using EMFAC2014 and are shown as line items within operational Tables 3-4-6 through 3-4-9. All other emissions for the annual average and peak scenarios were quantified using CalEEMod®, as these emissions did not rely on Fehr & Peers data and were not otherwise quantified for operational inventories.

[2] Exhaust PM for the annual average scenario includes tire wear and brake wear PM for on-road vehicles. The BAAQMD Thresholds do not include these sources so the comparison is conservative.

Table 5-2-1 indicates that construction activity associated with the proposed Project would result in emissions of criteria pollutants and precursors that would be below thresholds of significance for all pollutants. Therefore, impacts from emissions of NOx, PM, and or ROGs from construction activities are **less than significant**.

Impact AQ-2: With Inclusion of BAAQMD-Recommended Basic Construction Mitigation Measures, Project Construction Would Result in Less-Than-Significant, Localized Dust-related Air Quality Impacts.

In addition to exhaust emissions from construction equipment, Project-related demolition, excavation, soil stockpiling and handling, and other construction activities may generate wind-blown dust (including PM_{10} and $PM_{2.5}$). Construction-related dust emissions would vary from day to day, depending on the level and type of activity, silt content of the soil, and the weather. In the absence of mitigation, dust generated from construction activities may result in significant adverse impacts on a temporary and intermittent basis during the construction period.

According to BAAQMD significance thresholds, a project would not have a significant adverse air quality impact associated with construction dust if applicable BAAQMD-recommended construction best management practices are required as mitigation measures and implemented during construction activities.

BAAQMD notes that individual best management practices have been shown to reduce fugitive dust by anywhere from 30% to more than 90%, and conclude that projects that implement construction best management practices will reduce fugitive dust emissions to a less-than-significant level.[24]

The Project would implement best management practices (BMPs) to ensure that fugitive dust for Project construction would result in less-than-significant impacts. This mitigation also contains measures that would reduce emissions from construction equipment engine exhaust.

Mitigation Measure AQ-2: All construction activities for the Project shall comply with the following BAAQMD basic construction mitigation measures:

- All exposed surfaces (e.g. parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
- All haul trucks transporting soil, sand or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweepers is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 mph.

[24] BAAQMD. 2010. California Environmental Quality Act Guidelines Update. Proposed Thresholds of Significance. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/draft_baaqmd_ceqa_guidelines_may_2010_final.pdf?la=en Accessed October 2016.

- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes. Clear signage shall be provided for construction workers at all access points.
- All construction equipment shall be maintained and properly tuned in accordance with manufacturers' specifications. All equipment shall be checked by a certified visible emissions evaluator.
- Post a publicly visible sign with the telephone number and person to be contacted regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Implementation of the BMPs above would reduce the impact to a less-than-significant level.

Impact AQ-3: Project Construction Would Not Generate Emissions of TAC and $PM_{2.5}$ At Levels That Would Result in Health Risks above BAAQMD Significance Thresholds.

According to BAAQMD significance thresholds, Project construction would have a significant adverse air quality impact if construction-related emissions of toxic air contaminants would cause an excess cancer risk level exceeding 10 in 1 million, or an acute or chronic HI greater than 1.0, as measured by an HRA model that takes into consideration topography, wind patterns, and other facts in identifying the maximum exposed sensitive receptor. Sensitive receptors include residences, schools, hospitals and convalescent facilities, parks, and churches.

Additionally, BAAQMD has a concentration-based threshold for annual $PM_{2.5}$ concentrations that exceed 0.3 µg/m3.

Off-road equipment (which includes construction-related equipment) is a large contributor to diesel particulate matter (DPM) emissions in California, although since 2007, ARB has found the emissions to be substantially lower than previously expected.[25] Newer and more refined emission inventories have lowered the estimates of DPM emissions from off-road equipment such that off-road equipment is now considered the sixth largest source of DPM emissions in California.[26] For example, ARB's revised estimates of particulate matter (PM) emissions (of which DPM is a major component) for the San Francisco Bay Area Air Basin for the year 2010 have decreased by 83 percent from previous 2010 emissions estimates.[27] Approximately half

[25] ARB, *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* p.1 and p. 13

(Figure 4), October 2010.

[26] ARB, *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* October 2010.

[27] ARB, "In-Use Off-Road Equipment, 2011 Inventory Model," http://www.arb.ca.gov/msei/categories.htm#inuse_or_category.

of the reduction in emissions can be attributed to the economic recession and half to updated methodologies used to better assess construction emissions.[28]

Additionally, a number of federal and state regulations are requiring cleaner off-road equipment. Specifically, both the USEPA and California have set emissions standards for new off-road equipment engines, ranging from Tier 1 to Tier 4. Tier 1 emission standards were phased in from 1996 to 2000, and Tier 4 interim and final emission standards for all new engines will be phased in between 2008 and 2015. To meet the Tier 4 emission standards, engine manufacturers will be required to produce new engines with advanced emission-control technologies. Although the full benefits of these regulations will not be realized for several years, the USEPA estimates that by implementing the federal Tier 4 standards, NOx and PM emissions will be reduced by more than 90 percent.[29] Stanford voluntarily has committed to require its construction contractors to use engines meeting Tier 4 standards, with the exception of chainsaws and paving phase equipment. Furthermore, California regulations limit maximum idling times to five minutes, which further reduces public exposure to NOx and PM emissions.[30]

Construction activities do not lend themselves to analysis of long-term health risks because of the location of each individual construction project in relation to a sensitive receptor is temporary and variable. As explained in the BAAQMD's CEQA *Air Quality Guidelines*:

> "Due to the variable nature of construction activity, the generation of TAC emissions in most cases would be temporary, especially considering the short amount of time such equipment is typically within an influential distance that would result in the exposure of sensitive receptors to substantial concentrations. Concentrations of mobile-source diesel PM emissions are typically reduced by 70 percent at a distance of approximately 500 feet (CARB 2005). In addition, current models and methodologies for conducting health risk assessments are associated with longer-term exposure periods of 9, 40, and 70 years, which do not correlate well with the temporary and highly variable nature of construction activities. This results in difficulties with producing accurate estimates of health risk."[31]

Therefore, project-level health risk analyses of construction activities have a tendency to overestimate assessments of long-term health risks.

Although total emissions from construction activities were estimated based on the amount of square footage to be developed between full buildout of the 2000 GUP and full buildout of the 2018 GUP, it is not possible to conduct a health risk assessment (HRA) for each discrete project that will occur through 2035. Accordingly, a screening tool was developed to ensure future construction activities would not result in emissions of toxic air contaminants exceeding BAAQMD health risk significance thresholds. All particulate matter less than 10 µm in diameter (PM_{10}) is assumed to be diesel particulate matter (DPM) for purposes of health risk calculations.

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[28] ARB, *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* October 2010.

[29] USEPA, "Clean Air Nonroad Diesel Rule: Fact Sheet," May 2004.

[30] California Code of Regulations, Title 13, Division 3, § 2485.

[31] BAAQMD, *CEQA Air Quality Guidelines,* May 2011, page 8-6.

The tool is based on a health risk assessment described in **Appendix D**, which reflects the largest quantity of earth moving and the largest amount of above and below ground construction that Stanford has undertaken for a single project under the 2000 General Use Permit. It is likely to be larger than any single project that would be constructed under the 2018 General Use Permit. This analysis has been adapted to evaluate a variety of potential project sizes and distances from sensitive receptors. The resulting analysis demonstrates that:

- Health risk standards will not be exceeded, and a project-specific health risk analysis is not required, for any single construction project that is up to 3,270,000 square feet of combined building and/or parking structure area) and with up to 900,000 cubic yards of debris/soil exported, as long as:
  - The nearest childcare facility is farther than 140 meters from the project construction boundary
  - The nearest residence housing children is farther than 50 meters from the project construction boundary
  - The nearest adult resident is farther than 10 meters from the project construction boundary.[32]

If project construction will be closer than these distances from a sensitive receptor, the following additional screens should be employed:

- Health risk standards will not be exceeded, and a project-specific health risk analysis is not required, for any single construction project that is up to 540,000 square feet of combined building and/or parking structure area and with up to 150,000 cubic yards of debris/soil exported, as long as:
  - The nearest childcare facility is farther than 50 meters from the project construction boundary
  - The nearest resident is farther than 10 meters from the project construction boundary.
- Health risk standards will not be exceeded, and a project-specific health risk analysis is not required, for any single construction project that is up to 180,000 square feet of combined building and/or parking structure area and with up to 50,000 cubic yards of debris/soil exported, as long as:
  - The nearest childcare facility is farther than 30 meters from the project construction boundary
  - The nearest resident is farther than 10 meters from the project construction boundary.
- Health risk standards will not be exceeded, and a project-specific health risk analysis is not required, for any single construction project that is up to 45,000 square feet of

[32] Ramboll Environ conducted a conservative quantitative analysis of $PM_{2.5}$ concentrations for the largest project size confirming that $PM_{2.5}$ concentrations are below thresholds in all locations, including locations close to the theoretical project where cancer risk is above thresholds.

combined building and/or parking structure area and with up to 12,500 cubic yards of debris/soil exported, as long as:

- The nearest resident or childcare is farther than 10 meters from the project construction boundary.

The distances stated above are summarized in **Table 5-2-2**.

Table 5-2-2: Construction Health Risk Screening Distances

Maximum Project Size	Minimum Distance (m) to Nearest Receptor Type		
	Childcare Facility	Child Resident	Adult Resident
3,270,000 square feet; 900,000 CY debris/soil export	140	50	10
540,000 square feet; 150,000 CY debris/soil export	50	10*	10*
180,000 square feet; 50,000 CY debris/soil export	30	10*	10*
45,000 square feet; 12,500 CY debris/soil export	10*	10*	10*

*The screening tool also stipulates that a 10-meter buffer must exist around the project fence line where no sensitive receptor can reside. If Stanford wishes to construct a small project (within the limits set forth by the final screen listed above that does not include distance criteria) inside the 10-meter buffer, directly adjacent to a childcare facility, the project must both comply with the screening limits presented above and construction activities using diesel-powered equipment must not occur when children are present (meaning work must occur during off-hours[33] and/or on the weekends) in order to screen out of conducting a health risk analysis. See **Appendix D** for additional information regarding the screening tool.

If a construction project does not fit within the screening tool parameters, then the following mitigation measure should be implemented:

> Mitigation Measure AQ-3: If a construction project does not fit within the Health Risk Assessment screening parameters, Stanford shall submit to the County Planning Office a project-specific health risk analysis demonstrating that project construction activities will not result in a significant acute, chronic non-cancer or cancer-related health risk to sensitive receptors.

This mitigation measure would ensure **less-than-significant impacts** on health risk from construction activities.

[33] "Off-hours" refer to the periods of time when childcares are not in session.

5.2.2 Operational Impacts

Impact AQ-4: Project Operations Would Not Result in Emissions of NOx, PM, and ROGs above BAAQMD Significance Thresholds.

The proposed project would generate operational emissions from a variety of sources, including the following: new vehicle trips and offroad area sources; maintenance operation of diesel emergency generators and boilers; new laboratories; and fueling stations. Because construction activity is on-going and construction emissions occur throughout the life of the General Use Permit, emissions from off-road construction equipment have been included in the operational emissions. Details on CAP emission calculations are shown in Appendix A.

USEPA emission factors were used for the emergency generators and boilers. Vehicle trip emissions were calculated using EMFAC2014 emissions factors from ARB, based on vehicle trip generation rates developed for this project.

The results of the project operational criteria air pollutant emissions calculations are presented in **Table 5-2-3**. Details on calculations and methodology are provided in the technical appendix A. For purpose of this comparison, $PM_{2.5}$ is conservatively assumed to equal PM_{10}, though in reality only a fraction of total PM_{10} is $PM_{2.5}$. Table 5-2-3 indicates that operational criteria air pollutant emissions of the proposed project would result in emissions of criteria pollutants and precursors that would be below thresholds of significance for all pollutants. Therefore, impacts from emissions of NOx, PM, and or ROGs from operational activities are **less than significant**.

Table 5-2-3: Average Daily And Maximum Annual Operational Emissions (Change from Fall 2018 to Fall 2035)

	Average Daily Emissions (pounds/day)			
	ROG	NOx	PM_{10}	$PM_{2.5}$*
Emission Source				
Mobile Sources (including construction off-road equipment)	-57	-214	13	13
Hot Water Generators	0.4	0.7	0.5	0.5
Replacement Process Steam Plant	0.3	1.0	0.4	0.4
Other Natural Gas (e.g., PGE boilers)	1.4	26	2.0	2.0
Emergency Generators	0.5	8.9	0.3	0.3
Laboratories	18.6	-	-	-
Fuel Stations	-0.2	-	-	-

Table 5-2-3: Average Daily And Maximum Annual Operational Emissions (Change from Fall 2018 to Fall 2035)

	Average Daily Emissions (pounds/day)			
	ROG	**NOx**	**PM_{10}**	**$PM_{2.5}$***
Total	-36	-178	16	16
Significance Threshold	54	54	82	54
Above Threshold?	No	No	No	No
	Maximum Annual Emissions (short tons/year)			
	ROG	**NOx**	**PM_{10}**	**$PM_{2.5}$**
Emission Source				
Mobile Sources (including construction off-road equipment)	-10	-39	2.4	2.4
Hot Water Generators	0.1	0.1	0.1	0.1
Replacement Process Steam Plant	0.1	0.2	0.1	0.1
Other Natural Gas (e.g., PGE boilers)	0.3	4.7	0.4	0.4
Emergency Generators	0.01	1.6	0.05	0.05
Laboratories	3.4	-	-	-
Fuel Stations	-0.04	-	-	-
Total	-6.5	-32	3.0	3.0
Significance Threshold	10	10	15	10
Above Threshold?	No	No	No	No

* For purpose of this comparison, $PM_{2.5}$ is conservatively assumed to equal PM_{10}, though in reality only a fraction of total PM_{10} is $PM_{2.5}$.

Impact AQ-5: Project Operations Would Not Generate Emissions of TAC and $PM_{2.5}$ That Would Result in Health Risks above BAAQMD Significance Thresholds.

The sources of TAC emissions that would occur during the operational phase of the project include emissions from mobile sources (passenger vehicles and delivery vehicles), and stationary sources (diesel generators and laboratory fume hood stacks).

Mobile source air toxics are compounds emitted from highway vehicles, which are known or suspected to cause cancer or other serious health and environmental effects. Examples of mobile source air toxics include benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, polycyclic organic matter (POM), naphthalene, and diesel particulate matter.

Under the Project, new diesel emergency back-up generators may be installed during development under the 2018 GUP. To install new diesel generators, if larger than 50 horsepower, Stanford must obtain a permit from the BAAQMD and comply with the Air Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines. As a practical matter, the BAAQMD will not issue a permit for a new generator that results in an operational cancer risk greater than 10 in one million. Accordingly, the following mitigation measure would ensure new generators would not result in a significant health risk:

> Mitigation Measure AQ-5(a): Any new diesel-fired emergency generator with a rated power of 50 horsepower is required to have a permit with the BAAQMD. In accordance with BAAQMD Regulations 2-1 and 2-5, new sources of emissions must implement Best Available Control Technology for Toxics (T-BACT) if individual source risks exceed 1.0 in a million for cancer and/or chronic hazard index is greater than 0.20. Additionally, a permit will be denied if project cancer risk exceeds 10.0 in a million or if chronic or acute hazard index exceeds 1.0. Compliance with BAAQMD rules will ensure that new emergency generators will not result in a significant impact.

Under the proposed 2018 General Use Permit, chemical usage in laboratories could increase. The Project inventory assumes that chemical usage would increase proportionate to the increase in new academic and support square footage. Chemical usage across all laboratories from full buildout of the proposed Project was compared to baseline emissions at commencement of project operations. The resulting incremental difference in emissions was used to calculate potential cancer risk, and non-cancer acute and chronic health risks. This risk estimation conservatively assumed all receptors were sensitive populations being maximally exposed (as a resident). Additionally, the Project's incremental increase for all laboratory chemicals were assumed to be emitted from one stack instead of various stacks spread across campus, which overestimates concentrations at the nearest receptor. TAC emissions dispersion was estimated in a model accounting for local meteorological conditions. Further details on the methods for risk estimation for laboratories can be found in Appendix E. Under these highly conservative conditions, the incremental increase in cancer risk is calculated to be 4.5 in one million, which is well below the BAAQMD significance threshold of 10 in a million. Acute and chronic hazard indices (HIs) would increase by 0.03 and 0.01, respectively, which are also well below the BAAQMD significance threshold of 1.0. Therefore, impacts on health risks from laboratory TAC emissions from full build out of the proposed Project would be less than significant.

Additionally, under the Project, the following mitigation measure would ensure new laboratory space would not result in a significant health risk:

> Mitigation Measure AQ-5(b): For any proposed building project that contains more than 25,000 square feet of emissions generating laboratory space within a building **and** 50 fume foods, Stanford shall conduct a risk screening analysis and obtain a permit from the BAAQMD for the proposed building project; this permit may be required either prior to or as a condition of approval of the proposed building project. In accordance with BAAQMD Regulations 2-1 and 2-5, new sources of emissions must implement Best Available Control Technology for Toxics (T-BACT) if individual source

risks exceed 1.0 in a million for cancer and/or chronic hazard index is greater than 0.20. Additionally, a permit will be denied if project cancer risk exceeds 10.0 in a million or if chronic or acute hazard index exceeds 1.0. Compliance with BAAQMD rules will ensure that new laboratory operations will not result in a significant impact.

TAC and $PM_{2.5}$ emissions from mobile sources will be reduced under the Project compared to baseline conditions, resulting in a reduction of health risks from mobile sources. Consequently, the Project is considered to have a less than significant impact with regard to health risks from mobile sources and risks from mobile sources were not further evaluated.

As described in Section 4.1.1, natural gas combustion results in emissions of benzene, formaldehyde, and toluene. Under the Project, there would be an increase in these TAC emissions due to an increase in natural gas combustion associated with residential and non-residential growth, as shown in **Table 4-2**. However, these increases would be minimal and any newly permitted sources would meet BAAQMD standards. Therefore, impacts on health risks from natural gas combustion would be less than significant.

Therefore, impacts to health risk from emissions of TACs and $PM_{2.5}$ from operational activities would be **less than significant**.

Impact AQ-6: Project Operations Would Not Result in Local Concentrations of CO above BAAQMD Significance Thresholds.

BAAQMD provides a screening methodology based on peak hourly traffic volumes to evaluate potential impacts of CO emissions from mobile sources. The screening methodology focuses on intersections with vehicle traffic exceeding 44,000 vehicles per hour after Project buildout (or 24,000 vehicles per hour in locations with limited vertical or horizontal air mixing) that could violate or contribute to a violation of ambient air quality standards for CO. Based on the estimated Project-related traffic and existing traffic in the area, it is not expected that any of the intersections near the Project would experience more than 24,000 vehicles per hour at full buildout. Thus, the Project would not be expected to contribute to a violation of CO air quality standards.

Therefore, impacts to local concentrations of CO from operational activities are **less than significant**.

5.2.3 General Impacts

Impact AQ-7: The Project Would Not Result in Objectionable Odors.

The BAAQMD CEQA Guidelines identify wastewater treatment plants, oil refineries, asphalt plants, chemical manufacturing, painting/coating operations, coffee roasters, food processing facilities, recycling operations and metal smelters as odor sources of particular concern, and recommends buffer zones of one to two miles around them to avoid potential odor conflicts. The potential for the Project to result in objectionable odors is **less than significant**.

Impact AQ-8: The Project Would Not Conflict with Existing Air Quality Plans.

The most recently adopted air quality plan for the Bay Area is the 2010 Clean Air Plan (CleanAir Plan), which is an update to the BAAQMD's 2005 Ozone Strategy to comply with State air quality planning requirements. The Clean Air Plan also serves as a multi-pollutant air quality plan to protect public health and the climate. The Clean Air Plan control strategy includes revised, updated, and new measures in the three traditional control measure categories: stationary sources measures, mobile source measures, and transportation

control measures. In addition, the Clean Air Plan identifies two new categories of control measures, including land use and local impact measures and energy and climate measures.

The 2010 BAAQMD CEQA Guidelines recommend that consistency with the Clean Air Plan be used to evaluate plan-level projects.[34] This recommendation is applicable to long range plans (e.g., general plan, redevelopment plans, specific plans, area plans, community plans, regional plans, congestion management plans, etc.). Even though the proposed 2018 General Use Permit is not a plan-level project, this Air Quality Technical Report conservatively applies the BAAQMD CEQA Guidelines for plan-level approvals.

The 2010 BAAQMD CEQA Guidelines recommend the consideration of three questions:

- Does the project support the primary goals of the air quality plan;
- Does the project include applicable control measures from the air quality plan; and
- Does the project disrupt or hinder implementation of any Clean Air Plan control measures?

With regard to the first question, the BAAQMD CEQA Guidelines provide a basis for assessing support of the primary goals. The primary goals of the 2010 Bay Area Clean Air Plan are to:

- Attain air quality standards;
- Reduce population exposure and protect public health in the Bay Area; and
- Reduce GHG emissions and protect the climate.

Any project (i.e., project or plan) that would not support these goals would not be considered consistent with the 2010 Clean Air Plan. If approval of a project would not result in significant and unavoidable air quality impacts, after the application of all feasible mitigation, the project may be considered consistent with the 2010 Clean Air Plan.

The second question recommended in the 2010 BAAQMD CEQA Guidelines for evaluating consistency with the Clean Air Plan is whether the project includes applicable control measures from the air quality plan. The Clean Air Plan includes 55 control measures to reduce emissions of PM, PM precursors, and other air pollutants from a wide variety of emission sources. The control measures can be classified into six main categories: Stationary Source Measures, Mobile Source Measures, Transportation Control Measures, Land Use and Local Impact Measures, Energy and Climate Measures, and Further Study Measures.

The following attributes of the proposed Project and Stanford's ongoing programs will further the goals of the Clean Air Plan:

- MSM A-2: Zero Emission Vehicles and Plug-in Hybrids. Stanford will continue to convert its campus fleets to electric vehicles. The Bonair fleet will be 70% electric by 2035.
- MSM B-1: HDV Fleet Modernization. Stanford will replace all of its Marguerite bus fleet with electric buses by 2035.
- MSM C-1: Construction and Farming Equipment. The Project will use Tier 4 Final construction equipment and will comply with BAAQMD BMPs for construction, except for chainsaws and paving phase equipment.

[34] BAAQMD. 2011. California Environmental Quality Act Air Quality Guidelines. May.

- TCM A-1: Improve Local and Areawide Bus Service. Stanford provides local bus service with its Marguerite campus fleet.
- TCM D-1: Improve Bicycle Access and Facilities. Stanford provides bike paths, lanes, secure storage, and shower facilities.
- ECM 1: Energy Efficiency. Stanford has improved energy efficiency campus-wide through its SESI project.
- ECM 2: Renewable Energy. Stanford is installing solar panels on campus buildings, and will source electricity from the Stanford Solar Generation plant by 2017.

The final basis for evaluation consistency with the Clean Air Plan is whether the Project would disrupt or hinder implementation of any Clean Air Plan control measure. The Project would not affect any Mobile Source Measures, Stationary Source Measures, Transportation Control Measures, Land Use and Local Impact Measures, Energy and Climate Measures, or Further Study Measures and is consistent with applicable Transportation Control Measures. The Project therefore would not conflict with or obstruct implementation of the Clean Air Plan. The Project's impacts relative to the goals of the Clean Air Plan would be **less than significant**.

5.2.4 Cumulative Impacts

Impact AQ-9: The Project Would Not Result in Operational Emissions of NOx, PM, or ROGs that are Cumulatively Considerable.

BAAQMD developed thresholds of significance with consideration of individual project emission levels that would be cumulatively considerable. If a project exceeds the identified project significance levels, then its emissions would be cumulatively considerable. Table 5-2-3 shows that Project operational and construction emissions do not exceed emission thresholds for NOx, PM, or ROGs. Therefore emissions of NOx, PM, or ROGs from the Project does not result in a cumulatively considerable contribution to a cumulative air quality impact.

TABLES

Table 3-1-1
2014, 2015, Fall 2018, and Fall 2035 CAP Emissions - Summary
Stanford University
Stanford, CA

Sources	Criteria Pollutant Emissions																			
	2014 Inventory					2015 Inventory					Fall 2018 (Baseline) Inventory					Fall 2035 (Project) Inventory[1]				
	NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}
	[ton/yr]																			
Stationary Sources																				
Cardinal Cogen	101	83	1.1	40	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water Generators	-	-	-	-	-	0.56	1.9	0.030	0.30	0.35	0.61	2.1	0.032	0.33	0.38	0.74	2.5	0.039	0.40	0.47
Replacement Process Steam	-	-	-	-	-	0.76	12	0.024	0.22	0.31	0.82	13	0.026	0.24	0.33	1.0	16	0.032	0.29	0.40
Other Natural Gas (e.g., PGE boilers)	7.2	6.0	0.043	0.39	0.54	17	15	0.10	1.0	1.3	19	16	0.11	1.0	1.4	23	20	0.14	1.3	1.8
Emergency Generators	5.9	1.3	0.0036	0.28	0.15	6.8	1.7	0.0051	0.35	0.20	7.3	1.9	0.01	0.3827	0.21	9.0	2.3	0.01	0.4674	0.26
Laboratories	-	-	-	14	-	-	-	-	14	-	-	-	-	15	-	-	-	-	19	-
Valero Fuel Station	-	-	-	0.54	-	-	-	-	0.54	-	-	-	-	-	-	-	-	-	-	-
Bonair Fuel Station	-	-	-	0.078	-	-	-	-	0.078	-	-	-	-	0.074	-	-	-	-	0.037	-
Subtotal [ton/yr]	**114**	**90**	**1.1**	**55**	**25**	**25**	**31**	**0.16**	**17**	**2.2**	**27**	**33**	**0.18**	**17**	**2.3**	**34**	**41**	**0.22**	**21**	**2.9**
Mobile Sources																				
Worker Trips	13	128	0.24	18	3.2	13	128	0.24	18	3.2	7.2	74	0.22	7.6	3.2	2.7	36.3	0.2	3.8	3.8
Resident Trips	10	105	0.15	19	1.9	10	105	0.15	19	1.9	5.0	54	0.14	7	1.9	2.6	36.8	0.2	5.4	3.3
Campus Vehicles - On Road	27	15	0.062	2.4	1.9	27	15	0.062	2.4	1.9	22	15	0.057	1.9	1.8	1.8	3.1	0.0	0.6	2.1
Campus Vehicles - Off Road	2.1	18.5	0.0041	4.4	0.19	2.1	18.5	0.0041	4.4	0.19	2.1	18.5	0.0041	4.4	0.19	2.1	18.5	0.0	4.4	0.19
Other Trips	25	89	0.16	15	2.6	25	89	0.16	15	2.6	17	52	0.16	6.8	2.6	5.6	26.3	0.1	3.6	2.8
Construction Off-Road Equipment[2]	0.62	2.7	0.0042	1.3	0.21	0.60	2.7	0.0042	1.3	0.21	0.51	2.7	0.0042	1.2	0.20	0.4	2.7	0.0	1.2	0.19
Subtotal [ton/yr]	**77**	**358**	**0.62**	**60**	**9.9**	**77**	**358**	**0.62**	**60**	**9.9**	**54**	**215**	**0.58**	**29**	**10.0**	**15**	**124**	**0.47**	**19**	**12**
Total [ton/year]	**192**	**449**	**1.7**	**115**	**35**	**103**	**389**	**0.79**	**76**	**12**	**82**	**248**	**0.75**	**47**	**12**	**49**	**165**	**0.69**	**40**	**15**

Notes:

1. Fall 2035 represents full buildout of the Project. Mobile emission factors are conservatively used from year 2030, to be consistent with the GHG report and comparison to State 2030 targets.
2. Construction emissions are estimated using CalEEMod® 2013.2.2 using the average annual square footage of construction and demolition and estimated excavation from fiscal year 2001 through fiscal year 2015 with default construction schedules and equipment lists. Construction equipment is all assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
NO_X - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter under 10 microns
ROG - reactive organic gas
SO_2 - sulfur dioxide
ton - short tons
yr - year

RAMBOLL ENVIRON

Table 3-4-1
2014 CAP Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Annual Natural Gas Usage		Emission Factors[3]					Emissions				
			NO_x	VOC	CO	SO_2	PM_{10}	NO_x	VOC	CO	SO_2	PM_{10}
	[therms]	[MMBtu]	[lb/MMBtu]					[ton/yr]				
Other Natural Gas												
PGE Residential[1]	632,937	63,294	0.0980	0.0054	0.0824	0.0006	0.0075	3.1	0.17	2.6	0.019	0.24
PGE Commercial[1]	814,953	81,495						4.0	0.22	3.4	0.024	0.30
PGE Searsville/Olmstead[2]	13,408	1,341						0.066	0.0036	0.055	0.00039	0.0050
Total	**1,461,298**	**146,130**						**7.2**	**0.39**	**6.0**	**0.043**	**0.54**

Notes:

1. Annual Natural Gas usage provided by Stanford. Addresses were geocoded, and natural gas use from addresses outside of unincorporated Santa Clara County was removed. Cardinal Cogen emissions are shown separately in Table 3-4-2.
2. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
3. Criteria pollutant emission factors obtained from Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. The emission factors were converted from $lb/10^6$ scf to lb/MMBtu using BAAQMD default high heating value of 1,020 BTU/scf for natural gas.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
lb - pound
MMBTU - million British thermal units
NO_x - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter less than 10 μm in diameter
scf - standard cubic foot
SO_2 - sulfur dioxide
therms - 100,000 British thermal units
ton - short tons
VOC - volatile organic compounds
yr - year

Sources:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

USEPA. 1995. AP 42, Volume I, Fifth Edition. §1.4. Natural Gas Combustion. Available online at: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Accessed March, 2013

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Table 3-4-2
2014 CAP Emissions - Cardinal Cogen
Stanford University
Stanford, CA

Facility	Emissions Sources	Average Daily Emissions [lbs/day]					Annual Emissions [tons/year]				
		NO_X	CO	VOC	SO_2	PM_{10}	NO_X	CO	VOC	SO_2	PM_{10}
Cardinal Cogen	Cogen Total Emissions[1,2]	555	455	218	5.9	134	101	83	40	1.1	24

Notes:

1. BAAQMD 2014 Cardinal Cogen Criteria Air Pollutant Emissions (For 2014 calendar year emissions) presents annual average emissions in lbs/day for criteria pollutants. Ramboll Environ assumed 365 days/year to calculate total annual emissions.
2. Although the Cardinal Cogen exports electricity and steam to outside the study area, all CAP and TAC emissions are assumed to contribute to local air quality and are therefore included here.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CAP - criteria air pollutants
CO - carbon monoxide
GUP - general use permit
lb - pound
NO_X - nitrogen oxides
PM_{10} - particulate matter less than 10 µm in diameter
SO_2 - sulfur dioxide
TAC - toxic air contaminants
VOC - volatile organic compounds

Table 3-4-3
2015 CAP Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Annual Natural Gas Usage[1]	Emission Factors[2]					Emissions				
		NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}
	[MMBtu/yr]	[lb/MMBtu]					[ton/yr]				
Hot Water Generators	101,408	0.011	0.038	0.00059	0.0060	0.0070	0.56	1.9	0.030	0.30	0.35
Replacement Process Steam Plant	82,363	0.018	0.3001	5.9E-04	0.0054	0.0075	0.76	12	0.024	0.22	0.31
Other Natural Gas - Total	354,139	0.098	0.08	5.9E-04	0.0054	0.0075	17	15	0.10	0.95	1.3
PGE Residential	56,643						2.8	2.3	0.017	0.15	0.21
PGE Commercial	296,155						15	12	0.087	0.80	1.1
PGE Searsville/Olmstead[3]	1,341						0.066	0.055	0.00039	0.0036	0.0050
Total	**537,910**						**18.7**	**28.8**	**0.16**	**1.48**	**1.98**

Notes:

1. Annual Natural Gas usage provided by Stanford. Natural gas use within Stanford Academic Growth Boundary within unincorporated Santa Clara County in the A1 zoning areas. Natural gas data from the last six months of 2015 was scaled to approximate a full year of post-RCEF operations.
2. Hot Water Generator and Replacement Process Steam Plant boiler emission factors were provided by Stanford; the hot water generator emission factors are from the vendor except for SO_2 from AP-42. The replacement process steam plant NO_X and CO factors are based on BAAQMD Regulation 9-7, with all other emission factors from Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. For the remaining boilers, USEPA AP-42 emission factors were used for general natural gas use and exampt small boilers. The emission factors were converted from lb/10^6 scf to lb/MMBtu using BAAQMD default high heating value of 1,020 BTU/scf for natural gas. We assume that individual replacement boilers are covered by general natural gas use and that estimates are conservative by doing so. See table below for emission factor comparison.

Source	NO_x [lb/MMBtu]	CO [lb/MMBtu]	SO_2 [lb/MMBtu]	ROG [lb/MMBtu]	PM_{10} [lb/MMBtu]	EF Source
General Natural Gas	0.098039	0.082353	0.000588	0.005392	0.007451	AP-42
Exempt Small Boilers	0.098039	0.082353	0.000588	0.005392	0.007451	AP-42
Individual Replacement Boilers	0.037	0.3001	0.000588	0.005392	0.007451	AP42; 30 ppmv for NO_X, 400 ppmv for CO

3. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
EF - emission factor
lb - pound
MMBTU - million British thermal units
NO_X - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter less than 10 µm in diameter
$PM_{2.5}$ - particulate matter less than 2.5 µm in diameter
ppmv - part per million volume
RCEF - replacement central energy facility

References:

USEPA. 1995. AP 42, Volume I, Fifth Edition. §1.4. Natural Gas Combustion. Available online at: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Accessed July, 2016.

Table 3-4-4
Fall 2018 CAP Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Fall 2015 Annual Natural Gas Usage[1]	Scaling for Fall 2018[2]	Fall 2018 Annual Natural Gas Usage	Emission Factors[3]					Emissions				
				NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}
	[MMBtu/yr]	[%]	[MMBtu/yr]	[lb/MMBtu]					[ton/yr]				
Hot Water Generators	101,408	8%	109,605	0.011	0.038	5.9E-04	0.0060	0.0070	0.61	2.1	0.032	0.33	0.38
Replacement Process Steam Plant	82,363	8%	89,021	0.018	0.30	5.9E-04	0.0054	0.0075	0.82	13	0.026	0.24	0.33
Other Natural Gas - Total	354,139		379,172						19	16	0.11	1.0	1.4
PGE Residential	56,643	4%	58,626						2.9	2.4	0.017	0.16	0.22
PGE Commercial - Individual Replacement Boilers[4]	11,007	0%	11,007	0.098	0.08	5.9E-04	0.0054	0.0075	0.54	0.45	0.0032	0.030	0.041
PGE Commercial - Remaining[4]	285,148	8%	308,198						15	13	0.091	0.83	1.1
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341						0.066	0.055	3.9E-04	0.0036	0.0050
Total	**537,910**		**577,799**						**20.0**	**31.0**	**0.17**	**1.6**	**2.1**

Notes:

1. 2015 Annual Natural Gas usage details are shown in **Table 3-4-3.**

2. Scaling for Fall 2018 is primarily based on the increase in academic square footage and student beds expected from December 2015 to Fall 2018. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the Hot Water Generators, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; i.e., efficiency and use in new buildings is assumed equal to current buildings.

3. Hot Water Generator and Replacement Process Steam Plant boiler emission factors were provided by Stanford; the hot water generator emission factors are from the vendor except for SO_2 from AP-42. The replacement process steam plan NOx and CO factors are based on BAAQMD Regulation 9-7, with all other emission factors from Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. For the remaining boilers, USEPA AP-42 emission factors were used for general natural gas use and exampt small boilers. The emission factors were converted from lb/106 scf to lb/MMBtu using BAAQMD default high heating value of 1,020 BTU/scf for natural gas. We assume that individual replacement boilers are covered by general natural gas use and that estimates are conservative by doing so (except for CO). See table below for emission factor comparison.

Source	NO_X	CO	SO_2	ROG	PM_{10}	EF Source
	[lb/MMBtu]					
General Natural Gas	0.09804	0.08235	0.00059	0.00539	0.00745	AP-42
Exempt Small Boilers	0.09804	0.08235	0.00059	0.00539	0.00745	AP-42
Individual Replacement Boilers	0.037	0.3001	0.00059	0.00539	0.00745	AP42; 30 ppmv for NO_x, 400 ppmv for CO

4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.

5. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
BAAQMD - Bay Area Air Quality Management District
BTU - British thermal units
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CEF - Central Energy Facility
CO - carbon monoxide
GUP - general use permit
lb - pound
MMBTU - million British thermal units
NO_X - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter under 10 microns diameter
ppmv - parts per million by volume
ROG - reactive organic gas
scf - standard cubic foot
SO_2 - sulfur dioxide
ton - short tons
USEPA - United States Environmental Protection Agency
yr - year

References:

USEPA. 1995. AP 42, Volume I, Fifth Edition. §1.4. Natural Gas Combustion. Available online at: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Accessed July, 2016.

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Table 3-4-5
Fall 2035 CAP Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Fall 2018 Annual Natural Gas Usage[1]	Scaling for Fall 2035[2]	Fall 2035 Annual Natural Gas Usage	Emission Factors[3]					Emissions				
				NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}
	[MMBtu/yr]	[%]	[MMBtu/yr]	[lb/MMBtu]					[ton/yr]				
Hot Water Generators	109,605	22%	133,845	0.011	0.038	5.9E-04	0.0060	0.0070	0.74	2.5	0.039	0.40	0.47
Replacement Process Steam Plant	89,021	22%	108,709	0.018	0.30	5.9E-04	0.0054	0.0075	1.01	16	0.032	0.29	0.40
Other Natural Gas - Total	379,172		475,887						23	20	0.140	1.3	1.8
PGE Residential	58,626	38%	80,651						4.0	3.3	0.024	0.22	0.30
PGE Commercial - Individual Replacement Boilers[4]	11,007	0%	11,007	0.098	0.08	5.9E-04	0.0054	0.0075	0.54	0.45	0.0032	0.030	0.041
PGE Commercial - Remaining[4]	308,198	22%	376,358						18	15	0.111	1.01	1.4
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341						0.066	0.055	0.00039	0.0036	0.0050
PGE New Faculty/Staff Housing[6]	0	N/A	6,531						0.320	0.269	0.00192	0.0176	0.0243
Total	**577,799**		**718,441**						**25.1**	**38.4**	**0.21**	**2.0**	**2.6**

Notes:

1. Fall 2018 Annual Natural Gas usage details are shown in **Table 3-4-4.**
2. Scaling for Fall 2035 is primarily based on the increase in academic square footage and student beds expected from Fall 2018 to full buildout of the 2018 GUP. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the Hot Water Generators, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. Estimates for new faculty/staff housing are added. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; i.e., efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.
3. Hot Water Generator and Replacement Process Steam Plant boiler emission factors were provided by Stanford; the hot water generator emission factors are from the vendor except for SO_2 from AP-42. The replacement process steam plan NOx and CO factors are based on BAAQMD Regulation 9-7, with all other emission factors from Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. For the remaining boilers, USEPA AP-42 emission factors were used for general natural gas use and exampt small boilers. The emission factors were converted from lb/106 scf to lb/MMBtu using BAAQMD default high heating value of 1,020 BTU/scf for natural gas. We assume that individual replacement boilers are covered by general natural gas use and that estimates are conservative by doing so. See table below for emission factor comparison.

Source	NO_X	CO	SO_2	ROG	PM_{10}	EF Source
	[lb/MMBtu]					
General Natural Gas	0.098039	0.082353	0.000588	0.005392	0.007451	AP-42
Exempt Small Boilers	0.098039	0.082353	0.000588	0.005392	0.007451	AP-42
Individual Replacement Boilers	0.037	0.3001	0.000588	0.005392	0.007451	AP42; 30 ppmv for NO_x, 400 ppmv for CO

4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® version 2013.2.2 default for single family homes built to 2008 Title 24 standards in climate zone 4.
6. This represents the natural gas consumption from the 550 new faculty/staff high density homes to be constructed within the study boundary. The annual natural gas use is based on the CalEEMod® version 2013.2.2 default for condo/townhouse built to 2008 Title 24 standards in climate zone 4. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
BAAQMD - Bay Area Air Quality Management District
BTU - British thermal units
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CEF - Central Energy Facility
CO - carbon monoxide
GUP - general use permit
lb - pound
MMBTU - million British thermal units
NO_X - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter under 10 microns diameter
ppmv - parts per million by volume
ROG - reactive organic gas
scf - standard cubic foot
SO_2 - sulfur dioxide
ton - short tons
USEPA - United States Environmental Protection Agency
yr - year

References:

USEPA. 1995. AP 42, Volume I, Fifth Edition. §1.4. Natural Gas Combustion. Available online at: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Accessed July, 2016.

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Table 3-4-6
2014 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Total Emissions [ton/year][11]					
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_X
Off-Campus (Worker) Trips[3]	Undergraduate	234	2.0	70,286		512,385	0.21	1.2	0.12	0.027	0.011	0.0021
	Graduate	1,259	2.0	523,894		4,793,631	1.6	11	1.0	0.25	0.11	0.019
	Post-doc	555	2.0	246,412		2,335,983	0.74	5.1	0.50	0.12	0.052	0.0092
	Faculty/Staff	5,443	2.0	2,416,714		27,803,160	7.4	57	5.6	1.4	0.61	0.11
	Casual Employees	302	2.0	133,960		1,793,719	0.42	3.5	0.35	0.093	0.039	0.0070
	Contingent Employees	294	2.0	130,354		1,596,836	0.41	3.2	0.32	0.083	0.035	0.0062
	Temporary Employees	604	2.0	268,165		3,421,786	0.84	6.8	0.68	0.18	0.075	0.013
	Non-Employee Affiliates: 20% FTEs	169	2.0	75,118		892,407	0.23	1.8	0.18	0.046	0.020	0.0035
	Non-Employee Affiliates: FTEs	925	2.0	410,795		4,880,239	1.3	10	1.0	0.25	0.11	0.019
	Third Party Contractors	244	2.0	108,178		1,537,214	0.34	2.9	0.30	0.080	0.034	0.0060
	Janitorial Shift Workers	195	2.0	86,543		1,229,771	0.28	2.4	0.24	0.064	0.027	0.0048
	First Mile to Transit (all Workers + Students)	2,039	2.0	903,934		3,707,596	2.5	11.9	1.11	0.20	0.084	0.016
	Construction	975	2.0	432,713		6,148,856	1.4	12	1.2	0.32	0.13	0.024
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**	**18**	**128**	**13**	**3.2**	**1.3**	**0.24**
On-Campus (Resident) Trips[3]	Undergraduate	1,582	5.91	1,962,450		7,612,107	5.0	25	2.3	0.40	0.17	0.032
	Graduate	3,648	4.5	5,264,378		27,554,538	13.8	78	7.4	1.45	0.62	0.114
	Post-doc	28	3.7	33,580		168,975	0.089	0.49	0.046	0.0089	0.0038	7.0E-04
	Faculty/Staff	98	3.1	109,500		616,735	0.3	2	0.2	0.03	0.01	0.003
	Sub-Total	**5,356**		**7,369,908**		**35,952,355**	**19**	**105**	**9.9**	**1.9**	**0.81**	**0.15**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.7	454,946	7.3	3,321,104	0.83	6.9	0.65	0.17	0.072	0.013
	Bonair on-road - diesel[8]	11	3.2	12,890	7.3	94,099	0.0037	0.032	0.027	0.0070	0.0041	3.0E-04
	Bonair on-road buses - diesel[8]	10	1.1	4,075	7.3	29,749	0.025	0.14	0.62	0.030	0.0013	6.6E-04
	Bonair Unfiltered - on-road - gas[8]	74	1.7	45,317	7.3	330,811	0.092	0.68	0.064	0.017	0.0072	0.0013
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.56	2.5	11	0.36	0.20	0.016
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	0.0069	0.061	0.050	0.013	0.0078	0.0010
	Marguerite[10]	66				1,983,931	0.78	4.7	15	1.3	0.63	0.029
	Public Safety	31	2.8	31,879	7.3	232,720	0.058	0.48	0.045	0.012	0.0050	9.1E-04
	Sub-Total	**700**		**614,290**		**8,594,006**	**2.4**	**15**	**27**	**1.9**	**0.93**	**0.062**
Other Trips[3]	General Visitors (Vendor)	2,016,204	2.0	4,032,408		25,001,480	12	65	6.2	1.3	0.56	0.10
	Worker Non-Commute Trips			301,920		935,952	0.71	3.6	0.33	0.050	0.022	0.0041
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443	0.48	5.1	0.53	0.15	0.064	0.011
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.31	1.7	6.8	0.39	0.24	0.0078
	Event Visitor Traffic	149,958	2.0	299,917		6,652,357	1.0	11	1.2	0.34	0.14	0.026
	Deliveries - Trucks (total)	168,054	2.0	336,108		2,083,870	0.50	2.3	10	0.31	0.18	0.014
	Construction Vendor Trucks[12]		*2.4*	*8,510*		*62,123*	*0.07*	*0.61*	*0.62*	*0.017*	*0.012*	*0.0012*
	Construction Haul Trucks[12]		*2.4*	*7,987*		*159,740*	*0.11*	*0.97*	*1.6*	*0.034*	*0.022*	*0.0033*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**	**15**	**89**	**25**	**2.6**	**1.2**	**0.16**
					Total VMT	**143,212,045**						
						[bhp-hr/yr][6]						
Campus Vehicles - Off road equip[5,7]	Siebel and Red Barn equip - gas[9]					38,837	3.4	14	0.12	0.040	0.040	0.0015
	Siebel and Red Barn equip - diesel[9]					52,854	0.087	0.37	0.32	0.031	0.029	3.1E-04
	Off-road equip - gas					6,553	0.58	2.4	0.020	0.0068	0.0068	2.5E-04
	Off-road equip - diesel					102,570	0.17	0.72	0.62	0.060	0.055	6.1E-04
	Light Towers - gas					2,925	0.0026	0.0086	0.016	8.3E-04	8.3E-04	2.3E-05
	Light Towers - diesel					186,791	0.16	0.55	1.0	0.053	0.053	0.0014
	Sub-Total					**390,532**	**4.41**	**18.5**	**2.1**	**0.19**	**0.18**	**0.0041**
						Total Emissions from Mobile Sources [ton/yr]	**58**	**356**	**77**	**9.7**	**4.5**	**0.62**

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Table 3-4-6
2014 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix A (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. EMFAC emission factors for 2015 are used for calculating on-road emissions and are summarized in Mobile Appendix C.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. However, EMFAC2014 emission factors consistent with worker and vendor CalEEMod fleet breakdowns have been used to calculate CAP emissions for comparison with the BAAQMD construction thresholds of significance.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
CO_2 - carbon dioxide
EMFAC - Emissions Factor model
equip - equipment
FTE - full-time equivalent
GUP - general use permit
hr - hour
hp - horsepower
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
NO_X - nitrogen oxides
PM_{10} - particulate matter less than 10 µm in diameter
$PM_{2.5}$ - particulate matter less than 2.5 µm in diameter
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
SO_X - sulfur oxide
TBD - to be determined
ton - short tons
µm - micrometer
USEPA - United States Environmental Protection A
VMT - vehicle miles traveled

Table 3-4-7
2015 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Total Emissions [ton/year][11]					
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_X
Off-Campus (Worker) Trips[3]	Undergraduate	234	2.0	70,286		512,385	0.21	1.2	0.12	0.027	0.011	0.0021
	Graduate	1,259	2.0	523,894		4,793,631	1.6	11	1.0	0.25	0.11	0.019
	Post-doc	555	2.0	246,412		2,335,983	0.74	5.1	0.50	0.12	0.052	0.0092
	Faculty/Staff	5,443	2.0	2,416,714		27,803,160	7.4	57	5.6	1.4	0.61	0.11
	Casual Employees	302	2.0	133,960		1,793,719	0.42	3.5	0.35	0.093	0.039	0.0070
	Contingent Employees	294	2.0	130,354		1,596,836	0.41	3.2	0.32	0.083	0.035	0.0062
	Temporary Employees	604	2.0	268,165		3,421,786	0.84	6.8	0.68	0.18	0.075	0.013
	Non-Employee Affiliates: 20% FTEs	169	2.0	75,118		892,407	0.23	1.8	0.18	0.046	0.020	0.0035
	Non-Employee Affiliates: FTEs	925	2.0	410,795		4,880,239	1.3	10	1.0	0.25	0.11	0.019
	Third Party Contractors	244	2.0	108,178		1,537,214	0.34	2.9	0.30	0.080	0.034	0.0060
	Janitorial Shift Workers	195	2.0	86,543		1,229,771	0.28	2.4	0.24	0.064	0.027	0.0048
	First Mile to Transit (all Workers + Students)	2,039	2.0	903,934		3,707,596	2.5	11.9	1.11	0.20	0.084	0.016
	Construction	975	2.0	432,713		6,148,856	1.4	12	1.2	0.32	0.13	0.024
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**	**18**	**128**	**13**	**3.2**	**1.3**	**0.24**
On-Campus (Resident) Trips[3]	Undergraduate	1,582	5.91	1,962,450		7,612,107	5.0	25	2.3	0.40	0.17	0.032
	Graduate	3,648	4.5	5,264,378		27,554,538	13.8	78	7.4	1.45	0.62	0.114
	Post-doc	28	3.7	33,580		168,975	0.089	0.49	0.046	0.0089	0.0038	7.0E-04
	Faculty/Staff	98	2.6	94,698		619,941	0.3	2	0.2	0.03	0.01	0.003
	Sub-Total	**5,356**		**7,355,106**		**35,955,561**	**19**	**105**	**9.9**	**1.9**	**0.81**	**0.15**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.7	454,946	7.3	3,321,104	0.83	6.9	0.65	0.17	0.072	0.013
	Bonair on-road - diesel[8]	11	3.2	12,890	7.3	94,099	0.0037	0.032	0.027	0.0070	0.0041	3.0E-04
	Bonair on-road buses - diesel[8]	10	1.1	4,075	7.3	29,749	0.025	0.14	0.62	0.030	0.0013	6.6E-04
	Bonair Unfiltered - on-road - gas[8]	74	1.7	45,317	7.3	330,811	0.092	0.68	0.064	0.017	0.0072	0.0013
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.56	2.5	11	0.36	0.20	0.016
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	0.0069	0.061	0.050	0.013	0.0078	0.0010
	Marguerite[10]	66				1,983,931	0.78	4.7	15	1.3	0.63	0.029
	Public Safety	31	2.8	31,879	7.3	232,720	0.058	0.48	0.045	0.012	0.0050	9.1E-04
	Sub-Total	**700**		**614,290**		**8,594,006**	**2.4**	**15**	**27**	**1.9**	**0.93**	**0.062**
Other Trips[3]	General Visitors (Vendor)	2,016,204	2.0	4,032,408		25,001,480	12	65	6.2	1.3	0.56	0.10
	Worker Non-Commute Trips			301,920		935,952	0.71	3.6	0.33	0.050	0.022	0.0041
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443	0.48	5.1	0.53	0.15	0.064	0.011
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.31	1.7	6.8	0.39	0.24	0.0078
	Event Visitor Traffic	149,958	2.0	299,917		6,652,357	1.0	11	1.2	0.34	0.14	0.026
	Deliveries - Trucks (total)	168,054	2.0	336,108		2,083,870	0.50	2.3	10	0.31	0.18	0.014
	Construction Vendor Trucks[12]		*2.4*	*8,510*		*62,123*	*0.07*	*0.61*	*0.62*	*0.017*	*0.012*	*0.0012*
	Construction Haul Trucks[12]		*2.4*	*7,987*		*159,740*	*0.11*	*0.97*	*1.6*	*0.034*	*0.022*	*0.0033*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**	**15**	**89**	**25**	**2.6**	**1.2**	**0.16**
					Total VMT	**143,215,251**						
						[bhp-hr/yr][6]						
Campus Vehicles - Off road equip[5,7]	Siebel and Red Barn equip - gas[9]					38,837	3.4	14	0.12	0.040	0.040	0.0015
	Siebel and Red Barn equip - diesel[9]					52,854	0.087	0.37	0.32	0.031	0.029	3.1E-04
	Off-road equip - gas					6,553	0.58	2.4	0.020	0.0068	0.0068	2.5E-04
	Off-road equip - diesel					102,570	0.17	0.72	0.62	0.060	0.055	6.1E-04
	Light Towers - gas					2,925	0.0026	0.0086	0.016	8.3E-04	8.3E-04	2.3E-05
	Light Towers - diesel					186,791	0.16	0.55	1.0	0.053	0.053	0.0014
	Sub-Total					**390,532**	**4.41**	**18.5**	**2.1**	**0.19**	**0.18**	**0.0041**
						Total Emissions from Mobile Sources [ton/yr]	**58**	**356**	**77**	**9.7**	**4.5**	**0.62**

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Table 3-4-7
2015 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix A (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. However, EMFAC2014 emission factors consistent with worker and vendor CalEEMod fleet breakdowns have been used to calculate CAP emissions for comparison with the BAAQMD construction thresholds of significance.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
CO_2 - carbon dioxide
EMFAC - Emissions Factor model
equip - equipment
FTE - full-time equivalent
GUP - general use permit
hr - hour
hp - horsepower
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
NO_X - nitrogen oxides
PM_{10} - particulate matter less than 10 µm in diameter
$PM_{2.5}$ - particulate matter less than 2.5 µm in diameter
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
SO_X - sulfur oxide
TBD - to be determined
ton - short tons
µm - micrometer
USEPA - United States Environmental Protection A
VMT - vehicle miles traveled

Table 3-4-8
Fall 2018 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Total Emissions [ton/year][12]					
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_X
Off-Campus (Worker) Trips[3]	Undergraduate	185	2.0	55,470		404,378	0.07	0.51	0.049	0.021	0.009	0.0014
	Graduate	1286	2.0	534,884		4,894,189	0.7	5.9	0.57	0.25	0.11	0.017
	Post-doc	589	2.0	261,730		2,481,198	0.33	3.0	0.29	0.13	0.054	0.0088
	Faculty/Staff	5,682	2.0	2,522,720		28,678,561	3.2	33	3.2	1.5	0.62	0.10
	Casual Employees	314	2.0	139,563		1,868,744	0.18	2.1	0.21	0.096	0.040	0.0066
	Contingent Employees	306	2.0	135,808		1,663,642	0.18	1.9	0.19	0.086	0.036	0.0058
	Temporary Employees	629	2.0	279,355		3,564,566	0.37	4.0	0.40	0.18	0.077	0.013
	Non-Employee Affiliates: 20% FTEs	176	2.0	78,281		929,974	0.10	1.1	0.10	0.048	0.020	0.0033
	Non-Employee Affiliates: FTEs	964	2.0	428,097		5,085,797	0.55	5.8	0.57	0.26	0.11	0.018
	Third Party Contractors	263	2.0	116,833		1,660,191	0.16	1.8	0.18	0.085	0.036	0.0058
	Janitorial Shift Workers	210	2.0	93,394		1,327,128	0.13	1.5	0.15	0.068	0.029	0.0047
	First Mile to Transit (all Workers + Students)	2,125	2.0	941,983		3,864,416	1.07	5.9	0.54	0.201	0.085	0.0141
	Construction	975	2.0	432,713		6,148,856	0.58	6.8	0.68	0.32	0.13	0.022
	Sub-Total	**13,705**		**6,020,830**		**62,571,641**	**7.6**	**74**	**7.2**	**3.2**	**1.4**	**0.22**
On-Campus (Resident) Trips[3]	Undergraduate	1,654	5.84	2,028,810		7,869,489	1.87	12.3	1.12	0.41	0.17	0.029
	Graduate	3,829	4.4	5,479,152		28,680,441	5.40	40.2	3.76	1.48	0.63	0.103
	Post-doc	28	3.7	33,580		168,975	0.034	0.24	0.022	0.0088	0.0037	6.1E-04
	Faculty/Staff	98	2.6	94,698		619,941	0.10	0.8	0.08	0.03	0.01	0.002
	Sub-Total	**5,609**		**7,636,240**		**37,338,845**	**7.4**	**54**	**5.0**	**1.9**	**0.82**	**0.14**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	0.59	4.6	0.41	0.16	0.068	0.011
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	0.0023	0.024	0.014	0.0058	0.0029	2.6E-04
	Bonair on-road buses diesel	10	1.1	3,871	7.3	28,261	0.017	0.10	0.47	0.025	0.0010	6.1E-04
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	0.066	3.60	0.041	0.016	0.0068	0.0011
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.497	2.18	7.807	0.334	0.1837	0.0154
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	0.005	0.047	0.028	0.0115	0.0061	5.3E-04
	Marguerite[10]	66				2,144,233	0.67	4.4	13	1.3	0.58	0.027
	Public Safety	31	2.8	31,879	7.3	232,720	0.042	0.34	0.030	0.012	0.0050	0.0008
	Sub-Total	**700**		**588,428**		**8,565,520**	**1.9**	**15.3**	**22**	**1.8**	**0.86**	**0.057**
Other Trips[3]	General Visitors (Vendor)	2,177,501	2.0	4,355,001		27,001,599	5.1	36	3.4	1.4	0.59	0.10
	Worker Non-Commute Trips			326,074		1,010,828	0.26	1.7	0.16	0.05	0.022	0.004
	Non-event Visitor Trips - Passenger	61,835	2.0	147,705		3,130,985	0.22	3.3	0.33	0.16	0.067	0.011
	Non-event Visitor Trips - Buses	5,250	2.0	11,074		390,000	0.23	1.4	5.3	0.34	0.196	0.0073
	Event Visitor Traffic	67,085	2.0	301,862		6,695,507	0.45	7.1	0.71	0.34	0.14	0.023
	Deliveries - Trucks	181,499	2.0	362,997		2,250,579	0.48	2.2	7.5	0.32	0.18	0.015
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*	*0.041*	*0.43*	*0.47*	*0.013*	*0.008*	*0.0012*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20.0*	*159,740*	*0.062*	*0.69*	*1.2*	*0.022*	*0.011*	*0.0033*
	Sub-Total	**2,493,169**		**5,504,713**		**40,479,498**	**6.8**	**52**	**17**	**2.6**	**1.2**	**0.16**
					Total VMT	**148,955,504**						
						[bhp-hr/yr][6]						
Campus Vehicles - Off-road Equip[5,7]	Siebel and Red Barn equip - gas[9]					38,837	3.4	14	0.12	0.040	0.040	1.5E-03
	Siebel and Red Barn equip - diesel[9]					52,854	0.087	0.37	0.32	0.031	0.029	3.1E-04
	Off-road equip - gas					6,553	0.58	2.4	0.020	0.0068	0.0068	2.5E-04
	Off-road equip - diesel					102,570	0.17	0.72	0.62	0.060	0.055	6.1E-04
	Light Towers - gas					2,925	0.0026	0.0086	0.016	8.3E-04	8.3E-04	2.3E-05
	Light Towers - diesel					186,791	0.16	0.55	1.0	0.053	0.053	0.0014
	Sub-Total					**390,532**	**4.41**	**18.5**	**2.1**	**0.19**	**0.18**	**0.0041**
						Total Emissions from Mobile Sources [tons/yr]	**28**	**212**	**54**	**9.8**	**4.4**	**0.57**

Table 3-4-8
Fall 2018 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix B1. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B1 (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix B1. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2018 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix B1.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C. By fall 2018, Ramboll Environ assumed that the 10 oldest buses in the Marguerite fleet were converted from diesel-powered to electric-powered. These calculations are shown in Appendix C.
11. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles.
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. However, EMFAC2014 emission factors consistent with worker and vendor CalEEMod fleet breakdowns have been used to calculate CAP emissions for comparison with the BAAQMD construction thresholds of significance.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
CO_2 - carbon dioxide
EMFAC - Emissions Factor
FTE - Full time equivalent
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
NO_X - nitrogen oxides
PM_{10} - particulate matter under 10 microns
$PM_{2.5}$ - particulate matter under 2.5 microns
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
SO_X - sulfur oxide
TBD - To be determined
ton - short tons
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-4-9
Fall 2035 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Total Emissions [ton/year][11]					
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_X
Off-Campus (Worker) Trips[3]	Undergraduate	185	2.0	55,470		404,378	0.028	0.21	0.015	0.021	0.0085	9.3E-04
	Graduate	764	2.0	317,833		2,908,174	0.17	1.5	0.11	0.15	0.061	0.0066
	Post-doc	828	2.0	367,634		3,485,170	0.19	1.7	0.13	0.18	0.073	0.0079
	Faculty/Staff	7,220	2.0	3,205,524		35,698,523	1.7	17	1.3	1.8	0.75	0.081
	Casual Employees	398	2.0	176,826		2,367,699	0.10	1.1	0.084	0.12	0.050	0.0054
	Contingent Employees	388	2.0	172,068		2,107,835	0.094	1.0	0.076	0.11	0.044	0.0048
	Temporary Employees	797	2.0	353,942		4,516,305	0.19	2.2	0.16	0.23	0.095	0.010
	Non-Employee Affiliates: 20% FTEs	223	2.0	99,182		1,178,277	0.054	0.57	0.042	0.060	0.025	0.0027
	Non-Employee Affiliates: FTEs	1,222	2.0	542,399		6,443,705	0.29	3.1	0.23	0.33	0.13	0.015
	Third Party Contractors	321	2.0	142,671		2,027,352	0.079	1.0	0.072	0.10	0.042	0.0046
	Janitorial Shift Workers	257	2.0	114,049		1,620,630	0.063	0.76	0.057	0.082	0.034	0.0037
	First Mile to Transit (all Workers + Students)	2,654	2.0	1,177,343		4,853,984	0.58	2.9	0.20	0.25	0.103	0.0114
	Construction	975	2.0	432,713		6,148,856	0.24	2.9	0.22	0.31	0.13	0.014
	Sub-Total	**16,231**		**7,157,654**		**73,760,888**	**3.8**	**36**	**2.7**	**3.8**	**1.5**	**0.17**
On-Campus (Resident) Trips[3]	Undergraduate	2,079	5.84	2,550,030		9,891,078	1.0	6.1	0.42	0.51	0.21	0.023
	Graduate	5,974	4.5	8,613,822		45,087,773	3.6	26	1.8	2.3	1.0	0.10
	Post-doc	28	3.7	33,580		168,975	0.015	0.10	0.0068	0.0086	0.0036	3.9E-04
	Faculty/Staff	1,511	2.7	1,463,463		9,574,762	0.69	5.1	0.37	0.49	0.20	0.022
	Sub-Total	**9,592**		**12,660,895**		**64,722,587**	**5.4**	**37**	**2.6**	**3.3**	**1.4**	**0.15**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	0.16	1.1	0.080	0.080	0.033	0.0040
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	3.0E-04	0.0069	8.1E-04	0.0023	0.0010	9.6E-05
	Bonair on-road buses diesel	10	1.1	3,871	7.3	28,261	0.0029	0.030	0.079	0.0085	3.1E-04	2.6E-04
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	0.017	0.11	0.0079	0.0080	0.0033	4.0E-04
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59	2,424,184	0.36	1.6	1.6	0.29	0.14	0.014
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	0.0012	0.027	0.0032	0.0091	0.0038	3.8E-04
	Marguerite[10]	66				2,618,108	0	0	0	1.7	0.72	0
	Public Safety	31	2.8	31,879	7.3	232,720	0.022	0.17	0.012	0.012	0.0049	5.9E-04
	Sub-Total	**700**		**588,428**		**9,039,395**	**0.56**	**3.1**	**1.8**	**2.1**	**0.90**	**0.020**
Other Trips[3]	General Visitors (Vendor)	2,656,551	2.0	5,313,101		32,968,952	2.7	18	1.3	1.7	0.70	0.076
	Worker Non-Commute Trips			397,810		1,234,221	0.14	0.82	0.056	0.063	0.026	0.0030
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		3,675,599	0.088	1.6	0.13	0.19	0.077	0.0082
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.073	0.79	1.7	0.23	0.11	0.0061
	Event Visitor Traffic	67,085	2.0	299,917		6,980,045	0.18	3.1	0.24	0.35	0.15	0.016
	Deliveries - Trucks	221,428	2.0	442,856		2,747,957	0.44	2.1	2.2	0.33	0.16	0.016
	Construction Vendor Trucks[12]		*3.0*	*8,510*	*7.3*	*62,123*	*0.01*	*0.3*	*0.2*	*0.01*	*0.00*	*0.001*
	Construction Haul Trucks[12]		*4.0*	*7,987*	*20*	*159,740*	*0.03*	*0.5*	*0.4*	*0.02*	*0.01*	*0.003*
	Sub-Total	**3,012,148**		**6,604,231**		**47,996,774**	**3.6**	**26**	**6**	**2.8**	**1.2**	**0.13**
					Total VMT	**195,519,644**						
						[bhp-hr/yr][6]						
Campus Vehicles - Off-road Equip[5,7]	Siebel and Red Barn equip - gas[9]					38,837	3.4	14	0.12	0.040	0.040	0.0015
	Siebel and Red Barn equip - diesel[9]					52,854	0.087	0.37	0.32	0.031	0.029	3.1E-04
	Off-road equip - gas					6,553	0.58	2.4	0.020	0.0068	0.0068	2.5E-04
	Off-road equip - diesel					102,570	0.17	0.72	0.62	0.060	0.055	6.1E-04
	Light Towers - gas					2,925	0.0026	0.0086	0.016	8.3E-04	8.3E-04	2.3E-05
	Light Towers - diesel					186,791	0.16	0.55	1.0	0.053	0.053	0.0014
	Sub-Total					**390,532**	**4.41**	**18.5**	**2.1**	**0.19**	**0.18**	**0.0041**
					Total Emissions from Mobile Sources [tons/yr]		**18**	**121**	**15**	**12.2**	**5.2**	**0.47**

RAMBOLL ENVIRON

Table 3-4-9
Fall 2035 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix C. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix C (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix C. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2035 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix C.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the 2018 inventory was estimated to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2018 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are estimated by scaling assuming only 30% non-electric vehicles contribute to emissions in 2035 versus 60% in 2018. Additionally, Stanford expects the entire Marguerite fleet to be electric by 2035. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford and is assumed to remain constant from 2015 to 2035. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate emissions.
6. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption. Emission factors are shown in Mobile Appendix C.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite buses are assumed to all be electric by 2035. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles; this is kept constant through 2035.
11. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. However, EMFAC2014 emission factors consistent with worker and vendor CalEEMod fleet breakdowns have been used to calculate CAP emissions for comparison with the BAAQMD construction thresholds of significance.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
CO_2 - carbon dioxide
EMFAC - Emissions Factor
FTE - Full time equivalent
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
NO_X - nitrogen oxides
PM_{10} - particulate matter under 10 microns
$PM_{2.5}$ - particulate matter under 2.5 microns
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
SO_X - sulfur oxide
TBD - To be determined
ton - short tons
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-4-10
2014 CAP Emissions - Existing Emergency Diesel Engines
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled Actual Emissions[5]				
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-14	755	8.3	0%	BAAQMD Spec	5.7	0.40	0.14	0.0055	0.0800	0.039	0.003	0.0010	0.000038	0.0006
S-15	1490	8	0%	BAAQMD Spec	5.5	0.67	0.09	0.0055	0.08	0.072	0.009	0.0012	0.000072	0.0011
S-16	73	7.2	0%	BAAQMD Spec	6.3	2.0	0.78	0.0055	0.10	0.004	0.001	0.0005	0.000003	0.0001
S-17	300	20.5	0%	BAAQMD Spec	6.8	0.29	0.16	0.0055	0.07	0.046	0.002	0.0011	0.000037	0.0005
S-18	135	7.2	0%	BAAQMD Spec	11	1.8	0.80	0.0055	0.25	0.012	0.002	0.0009	0.000006	0.0003
S-21	465	21.7	0%	BAAQMD Spec	10	1.0	0.25	0.0055	0.15	0.106	0.011	0.0028	0.000061	0.0017
S-23	465	11.1	0%	BAAQMD Spec	10	1.0	0.25	0.0055	0.15	0.054	0.006	0.0014	0.000031	0.0009
S-25	587	0	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.000	0.000	0.0000	0.000000	0.0000
S-28	900	7.1	0%	BAAQMD Spec	13	1.1	0.42	0.0055	0.18	0.094	0.008	0.0030	0.000039	0.0013
S-30	166	7.2	0%	BAAQMD Spec	11	3.3	0.30	0.0055	0.25	0.014	0.004	0.0004	0.000007	0.0003
S-31	166	9.1	0%	BAAQMD Spec	11	3.3	0.30	0.0055	0.25	0.018	0.005	0.0005	0.000009	0.0004
S-32	390	7.6	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.046	0.010	0.0037	0.000018	0.0033
S-33	1008	16.2	0%	BAAQMD Spec	13	1.1	0.42	0.0055	0.18	0.239	0.020	0.0076	0.000099	0.0032
S-34	605	10	0%	Tier Std	6.9	8.5	1.00	0.0055	0.40	0.046	0.057	0.0067	0.000037	0.0027
S-35	170	13.2	0%	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.017	0.007	0.0028	0.000014	0.0025
S-37	207	11	0%	Tier Std	6.9	8.5	1.00	0.0055	0.40	0.017	0.021	0.0025	0.000014	0.0010
S-38	380	7.9	0%	BAAQMD Spec	9.3	1.0	0.50	0.0055	0.50	0.031	0.003	0.0017	0.000018	0.0017
S-39	210	6.9	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.022	0.005	0.0018	0.000009	0.0016
S-46	79	8.4	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.010	0.002	0.0008	0.000004	0.0007
S-47	207	6.6	0%	BAAQMD Spec	6.9	11.4	1.30	0.0055	0.40	0.010	0.017	0.0020	0.000008	0.0006
S-52	102	2	0%	BAAQMD Spec	12	1.5	0.40	0.0055	0.25	0.003	0.000	0.0001	0.000001	0.0001
S-56	60	5.6	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.005	0.001	0.0004	0.000002	0.0004
S-57	218	5.1	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.017	0.004	0.0014	0.000007	0.0012
S-58	504	6.1	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.048	0.010	0.0039	0.000019	0.0034
S-59	135	6.1	0%	BAAQMD Spec	8.7	0.30	0.06	0.0055	0.13	0.008	0.000	0.0001	0.000005	0.0001
S-60	317	6	0%	BAAQMD Spec	6.9	8.5	1.00	0.0055	0.40	0.014	0.018	0.0021	0.000012	0.0008
S-61	300	70.2	0%	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.146	0.014	0.0116	0.000128	0.0030
S-62	300	6	0%	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.013	0.001	0.0010	0.000011	0.0003
S-63	300	8.7	0%	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.018	0.002	0.0014	0.000016	0.0004
S-65	672	7.4	0%	AP-42	11	2.49	0.32	0.0055	0.32	0.060	0.014	0.0018	0.000030	0.0017
S-67	1008	7.3	25%	BAAQMD Spec	14	1.0	0.30	0.0055	0.15	0.110	0.008	0.0024	0.000045	0.0009
S-68	1848	7.8	25%	BAAQMD Spec	14	2.4	0.08	0.0055	0.20	0.226	0.039	0.0013	0.000087	0.0024
S-71	270	23.8	25%	BAAQMD Spec	7.6	0.67	0.70	0.0055	0.21	0.054	0.005	0.0050	0.000039	0.0011
S-72	380	6.7	25%	BAAQMD Spec	9.3	1.0	0.48	0.0055	0.50	0.026	0.003	0.0013	0.000015	0.0011
S-73	900	7.8	25%	BAAQMD Spec	14	1.0	0.30	0.0055	0.15	0.105	0.008	0.0023	0.000043	0.0009
S-74	102	7.9	0%	BAAQMD Spec	9.2	0.77	0.38	0.0055	0.12	0.008	0.001	0.0003	0.000005	0.0001
S-75	102	6.7	0%	BAAQMD Spec	9.2	0.77	0.38	0.0055	0.12	0.007	0.001	0.0003	0.000004	0.0001
S-76	317	15.3	0%	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.034	0.003	0.0027	0.000029	0.0007
S-77	755	8.8	0%	BAAQMD Spec	5.7	0.40	0.14	0.0055	0.08	0.042	0.003	0.0010	0.000040	0.0006
S-78	2220	5.5	0%	BAAQMD Spec	6.9	8.5	1.00	0.0055	0.40	0.093	0.114	0.0135	0.000074	0.0054
S-79	470	6.8	0%	BAAQMD Spec	3.2	0.50	0.17	0.0055	0.09	0.011	0.002	0.0006	0.000019	0.0003
S-80	2220	7.8	0%	BAAQMD Spec	7.8	1.3	0.17	0.0055	0.11	0.149	0.025	0.0032	0.000105	0.0021
S-81	230	10.6	0%	Exec Order	7.6	1.1	0.10	0.0055	0.08	0.020	0.003	0.0003	0.000015	0.0002
S-82	317	6.9	0%	BAAQMD Spec	3.7	0.47	0.14	0.0055	0.14	0.009	0.001	0.0003	0.000013	0.0003
S-83	755	9.3	0%	BAAQMD Spec	5.7	0.40	0.14	0.0055	0.08	0.044	0.003	0.0011	0.000043	0.0006
S-84	317	8.1	0%	BAAQMD Spec	3.7	0.47	0.14	0.0055	0.14	0.010	0.001	0.0004	0.000016	0.0004
S-88	395	6.7	0%	BAAQMD Spec	3.9	0.20	0.20	0.0055	0.06	0.011	0.001	0.0006	0.000016	0.0002
S-89	317	7.2	0%	BAAQMD Spec	3.7	0.47	0.14	0.0055	0.14	0.009	0.001	0.0004	0.000014	0.0004
S-91	395	6.2	0%	Exec Order	6.7	1.3	0.35	0.0055	0.19	0.018	0.004	0.0010	0.000015	0.0005

Table 3-4-10
2014 CAP Emissions - Existing Emergency Diesel Engines
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled Actual Emissions[5]				
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-92	750	8.2	0%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.054	0.005	0.0028	0.000037	0.0009
S-93	325	8.2	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.041	0.009	0.0034	0.000016	0.0029
S-94	277	15.1	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.065	0.014	0.0053	0.000025	0.0046
S-95	750	6.3	0%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.042	0.004	0.0022	0.000029	0.0007
S-96	325	10.1	0%	Exec Order	4.9	4.3	0.26	0.0055	0.21	0.018	0.015	0.0009	0.000020	0.0008
S-97	1175	9.5	0%	Exec Order	7.9	0.93	0.41	0.0055	0.15	0.097	0.011	0.0051	0.000068	0.0018
S-98	1523	8.5	0%	Exec Order	7.9	0.93	0.41	0.0055	0.15	0.112	0.013	0.0059	0.000078	0.0021
S-99	1523	8	0%	Exec Order	7.9	0.93	0.41	0.0055	0.15	0.105	0.013	0.0056	0.000074	0.0020
S-100	2220	15.8	0%	Exec Order	7.7	1.6	0.41	0.0055	0.11	0.299	0.062	0.0157	0.000213	0.0041
S-102	207	8.3	0%	Exec Order	5.7	0.6	0.30	0.0055	0.20	0.011	0.001	0.0006	0.000010	0.0004
S-105	1490	9.3	0%	Exec Order	7.5	0.9	0.39	0.0055	0.16	0.114	0.014	0.0060	0.000084	0.0024
S-106	755	9.2	0%	Exec Order	7.2	0.9	0.38	0.0055	0.17	0.055	0.007	0.0029	0.000042	0.0013
S-110	364	9.4	85%	AP-42	14	3.0	1.14	0.0055	1.00	0.053	0.011	0.0043	0.000021	0.0006
S-111	145	28.3	85%	Exec Order	4.8	1.2	0.25	0.0055	0.17	0.022	0.005	0.0011	0.000025	0.0001
S-112	2220	10.2	85%	Exec Order	7.7	1.6	0.41	0.0055	0.11	0.193	0.040	0.0102	0.000137	0.0004
S-113	398	8.5	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.052	0.011	0.0043	0.000021	0.0037
S-115	130	7.8	85%	AP-42	14	3.0	1.14	0.0055	1.00	0.016	0.003	0.0013	0.000006	0.0002
S-116	364	11	85%	AP-42	14	3.0	1.14	0.0055	1.00	0.062	0.013	0.0050	0.000024	0.0007
S-44	170	6.7	0%	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.009	0.004	0.0014	0.000007	0.0013
S-66	166	6.5	85%	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.008	0.004	0.0014	0.000007	0.0002
S-70	102	6.8	85%	AP-42	14	3.0	1.14	0.0055	1.00	0.011	0.002	0.0009	0.000004	0.0001
S-107	755	7.8	85%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.052	0.005	0.0027	0.000036	0.0001
S-108	755	7.4	85%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.049	0.005	0.0026	0.000034	0.0001
S-109	755	6.9	85%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.046	0.005	0.0024	0.000032	0.0001
None	100	5.9	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.009	0.002	0.0007	0.000004	0.0006
S-114	1214	7.2	0%	Exec Order	6.8	1.7	0.36	0.0055	0.19	0.066	0.017	0.0035	0.000053	0.0018
S-11	1807	11	0%	AP-42	11	2.5	0.32	0.0055	0.32	0.239	0.055	0.0070	0.000121	0.0070
S-12	1186	66	0%	AP-42	11	2.5	0.32	0.0055	0.32	0.939	0.215	0.0276	0.000475	0.0274
S-13	1186	11	0%	AP-42	11	2.5	0.32	0.0055	0.32	0.157	0.036	0.0046	0.000079	0.0046
S-53	250	12	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.047	0.010	0.0038	0.000018	0.0033
S-69	1680	12.2	25%	AP-42	11	2.5	0.32	0.0055	0.32	0.246	0.056	0.0072	0.000124	0.0054
S-90	102	7.9	25%	AP-42	14	3.0	1.14	0.0055	1.00	0.012	0.003	0.0010	0.000005	0.0007
S-101	480	12.5	0%	Exec Order	4.3	3.6	0.23	0.0055	0.24	0.028	0.024	0.0015	0.000036	0.0016
S-104	2206	15.7	0%	Exec Order	7.0	1.6	0.37	0.0055	0.19	0.266	0.061	0.0140	0.000210	0.0071
S-117	274	14.4	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.061	0.013	0.0050	0.000024	0.0043
None	50	6.6	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.005	0.001	0.0004	0.000002	0.0004
None	50	9.3	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.007	0.002	0.0006	0.000003	0.0005
None	50	10.3	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.008	0.002	0.0006	0.000003	0.0006
S-112	50	10.2	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.008	0.002	0.0006	0.000003	0.0006
								Total	**[ton/yr]**	**5.9**	**1.3**	**0.28**	**0.0036**	**0.15**

Notes:

1. List of campus-wide emergency generators along with their BAAQMD ID, year, engine rating, and diesel particulate filter abatement is provided by Stanford. There are four generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.
2. Usage from Stanford.
3. Lists the source for the NOx, CO, POC and PM_{10} emission factor. 'BAAQMD Spec' refers to BAAQMD Specification Sheets for certain generators which was provided by Stanford. 'Exec Order' refers to ARB Executive Order which is available via the ARB Off-road Certification database. 'AP-42' refers to the USEPA compilation of air pollutant emission factors. 'Tier Std' refers to the ARB/USEPA Tier Standards .
4. SO_2 emission factor for all the emergency generators was calculated using 0.0015 weight percent sulfur and the emission factor provided in Table 3.4-1 from AP-42. The % sulfur in fuel oil was assumed to be 15 ppm, based on diesel fuel sulfur content from California Diesel Fuel Regulation.
5. Annual emissions were calculated assuming actual hours of operation for each generator.

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Table 3-4-10
2014 CAP Emissions - Existing Emergency Diesel Engines
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled Actual Emissions[5]				
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				

Abbreviations:

CAP - criteria air pollutants
AP 42 - USEPA compilation of air pollutant emission factors
ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
BAAQMD Spec - BAAQMD Specification Sheet
bhp - brake horsepower
CO - carbon monoxide
Exec Order - ARB Executive Order
g - gram
hp - horsepower
hr - hour
ID - identification
NO_x - nitrogen oxides
PM_{10} - particulate matter less than 10 μm in d
POC - precursor organic compound
SO_2 - sulfur dioxide
Tier Std - ARB/USEPA Tier Standards
ton - short tons
μm - micrometer
USEPA - United States Environmental Protection Agency
yr - year

References:

ARB. California Diesel Fuel Regulation. Available online at: http://www.arb.ca.gov/fuels/diesel/081404dslregs.pdf.
ARB. Off-Road Certification database. Available online at: http://www.arb.ca.gov/msprog/offroad/cert/cert.php.
USEPA. 1995. AP 42, Volume I, Fifth Edition. §3.4. Large Stationary Diesel and All Stationary Dual-Fuel Engines. Available online at: http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf
USEPA. Non-road Compression -Ignition Engines - Exhaust Emission Standards. Available online at: http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm.

Table 3-4-11
2015, 2018, and Fall 2035 CAP Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled 2015 Emissions				
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-14	755	10	--	BAAQMD Spec	5.7	0.40	0.14	0.0055	0.0800	0.048	0.0034	0.0012	4.6E-05	6.7E-04
S-15	1490	7.9	--	BAAQMD Spec	5.5	0.7	0.09	0.0055	0.08	0.071	0.0087	0.0012	7.1E-05	0.0010
S-16	73	8.7	--	BAAQMD Spec	6	2.0	0.78	0.0055	0.10	0.0044	0.0014	5.5E-04	3.9E-06	7.0E-05
S-17	300	66	--	BAAQMD Spec	7	0.3	0.16	0.0055	0.07	0.15	0.0063	0.0035	1.2E-04	0.0015
S-18	135	7.3	--	BAAQMD Spec	10.8	1.8	0.80	0.0055	0.25	0.012	0.0020	8.7E-04	6.0E-06	2.7E-04
S-21	465	13	--	BAAQMD Spec	10	1.0	0.25	0.0055	0.15	0.063	0.0065	0.0017	3.7E-05	0.0010
S-23	465	14.4	--	BAAQMD Spec	10	1.0	0.25	0.0055	0.15	0.070	0.007	0.002	0.000	0.001
S-28	900	8.5	--	BAAQMD Spec	13	1.1	0.42	0.0055	0.18	0.112	0.009	0.004	0.000	0.002
S-30	166	7.4	--	BAAQMD Spec	10.7	3.3	0.30	0.0055	0.25	0.014	0.0045	4.1E-04	7.4E-06	3.4E-04
S-31	166	10.2	--	BAAQMD Spec	11	3.3	0.30	0.0055	0.25	0.020	0.0061	5.6E-04	1.0E-05	4.7E-04
S-32	390	8	--	AP-42	14	3.0	1.14	0.0055	1.00	0.048	0.010	0.0039	1.9E-05	0.0034
S-33	1008	8.3	--	BAAQMD Spec	13.3	1.1	0.42	0.0055	0.18	0.12	0.010	0.0039	5.1E-05	0.0017
S-34	605	46.1	--	Tier Std	7	8.5	1.00	0.0055	0.40	0.21	0.26	0.031	1.7E-04	0.012
S-35	170	7.3	--	Tier Std/AP-42	6.9	3.03	1.14	0.0055	1.00	0.0094	0.0041	0.0016	7.5E-06	0.0014
S-37	207	11.6	--	Tier Std	6.9	8.50	1.00	0.0055	0.40	0.018	0.022	0.0026	1.5E-05	0.0011
S-38	380	8.5	--	BAAQMD Spec	9	1.0	0.50	0.0055	0.50	0.033	0.0036	0.0018	2.0E-05	0.0018
S-39	210	8.1	--	AP-42	14	3.0	1.14	0.0055	1.00	0.026	0.0057	0.0021	1.0E-05	0.0019
S-46	79	7.8	--	AP-42	14	3.0	1.14	0.0055	1.00	0.010	0.0021	7.8E-04	3.8E-06	6.8E-04
S-47	207	8	--	BAAQMD Spec	6.9	11.4	1.30	0.0055	0.40	0.013	0.021	0.0024	1.0E-05	7.3E-04
S-51	86	6.4	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.0085	0.0018	6.9E-04	3.3E-06	6.1E-04
S-56	60	6.5	--	AP-42	14.1	3.03	1.14	0.0055	1.00	0.006	0.001	0.000	0.000	0.000
S-57	218	6.5	--	AP-42	14.1	3.03	1.14	0.0055	1.00	0.022	0.0047	0.0018	8.6E-06	0.0016
S-58	504	6.5	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.051	0.011	0.0041	2.0E-05	0.0036
S-59	135	7	--	BAAQMD Spec	8.7	0.30	0.06	0.0055	0.13	0.0090	3.1E-04	6.3E-05	5.7E-06	1.4E-04
S-60	317	6.5	--	BAAQMD Spec	6.9	8.5	1.00	0.0055	0.40	0.016	0.019	0.0023	1.2E-05	9.1E-04
S-61	300	6.5	--	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.014	0.0013	0.0011	1.2E-05	2.8E-04
S-62	300	6.5	--	BAAQMD Spec	6.3	0.6	0.50	0.0055	0.13	0.014	0.0013	0.0011	1.2E-05	2.8E-04
S-63	300	7	--	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.015	0.0014	0.0012	1.3E-05	3.0E-04
S-65	672	8.1	--	AP-42	10.9	2.49	0.32	0.0055	0.32	0.065	0.015	0.0019	3.3E-05	0.0019
S-67	1008	6.8	25%	BAAQMD Spec	13.6	1.0	0.30	0.0055	0.15	0.10	0.0076	0.0023	4.2E-05	8.5E-04
S-68	1848	9.9	25%	BAAQMD Spec	14.2	2.4	0.08	0.0055	0.20	0.29	0.049	0.0016	1.1E-04	0.0030
S-71	270	7.7	25%	BAAQMD Spec	7.6	0.7	0.70	0.0055	0.21	0.017	0.0015	0.0016	1.3E-05	3.5E-04
S-72	380	7.5	25%	BAAQMD Spec	9.3	1.0	0.48	0.0055	0.50	0.029	0.0031	0.0015	1.7E-05	0.0012
S-73	900	7.9	25%	BAAQMD Spec	13.6	1.0	0.30	0.0055	0.15	0.11	0.0078	0.0024	4.3E-05	8.8E-04
S-74	102	7.9	--	BAAQMD Spec	9.2	0.8	0.38	0.0055	0.12	0.0082	6.8E-04	3.4E-04	4.9E-06	1.1E-04
S-75	102	8.1	--	BAAQMD Spec	9.2	0.8	0.38	0.0055	0.12	0.0084	7.0E-04	3.5E-04	5.0E-06	1.1E-04
S-76	317	7.8	--	BAAQMD Spec	6.3	0.6	0.50	0.0055	0.13	0.017	0.0016	0.0014	1.5E-05	3.5E-04
S-77	755	8	--	BAAQMD Spec	5.7	0.4	0.14	0.0055	0.08	0.038	0.0027	9.3E-04	3.7E-05	5.3E-04
S-78	2220	12.3	--	BAAQMD Spec	6.9	8.5	1.00	0.0055	0.40	0.21	0.26	0.030	1.7E-04	0.012
S-79	470	6.5	--	BAAQMD Spec	3.2	0.5	0.17	0.0055	0.09	0.011	0.0017	5.7E-04	1.9E-05	3.0E-04
S-80	2220	12.7	--	BAAQMD Spec	7.8	1.3	0.17	0.0055	0.11	0.24	0.040	0.0053	1.7E-04	0.0034
S-81	230	11.5	--	Exec Order	7.6	1.1	0.10	0.0055	0.08	0.022	0.0032	2.9E-04	1.6E-05	2.3E-04
S-82	317	8.1	--	BAAQMD Spec	3.7	0.5	0.14	0.0055	0.14	0.010	0.0013	4.0E-04	1.6E-05	4.0E-04
S-83	755	8.7	--	BAAQMD Spec	5.7	0.4	0.14	0.0055	0.08	0.041	0.0029	0.0010	4.0E-05	5.8E-04

RAMBOLL ENVIRON

Table 3-4-11
2015, 2018, and Fall 2035 CAP Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled 2015 Emissions				
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-84	317	7.5	--	BAAQMD Spec	3.7	0.5	0.14	0.0055	0.14	0.010	0.0012	3.7E-04	1.4E-05	3.7E-04
S-88	395	7.8	--	BAAQMD Spec	3.9	0.2	0.20	0.0055	0.06	0.013	6.8E-04	6.9E-04	1.9E-05	2.0E-04
S-91	395	8.5	--	Exec Order	6.7	1.3	0.35	0.0055	0.19	0.025	0.0049	0.0013	2.0E-05	6.9E-04
S-92	750	9.1	--	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.060	0.0060	0.0032	4.1E-05	0.0010
S-93	325	8.1	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.041	0.0088	0.0033	1.6E-05	0.0029
S-94	277	9.1	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.039	0.0084	0.0032	1.5E-05	0.0028
S-95	750	6.7	--	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.044	0.0044	0.0023	3.0E-05	7.4E-04
S-96	325	8.5	--	Exec Order	4.9	4.3	0.26	0.0055	0.21	0.015	0.013	7.9E-04	1.7E-05	6.5E-04
S-97	1175	7.9	--	Exec Order	7.9	0.9	0.41	0.0055	0.15	0.080	0.010	0.0042	5.6E-05	0.0015
S-98	1523	8.5	--	Exec Order	7.9	0.9	0.41	0.0055	0.15	0.11	0.013	0.0059	7.8E-05	0.0021
S-99	1523	8.7	--	Exec Order	7.9	0.9	0.41	0.0055	0.15	0.11	0.014	0.0060	8.0E-05	0.0021
S-100	2220	10.5	--	Exec Order	7.7	1.6	0.41	0.0055	0.11	0.20	0.041	0.010	1.4E-04	0.0027
S-102	207	2.2	--	Exec Order	5.7	0.6	0.30	0.0055	0.20	0.0029	3.0E-04	1.5E-04	2.8E-06	1.0E-04
S-105	1490	12.3	--	Exec Order	7.5	0.9	0.39	0.0055	0.16	0.15	0.019	0.0079	1.1E-04	0.0032
S-106	755	12.6	--	Exec Order	7.2	0.9	0.38	0.0055	0.17	0.076	0.010	0.0040	5.8E-05	0.0018
S-110	364	8.9	85%	AP-42	14.1	3.0	1.14	0.0055	1.00	0.050	0.011	0.0041	2.0E-05	5.3E-04
S-111	145	8.2	85%	Exec Order	4.8	1.2	0.25	0.0055	0.17	0.0063	0.0016	3.3E-04	7.2E-06	3.4E-05
S-112	2220	8.3	85%	Exec Order	7.7	1.6	0.41	0.0055	0.11	0.16	0.032	0.0083	1.1E-04	3.2E-04
S-113	398	10.3	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.064	0.014	0.0052	2.5E-05	0.0045
S-115	130	11.2	85%	AP-42	14.1	3.0	1.14	0.0055	1.00	0.023	0.0049	0.0018	8.8E-06	2.4E-04
S-116	364	10.5	85%	AP-42	14.1	3.0	1.14	0.0055	1.00	0.059	0.013	0.0048	2.3E-05	6.3E-04
S-124	2206	9	--	0	14.1	3.0	1.14	0.0055	1.00	0.31	0.066	0.025	1.2E-04	0.022
S-125	464	7.1	--	0	14.1	3.0	1.14	0.0055	1.00	0.051	0.011	0.0041	2.0E-05	0.0036
S-44	170	6.7	--	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.0087	0.0038	0.0014	6.9E-06	0.0013
S-66	166	6.8	85%	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.0086	0.0038	0.0014	6.8E-06	1.9E-04
S-70	102	6.8	85%	AP-42	14.1	3.0	1.14	0.0055	1.00	0.011	0.0023	8.7E-04	4.2E-06	1.1E-04
S-107	755	7.7	85%	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.051	0.0051	0.0027	3.5E-05	1.3E-04
S-108	755	7.9	85%	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.052	0.0053	0.0028	3.6E-05	1.3E-04
S-109	755	7.5	85%	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.050	0.0050	0.0026	3.4E-05	1.2E-04
None	100	6.5	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.010	0.0022	8.2E-04	3.9E-06	7.2E-04
S-114	1214	8.5	--	Exec Order	6.8	1.7	0.36	0.0055	0.19	0.078	0.020	0.0041	6.3E-05	0.0021
S-11	1807	14	--	AP-42	10.9	2.5	0.32	0.0055	0.32	0.30	0.070	0.0089	1.5E-04	0.0089
S-12	1186	41	--	AP-42	10.9	2.5	0.32	0.0055	0.32	0.58	0.13	0.017	2.9E-04	0.017
S-13	1186	13	--	AP-42	10.9	2.5	0.32	0.0055	0.32	0.19	0.042	0.0054	9.3E-05	0.0054
S-53	250	13	--	AP-42	14.1	3.03	1.14	0.0055	1.00	0.050	0.011	0.0041	2.0E-05	0.0036
S-69	1680	12.6	25%	AP-42	10.9	2.49	0.32	0.0055	0.32	0.25	0.058	0.0075	1.3E-04	0.0056
S-90	102	34	25%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.054	0.012	0.0044	2.1E-05	0.0029
S-101	480	13.6	--	Exec Order	4.3	3.60	0.23	0.0055	0.24	0.031	0.026	0.0016	4.0E-05	0.0017
S-104	2206	41.6	--	Exec Order	7.0	1.60	0.37	0.0055	0.19	0.70	0.16	0.037	5.6E-04	0.019
S-117	274	10.9	--	AP-42	14.1	3.03	1.14	0.0055	1.00	0.046	0.010	0.0038	1.8E-05	0.0033
None	50	10.2	0%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.0079	0.0017	6.4E-04	3.1E-06	5.6E-04
None	50	8.4	0%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.0065	0.0014	5.3E-04	2.5E-06	4.6E-04
None	50	3.6	0%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.0028	6.0E-04	2.3E-04	1.1E-06	2.0E-04
None	50	2.2	0%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.0017	3.7E-04	1.4E-04	6.7E-07	1.2E-04

RAMBOLL ENVIRON

Table 3-4-11
2015, 2018, and Fall 2035 CAP Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled 2015 Emissions				
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-122	755	5.8	85%	SMOP Application	3.7	0.4	0.2	0.01	0.08	0.018	0.0019	0.0010	2.7E-05	5.8E-05
S-123	2922	11.9	85%	SMOP Application	3.6	0.7	0.2	0.01	0.09	0.14	0.027	0.0078	2.1E-04	5.2E-04
S-121	145	5.4	85%	SMOP Application	2.5	0.7	0.1	0.93	0.1	0.0021	6.0E-04	1.2E-04	8.0E-04	1.3E-05
								Total for 2015	[ton/yr]	**6.8**	**1.7**	**0.35**	**0.0051**	**0.20**
								Scaling factor for Fall 2018				8%		
								Total for Fall 2018	[ton/yr]	**7.3**	**1.9**	**0.38**	**0.0055**	**0.21**
								Scaling factor for Fall 2035				22%		
								Total for Fall 2035	[ton/yr]	**9.0**	**2.3**	**0.47**	**0.0068**	**0.26**

Notes:

1. List of campus-wide emergency generators along with their BAAQMD ID, year, engine rating, and diesel particulate filter abatement is provided by Stanford for 2015. There are four generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.
2. 2015 is based on actual non-emergency and emergency run hours in 2015. For Fall 2018, it is assumed that the number of generators will increase proportional to the increase in academic square footage (8%); however, since the size and type of generator is unknown, Ramboll Environ assumed an 8% increase in total emissions. This same methodology was used to represent the increase in academic square footage from Fall 2018 to the buildout of the 2018 GUP (an additional 22% increase).
3. Lists the source for the NOx, CO, POC and PM_{10} emission factor. 'BAAQMD Spec' refers to BAAQMD Specification Sheets for certain generators which was provided by Stanford. 'Exec Order' refers to ARB Executive Order which is available via the ARB Off-road Certification database. 'AP-42' refers to the USEPA compilation of air pollutant emission factors. 'Tier Std' refers to the ARB/USEPA Tier Standards .
4. SO_2 emission factor for all the emergency generators was calculated using 0.0015 weight percent sulfur and the emission factor provided in Table 3.4-1 from AP-42. The % sulfur in fuel oil was assumed to be 15 ppm, based on diesel fuel sulfur content from California Diesel Fuel Regulation.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
BAAQMD Spec - BAAQMD Specification Sheets
bhp - brake horsepower
CAP - criteria air pollutants
CO - carbon monoxide
Exec Order - ARB Executive Order
g - gram
hp - horsepower
hr - hour
ID - identification
NO_X - nitrogen oxides
PM_{10} - particulate matter under 10 micron diameter
POC - precursor organic compound
ppm - parts per million
SO_2 - sulfur dioxide
Tier Std - ARB/USEPA Tier Standards
ton - short tons
US EPA - United States Environmental Protection Agency
yr - year

References:

ARB. California Diesel Fuel Regulation. Available online at: http://www.arb.ca.gov/fuels/diesel/081404dslregs.pdf
ARB. Off-Road Certification database. Available online at: http://www.arb.ca.gov/msprog/offroad/cert/cert.php
USEPA. Non-road Compression -Ignition Engines - Exhaust Emission Standards. Available online at: http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
USEPA. 1995. AP 42, Volume I, Fifth Edition. §3.4. Large Stationary Diesel and All Stationary Dual-Fuel Engines. Available online at: http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

Table 3-4-12
2014 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2014)[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	ROG Emissions[4,6] [lbs/year]
1,1,1-Trichloroethane	71-55-6	195	164	572	5%	34	0
1,1,2-Trichloroethane	79-00-5	30	164	270	5%	2.5	0
1,2-Dichloroethane	107-06-2	245	164	0	5%	0	0
1,3-Butadiene	106-99-0	101	164	288	100%	177	177
1,4-Dichlorobenzene	106-46-7	15	84	286	1%	0.50	0.50
1,4-Dioxane	123-91-1	166	164	968	5%	49	49
2,4,6-Trichlorophenol	88-06-2	2.9	164	419	1%	0.074	0.074
2-Chlorophenol	95-57-8	6.0	164	323	5%	0.59	0.59
2-Nitropropane	79-46-9	25	164	42	5%	0.32	0.32
Acetaldehyde	75-07-0	35	164	0	5%	0	0
Acetone	67-64-1	5,583	32,613	568,611	100%	97,340	0
Acetonitrile	75-05-8	0,930	164	1,098	5%	0,311	0,311
Acrylamide	79-06-1	42	164	1,105	1%	2.8	2.8
Acrylonitrile	107-13-1	78	164	0	5%	0	0
Ammonia	7664-41-7	156	164	506	100%	481	0
Arsenic and inorganic compounds	7440-38-2	35	164	308	1%	0.66	0
Benzene	71-43-2	1,307	164	1,023	5%	408	408
Beryllium	7440-41-7	0.15	164	226	1%	0.0021	0
Bromine and compounds	7726-95-6	12	164	820	5%	3	0
Butane	106-97-8	21	164	728	100%	93	93
Butyraldhyde	123-72-8	198	164	531	5%	32	32
Cadmium and compounds	7440-43-9	105	164	474	1%	3.03	0
Carbon disulfide	75-15-0	41	164	789	5%	10	0
Carbon tetrachloride	56-23-5	278	164	995	5%	84	0
Chlorine	7782-50-5	1	164	298	100%	1	0
Chlorobenzene	108-90-7	0,314	164	618	5%	59	59
Chloroform	67-66-3	1,795	164	1,181	5%	0,646	0,646
Chloromethane	74-87-3	57	62	62	100%	57	57
Cresol	1319-77-3	102	164	0	1%	0	0
Diethyl ether	60-29-7	4,857	164	1,120	5%	1,658	1,658
Dimethyl formamide	68-12-2	0,859	164	1,128	5%	0,295	0,295
Dimethyl sulfate	77-78-1	104	164	707	5%	22	22
Epichlorohydrin	106-89-8	343.0	164	290	5%	30.33	30.33
Ethanol	64-17-5	1,012	164	1,186	5%	0,366	0,366
Ethyl acetate	141-78-6	5,291	164	1,123	5%	1,812	1,812
Ethyl benzene	100-41-4	29	164	403	5%	3.6	3.6
Ethyl diazoacetate	623-73-4	6.4	164	0	5%	0	0
Ethylene dibromide	106-93-4	7.4	164	428	5%	1.0	1.0
Ethylene glycol	107-21-1	0,391	164	1,176	5%	140	140
Ethylene glycol butyl ether	111-76-2	55	164	0	5%	0	0
Ethylene glycol ethyl ether	110-80-5	54	164	510	5%	8	8
Ethylene glycol methyl ether	109-86-4	579	164	979	5%	173	173
Ethylene oxide	75-21-8	2.9	164	0	100%	0	0
Formaldehyde	50-00-0	32	164	143	5%	1	1
Glutaraldehyde	111-30-8	31	164	1,028	5%	10	10
Hexachlorobenzene	118-74-1	1.3	164	164	1%	0.013	0.013
Hexanal	66-25-1	2	164	288	5%	0.2	0.2
Hexavalent chromium	18540-29-9	590	164	908	1%	33	0
Hydrazine	302-01-2	88	164	834	5%	22.4	22.4
Hydrogen chloride	7647-01-0	299	164	1,186	5%	108	0
Hydrogen fluoride	7664-39-3	29	164	190	100%	34	0
Hydrogen sulfide	7783-06-4	4.9	164	216	100%	6.5	0
Isopentane	78-78-4	9	164	964	5%	3	3
Isopropyl alcohol	67-63-0	1,938	32,613	303,330	100%	18,025	18,025
Lead and compounds	7439-92-1	165	164	430	1%	4.3	0
Maleic anhydride	108-31-6	36	164	656	1%	1.4	1.4
Manganese and compounds	7439-96-5	276	164	481	1%	8.09	0
Mercury and inorganic compounds	7439-97-6	1135	164	816	5%	282	0
Methanol	67-56-1	1,257	164	1,181	5%	0,453	0,453
Methyl bromide	74-83-9	109	62	93	100%	163	0
Methyl ethyl ketone	78-93-3	59	164	791	5%	14	14
Methyl methacrylate	80-62-6	43	164	705	5%	9.2	9.2
Methylene chloride	75-09-2	6,823	164	1,154	20%	9,602	0
Naphthalene	91-20-3	18	164	879	1%	1	1

Table 3-4-12
2014 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2014)[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	ROG Emissions[4,6] [lbs/year]
n-Heptane	142-82-5	1,284	164	1,060	5%	415	415
n-Hexane	110-54-3	2,195	164	1,147	5%	0,768	0,768
Nickel and compounds	7440-02-0	238	164	631	1%	9.16	0
Nitric acid	7697-37-2	412	164	1,156	5%	145	145
Nitrobenzene	98-95-3	222	164	516	5%	35	0
n-Methylpyrollidone	872-50-4	0,454	164	1,014	5%	140	140
Octane	111-65-9	6	164	859	5%	2	2
Osmium tetroxide	20816-12-0	15.00	164	632	1%	0.578	0
Pentachlorophenol	87-86-5	2.9	31	163	1%	0.15	0.15
Pentane	109-66-0	0,924	164	1,014	5%	0,286	0,286
Phenol	108-95-2	145	164	1,046	5%	46	46
Phosgene	75-44-5	0.32	164	0	100%	0	0
Phosphoric acid	7664-38-2	221	164	1,176	5%	79	79
Propylene oxide	75-56-9	59	164	0	5%	0	0
Pyridine	110-86-1	0,412	164	1,114	5%	140	140
Sodium hydroxide	1310-73-2	0,566	164	1,181	1%	41	0
Styrene	100-42-5	45	164	589	5%	8	8
t-Butyl alcohol	75-65-0	111	164	1,021	5%	35	35
tert-Butylbenzene	98-06-6	28	164	349	5%	3.0	3.0
Tetrachloroethylene	127-18-4	29	164	491	5%	4	4
Tetrahydrofuran	109-99-9	1,856	164	1,081	5%	0,612	0,612
Toluene	108-88-3	1,012	164	1,176	5%	0,363	0,363
Trichloroethylene	79-01-6	119	164	753	5%	27	0
Trichlorotrifluroethane	76-13-1	51	164	539	5%	8.4	0.0
Triethylamine	121-44-8	0,424	164	1,085	5%	140	140
Valeraldehyde	110-62-3	12	164	301	5%	1.1	1.1
Vinyl chloride	75-01-4	132	164	218	100%	175	175
Xylenes	1330-20-7	0,496	164	1,088	5%	165	165
Zinc and compounds	7440-66-6	625	164	991	1%	38	0
Total						**136,775**	**28,414**

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from a Stanford 2001 inventory for the ChemBio building, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)
   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. The quantity of chemicals used is assumed to scale linearly with the number of fume hoods in each laboratory. The exception to this assumption is for isopropanol and acetone where the emissions are assumed to scale by wet laboratory square footage.

3. Emission factors represent what percentage of the mass usage of the chemical is emitted into the air. Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%
   Emission Factor for Liquids = 5%
   Emission Factor for Solids/Metals = 1%
   Emission Factor for Methylene Chloride = 20%

4. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

5. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

6. ROGs are identified by ARB. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf.

Abbreviations:

ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstract
HHRA - human health risk assessment
lb - pound
ROG - Reactive Organic Gas
TAC - Toxic Air Contaminant

Table 3-4-13
2015 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	ROG Emissions[4,6] [lbs/year]
1,1,1-Trichloroethane	71-55-6	195	164	572	5%	34	0
1,1,2-Trichloroethane	79-00-5	30	164	270	5%	2.5	0
1,2-Dichloroethane	107-06-2	245	164	0	5%	0	0
1,3-Butadiene	106-99-0	101	164	288	100%	177	177
1,4-Dichlorobenzene	106-46-7	15	84	286	1%	0.50	0.50
1,4-Dioxane	123-91-1	166	164	968	5%	49	49
2,4,6-Trichlorophenol	88-06-2	2.9	164	419	1%	0.074	0.074
2-Chlorophenol	95-57-8	6.0	164	323	5%	0.59	0.59
2-Nitropropane	79-46-9	25	164	42	5%	0.32	0.32
Acetaldehyde	75-07-0	35	164	0	5%	0	0
Acetone	67-64-1	5,583	32,613	568,611	100%	97,340	0
Acetonitrile	75-05-8	0,930	164	1,098	5%	0,311	0,311
Acrylamide	79-06-1	42	164	1,105	1%	2.8	2.8
Acrylonitrile	107-13-1	78	164	0	5%	0	0
Ammonia	7664-41-7	156	164	506	100%	481	0
Arsenic and inorganic compounds	7440-38-2	35	164	308	1%	0.66	0
Benzene	71-43-2	1,307	164	1,023	5%	408	408
Beryllium	7440-41-7	0.15	164	226	1%	0.0021	0
Bromine and compounds	7726-95-6	12	164	820	5%	3	0
Butane	106-97-8	21	164	728	100%	93	93
Butyraldhyde	123-72-8	198	164	531	5%	32	32
Cadmium and compounds	7440-43-9	105	164	474	1%	3.03	0
Carbon disulfide	75-15-0	41	164	789	5%	10	0
Carbon tetrachloride	56-23-5	278	164	995	5%	84	0
Chlorine	7782-50-5	1	164	298	100%	1	0
Chlorobenzene	108-90-7	0,314	164	618	5%	59	59
Chloroform	67-66-3	1,795	164	1,181	5%	0,646	0,646
Chloromethane	74-87-3	57	62	62	100%	57	57
Cresol	1319-77-3	102	164	0	1%	0	0
Diethyl ether	60-29-7	4,857	164	1,120	5%	1,658	1,658
Dimethyl formamide	68-12-2	0,859	164	1,128	5%	0,295	0,295
Dimethyl sulfate	77-78-1	104	164	707	5%	22	22
Epichlorohydrin	106-89-8	343.0	164	290	5%	30.33	30.33
Ethanol	64-17-5	1,012	164	1,186	5%	0,366	0,366
Ethyl acetate	141-78-6	5,291	164	1,123	5%	1,812	1,812
Ethyl benzene	100-41-4	29	164	403	5%	3.6	3.6
Ethyl diazoacetate	623-73-4	6.4	164	0	5%	0	0
Ethylene dibromide	106-93-4	7.4	164	428	5%	1.0	1.0
Ethylene glycol	107-21-1	0,391	164	1,176	5%	140	140
Ethylene glycol butyl ether	111-76-2	55	164	0	5%	0	0
Ethylene glycol ethyl ether	110-80-5	54	164	510	5%	8	8
Ethylene glycol methyl ether	109-86-4	579	164	979	5%	173	173
Ethylene oxide	75-21-8	2.9	164	0	100%	0	0
Formaldehyde	50-00-0	32	164	143	5%	1	1
Glutaraldehyde	111-30-8	31	164	1,028	5%	10	10
Hexachlorobenzene	118-74-1	1.3	164	164	1%	0.013	0.013
Hexanal	66-25-1	2	164	288	5%	0.2	0.2
Hexavalent chromium	18540-29-9	590	164	908	1%	33	0
Hydrazine	302-01-2	88	164	834	5%	22.4	22.4
Hydrogen chloride	7647-01-0	299	164	1,186	5%	108	0
Hydrogen fluoride	7664-39-3	29	164	190	100%	34	0
Hydrogen sulfide	7783-06-4	4.9	164	216	100%	6.5	0
Isopentane	78-78-4	9	164	964	5%	3	3
Isopropyl alcohol	67-63-0	1,938	32,613	303,330	100%	18,025	18,025
Lead and compounds	7439-92-1	165	164	430	1%	4.3	0
Maleic anhydride	108-31-6	36	164	656	1%	1.4	1.4
Manganese and compounds	7439-96-5	276	164	481	1%	8.09	0
Mercury and inorganic compounds	7439-97-6	1135	164	816	5%	282	0
Methanol	67-56-1	1,257	164	1,181	5%	0,453	0,453
Methyl bromide	74-83-9	109	62	93	100%	163	0
Methyl ethyl ketone	78-93-3	59	164	791	5%	14	14
Methyl methacrylate	80-62-6	43	164	705	5%	9.2	9.2
Methylene chloride	75-09-2	6,823	164	1,154	20%	9,602	0
Naphthalene	91-20-3	18	164	879	1%	1	1
n-Heptane	142-82-5	1,284	164	1,060	5%	415	415
n-Hexane	110-54-3	2,195	164	1,147	5%	0,768	0,768
Nickel and compounds	7440-02-0	238	164	631	1%	9.16	0
Nitric acid	7697-37-2	412	164	1,156	5%	145	145
Nitrobenzene	98-95-3	222	164	516	5%	35	0

Table 3-4-13
2015 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	ROG Emissions[4,6] [lbs/year]
n-Methylpyrollidone	872-50-4	0,454	164	1,014	5%	140	140
Octane	111-65-9	6	164	859	5%	2	2
Osmium tetroxide	20816-12-0	15.00	164	632	1%	0.578	0
Pentachlorophenol	87-86-5	2.9	31	163	1%	0.15	0.15
Pentane	109-66-0	0,924	164	1,014	5%	0,286	0,286
Phenol	108-95-2	145	164	1,046	5%	46	46
Phosgene	75-44-5	0.32	164	0	100%	0	0
Phosphoric acid	7664-38-2	221	164	1,176	5%	79	79
Propylene oxide	75-56-9	59	164	0	5%	0	0
Pyridine	110-86-1	0,412	164	1,114	5%	140	140
Sodium hydroxide	1310-73-2	0,566	164	1,181	1%	41	0
Styrene	100-42-5	45	164	589	5%	8	8
t-Butyl alcohol	75-65-0	111	164	1,021	5%	35	35
tert-Butylbenzene	98-06-6	28	164	349	5%	3.0	3.0
Tetrachloroethylene	127-18-4	29	164	491	5%	4	4
Tetrahydrofuran	109-99-9	1,856	164	1,081	5%	0,612	0,612
Toluene	108-88-3	1,012	164	1,176	5%	0,363	0,363
Trichloroethylene	79-01-6	119	164	753	5%	27	0
Trichlorotrifluroethane	76-13-1	51	164	539	5%	8.4	0.0
Triethylamine	121-44-8	0,424	164	1,085	5%	140	140
Valeraldehyde	110-62-3	12	164	301	5%	1.1	1.1
Vinyl chloride	75-01-4	132	164	218	100%	175	175
Xylenes	1330-20-7	0,496	164	1,088	5%	165	165
Zinc and compounds	7440-66-6	625	164	991	1%	38	0
Total						**136,775**	**28,414**

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from a Stanford 2001 inventory for the ChemBio building, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)
   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. The quantity of chemicals used is assumed to scale linearly with the number of fume hoods in each laboratory. The exception to this assumption is for isopropanol and acetone where the emissions are assumed to scale by wet laboratory square footage.

3. Emission factors represent what percentage of the mass usage of the chemical is emitted into the air. Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%
   Emission Factor for Liquids = 5%
   Emission Factor for Solids/Metals = 1%
   Emission Factor for Methylene Chloride = 20%

4. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

5. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

6. ROGs are identified by ARB. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf

Abbreviations:

ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstracts Service
HHRA - human health risk assessment
lb - pound
ROG - reactive organic gas
TAC - toxic air contaminants
yr - year

Table 3-4-14
Fall 2018 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Scaling for Fall 2018[3]	Fume Hoods on Campus with Chemical (Fall 2018)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
1,1,1-Trichloroethane	71-55-6	195	164	572	8%	618	5%	37	0
1,1,2-Trichloroethane	79-00-5	30	164	270	8%	292	5%	2.7	0
1,2-Dichloroethane	107-06-2	245	164	0	8%	0	5%	0	0
1,3-Butadiene	106-99-0	101	164	288	8%	311	100%	192	192
1,4-Dichlorobenzene	106-46-7	15	84	286	8%	309	1%	0.54	0.54
1,4-Dioxane	123-91-1	166	164	968	8%	1,046	5%	53	53
2,4,6-Trichlorophenol	88-06-2	2.9	164	419	8%	453	1%	0.080	0.080
2-Chlorophenol	95-57-8	6.0	164	323	8%	349	5%	0.64	0.64
2-Nitropropane	79-46-9	25	164	42	8%	45	5%	0.35	0.35
Acetaldehyde	75-07-0	35	164	0	8%	0	5%	0	0
Acetone	67-64-1	5,583	32,613	568,611	8%	614,575	100%	105,209	0
Acetonitrile	75-05-8	0,930	164	1,098	8%	1,187	5%	0,336	0,336
Acrylamide	79-06-1	42	164	1,105	8%	1,194	1%	3.1	3.1
Acrylonitrile	107-13-1	78	164	0	8%	0	5%	0	0
Ammonia	7664-41-7	156	164	506	8%	547	100%	520	0
Arsenic and inorganic compounds	7440-38-2	35	164	308	8%	333	1%	0.71	0
Benzene	71-43-2	1,307	164	1,023	8%	1,106	5%	441	441
Beryllium	7440-41-7	0.15	164	226	8%	244	1%	0.0022	0
Bromine and compounds	7726-95-6	12	164	820	8%	886	5%	3	0
Butane	106-97-8	21	164	728	8%	787	100%	101	101
Butyraldhyde	123-72-8	198	164	531	8%	574	5%	35	35
Cadmium and compounds	7440-43-9	105	164	474	8%	512	1%	3.28	0
Carbon disulfide	75-15-0	41	164	789	8%	853	5%	11	0
Carbon tetrachloride	56-23-5	278	164	995	8%	1,075	5%	91	0
Chlorine	7782-50-5	1	164	298	8%	322	100%	1	0
Chlorobenzene	108-90-7	0,314	164	618	8%	668	5%	64	64
Chloroform	67-66-3	1,795	164	1,181	8%	1,276	5%	0,699	0,699
Chloromethane	74-87-3	57	62	62	8%	67	100%	62	62
Cresol	1319-77-3	102	164	0	8%	0	1%	0	0
Diethyl ether	60-29-7	4,857	164	1,120	8%	1,211	5%	1,793	1,793
Dimethyl formamide	68-12-2	0,859	164	1,128	8%	1,219	5%	0,319	0,319
Dimethyl sulfate	77-78-1	104	164	707	8%	764	5%	24	24
Epichlorohydrin	106-89-8	343.0	164	290	8%	313	5%	32.78	32.78
Ethanol	64-17-5	1,012	164	1,186	8%	1,282	5%	0,396	0,396
Ethyl acetate	141-78-6	5,291	164	1,123	8%	1,214	5%	1,958	1,958
Ethyl benzene	100-41-4	29	164	403	8%	436	5%	3.9	3.9
Ethyl diazoacetate	623-73-4	6.4	164	0	8%	0	5%	0	0
Ethylene dibromide	106-93-4	7.4	164	428	8%	463	5%	1.0	1.0
Ethylene glycol	107-21-1	0,391	164	1,176	8%	1,271	5%	152	152
Ethylene glycol butyl ether	111-76-2	55	164	0	8%	0	5%	0	0
Ethylene glycol ethyl ether	110-80-5	54	164	510	8%	551	5%	9	9
Ethylene glycol methyl ether	109-86-4	579	164	979	8%	1,058	5%	187	187
Ethylene oxide	75-21-8	2.9	164	0	8%	0	100%	0	0
Formaldehyde	50-00-0	32	164	143	8%	155	5%	2	2
Glutaraldehyde	111-30-8	31	164	1,028	8%	1,111	5%	11	11

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Table 3-4-14
Fall 2018 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Scaling for Fall 2018[3]	Fume Hoods on Campus with Chemical (Fall 2018)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
Hexachlorobenzene	118-74-1	1.3	164	164	8%	177	1%	0.014	0.014
Hexanal	66-25-1	2	164	288	8%	311	5%	0.2	0.2
Hexavalent chromium	18540-29-9	590	164	908	8%	981	1%	35	0
Hydrazine	302-01-2	88	164	834	8%	901	5%	24.2	24.2
Hydrogen chloride	7647-01-0	299	164	1,186	8%	1,282	5%	117	0
Hydrogen fluoride	7664-39-3	29	164	190	8%	205	100%	36	0
Hydrogen sulfide	7783-06-4	4.9	164	216	8%	233	100%	7.0	0
Isopentane	78-78-4	9	164	964	8%	1,042	5%	3	3
Isopropyl alcohol	67-63-0	1,938	32,613	303,330	8%	327,850	100%	19,482	19,482
Lead and compounds	7439-92-1	165	164	430	8%	465	1%	4.7	0
Maleic anhydride	108-31-6	36	164	656	8%	709	1%	1.6	1.6
Manganese and compounds	7439-96-5	276	164	481	8%	520	1%	8.75	0
Mercury and inorganic compounds	7439-97-6	1135	164	816	8%	882	5%	305	0
Methanol	67-56-1	1,257	164	1,181	8%	1,276	5%	0,489	0,489
Methyl bromide	74-83-9	109	62	93	8%	101	100%	177	0
Methyl ethyl ketone	78-93-3	59	164	791	8%	855	5%	15	15
Methyl methacrylate	80-62-6	43	164	705	8%	762	5%	10.0	10.0
Methylene chloride	75-09-2	6,823	164	1,154	8%	1,247	20%	10,378	0
Naphthalene	91-20-3	18	164	879	8%	950	1%	1	1
n-Heptane	142-82-5	1,284	164	1,060	8%	1,146	5%	448	448
n-Hexane	110-54-3	2,195	164	1,147	8%	1,240	5%	0,830	0,830
Nickel and compounds	7440-02-0	238	164	631	8%	682	1%	9.90	0
Nitric acid	7697-37-2	412	164	1,156	8%	1,249	5%	157	157
Nitrobenzene	98-95-3	222	164	516	8%	558	5%	38	0
n-Methylpyrollidone	872-50-4	0,454	164	1,014	8%	1,096	5%	152	152
Octane	111-65-9	6	164	859	8%	928	5%	2	2
Osmium tetroxide	20816-12-0	15.00	164	632	8%	683	1%	0.625	0
Pentachlorophenol	87-86-5	2.9	31	163	8%	176	1%	0.17	0.17
Pentane	109-66-0	0,924	164	1,014	8%	1,096	5%	0,309	0,309
Phenol	108-95-2	145	164	1,046	8%	1,131	5%	50	50
Phosgene	75-44-5	0.32	164	0	8%	0	100%	0	0
Phosphoric acid	7664-38-2	221	164	1,176	8%	1,271	5%	86	86
Propylene oxide	75-56-9	59	164	0	8%	0	5%	0	0
Pyridine	110-86-1	0,412	164	1,114	8%	1,204	5%	151	151
Sodium hydroxide	1310-73-2	0,566	164	1,181	8%	1,276	1%	44	0
Styrene	100-42-5	45	164	589	8%	637	5%	9	9
t-Butyl alcohol	75-65-0	111	164	1,021	8%	1,104	5%	37	37
tert-Butylbenzene	98-06-6	28	164	349	8%	377	5%	3.2	3.2
Tetrachloroethylene	127-18-4	29	164	491	8%	531	5%	5	5
Tetrahydrofuran	109-99-9	1,856	164	1,081	8%	1,168	5%	0,661	0,661
Toluene	108-88-3	1,012	164	1,176	8%	1,271	5%	0,392	0,392
Trichloroethylene	79-01-6	119	164	753	8%	814	5%	30	0
Trichlorotrifluroethane	76-13-1	51	164	539	8%	583	5%	9.1	0.0
Triethylamine	121-44-8	0,424	164	1,085	8%	1,173	5%	152	152
Valeraldehyde	110-62-3	12	164	301	8%	325	5%	1.2	1.2

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Table 3-4-14
Fall 2018 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Scaling for Fall 2018[3]	Fume Hoods on Campus with Chemical (Fall 2018)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
Vinyl chloride	75-01-4	132	164	218	8%	236	100%	190	190
Xylenes	1330-20-7	0,496	164	1,088	8%	1,176	5%	178	178
Zinc and compounds	7440-66-6	625	164	991	8%	1,071	1%	41	0
Total								**147,831**	**30,711**

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from a Stanford 2001 inventory for the ChemBio building, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)

   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. The quantity of chemicals used in 2015 is assumed to scale linearly with the number of fume hoods in each laboratory. The exception to this assumption is for isopropanol and acetone where the emissions are assumed to scale by wet laboratory square footage.

3. Scaling for Fall 2018 is based on the increase in academic square footage expected from December 2015 to full buildout of the 2000 GUP, with the assumption that the increase in laboratory space is proportional to the increase in overall academic space.

4. Emission factors represent what percentage of the mass usage of the chemical is emitted into the air. Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%

   Emission Factor for Liquids = 5%

   Emission Factor for Solids/Metals = 1%

   Emission Factor for Methylene Chloride = 20%

5. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

6. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

7. ROGs are identified by ARB. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf

Abbreviations:

ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstracts Service
HHRA - human health risk assessment
lb - pound
ROG - reactive organic gas
TAC - toxic air contaminants
yr - year

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Table 3-4-15
Fall 2035 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (Fall 2018)[2]	Scaling for Fall 2035[3]	Fume Hoods on Campus with Chemical (Fall 2035)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
1,1,1-Trichloroethane	71-55-6	195	164	618	22%	755	5%	45	0
1,1,2-Trichloroethane	79-00-5	30	164	292	22%	356	5%	3.3	0
1,2-Dichloroethane	107-06-2	245	164	0	22%	0	5%	0	0
1,3-Butadiene	106-99-0	101	164	311	22%	380	100%	234	234
1,4-Dichlorobenzene	106-46-7	15	84	309	22%	377	1%	0.65	0.65
1,4-Dioxane	123-91-1	166	164	1,046	22%	1,278	5%	65	65
2,4,6-Trichlorophenol	88-06-2	2.9	164	453	22%	553	1%	0.098	0.098
2-Chlorophenol	95-57-8	6.0	164	349	22%	426	5%	0.78	0.78
2-Nitropropane	79-46-9	25	164	45	22%	55	5%	0.42	0.42
Acetaldehyde	75-07-0	35	164	0	22%	0	5%	0	0
Acetone	67-64-1	5,583	32,613	614,575	22%	750,492	100%	128,476	0
Acetonitrile	75-05-8	0,930	164	1,187	22%	1,449	5%	0,411	0,411
Acrylamide	79-06-1	42	164	1,194	22%	1,458	1%	3.7	3.7
Acrylonitrile	107-13-1	78	164	0	22%	0	5%	0	0
Ammonia	7664-41-7	156	164	547	22%	668	100%	635	0
Arsenic and inorganic compounds	7440-38-2	35	164	333	22%	407	1%	0.87	0
Benzene	71-43-2	1,307	164	1,106	22%	1,350	5%	538	538
Beryllium	7440-41-7	0.15	164	244	22%	298	1%	0.0027	0
Bromine and compounds	7726-95-6	12	164	886	22%	1,082	5%	4	0
Butane	106-97-8	21	164	787	22%	961	100%	123	123
Butyraldhyde	123-72-8	198	164	574	22%	701	5%	42	42
Cadmium and compounds	7440-43-9	105	164	512	22%	626	1%	4.01	0
Carbon disulfide	75-15-0	41	164	853	22%	1,041	5%	13	0
Carbon tetrachloride	56-23-5	278	164	1,075	22%	1,313	5%	111	0
Chlorine	7782-50-5	1	164	322	22%	393	100%	2	0
Chlorobenzene	108-90-7	0,314	164	668	22%	816	5%	78	78
Chloroform	67-66-3	1,795	164	1,276	22%	1,559	5%	0,853	0,853
Chloromethane	74-87-3	57	62	67	22%	82	100%	76	76
Cresol	1319-77-3	102	164	0	22%	0	1%	0	0
Diethyl ether	60-29-7	4,857	164	1,211	22%	1,478	5%	2,189	2,189
Dimethyl formamide	68-12-2	0,859	164	1,219	22%	1,489	5%	0,390	0,390
Dimethyl sulfate	77-78-1	104	164	764	22%	933	5%	30	30
Epichlorohydrin	106-89-8	343.0	164	313	22%	383	5%	40.03	40.03
Ethanol	64-17-5	1,012	164	1,282	22%	1,565	5%	0,483	0,483
Ethyl acetate	141-78-6	5,291	164	1,214	22%	1,482	5%	2,391	2,391
Ethyl benzene	100-41-4	29	164	436	22%	532	5%	4.7	4.7
Ethyl diazoacetate	623-73-4	6.4	164	0	22%	0	5%	0	0
Ethylene dibromide	106-93-4	7.4	164	463	22%	565	5%	1.3	1.3
Ethylene glycol	107-21-1	0,391	164	1,271	22%	1,552	5%	185	185
Ethylene glycol butyl ether	111-76-2	55	164	0	22%	0	5%	0	0
Ethylene glycol ethyl ether	110-80-5	54	164	551	22%	673	5%	11	11
Ethylene glycol methyl ether	109-86-4	579	164	1,058	22%	1,292	5%	228	228
Ethylene oxide	75-21-8	2.9	164	0	22%	0	100%	0	0
Formaldehyde	50-00-0	32	164	155	22%	189	5%	2	2
Glutaraldehyde	111-30-8	31	164	1,111	22%	1,357	5%	13	13

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Table 3-4-15
Fall 2035 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (Fall 2018)[2]	Scaling for Fall 2035[3]	Fume Hoods on Campus with Chemical (Fall 2035)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
Hexachlorobenzene	118-74-1	1.3	164	177	22%	216	1%	0.017	0.017
Hexanal	66-25-1	2	164	311	22%	380	5%	0.3	0.3
Hexavalent chromium	18540-29-9	590	164	981	22%	1,198	1%	43	0
Hydrazine	302-01-2	88	164	901	22%	1,101	5%	29.5	29.5
Hydrogen chloride	7647-01-0	299	164	1,282	22%	1,565	5%	143	0
Hydrogen fluoride	7664-39-3	29	164	205	22%	251	100%	44	0
Hydrogen sulfide	7783-06-4	4.9	164	233	22%	285	100%	8.6	0
Isopentane	78-78-4	9	164	1,042	22%	1,272	5%	3	3
Isopropyl alcohol	67-63-0	1,938	32,613	327,850	22%	400,356	100%	23,791	23,791
Lead and compounds	7439-92-1	165	164	465	22%	568	1%	5.7	0
Maleic anhydride	108-31-6	36	164	709	22%	866	1%	1.9	1.9
Manganese and compounds	7439-96-5	276	164	520	22%	635	1%	10.68	0
Mercury and inorganic compounds	7439-97-6	1135	164	882	22%	1,077	5%	373	0
Methanol	67-56-1	1,257	164	1,276	22%	1,559	5%	0,597	0,597
Methyl bromide	74-83-9	109	62	101	22%	123	100%	216	0
Methyl ethyl ketone	78-93-3	59	164	855	22%	1,044	5%	19	19
Methyl methacrylate	80-62-6	43	164	762	22%	931	5%	12.2	12.2
Methylene chloride	75-09-2	6,823	164	1,247	22%	1,523	20%	12,674	0
Naphthalene	91-20-3	18	164	950	22%	1,160	1%	1	1
n-Heptane	142-82-5	1,284	164	1,146	22%	1,399	5%	548	548
n-Hexane	110-54-3	2,195	164	1,240	22%	1,514	5%	1,013	1,013
Nickel and compounds	7440-02-0	238	164	682	22%	833	1%	12.09	0
Nitric acid	7697-37-2	412	164	1,249	22%	1,526	5%	192	192
Nitrobenzene	98-95-3	222	164	558	22%	681	5%	46	0
n-Methylpyrollidone	872-50-4	0,454	164	1,096	22%	1,338	5%	185	185
Octane	111-65-9	6	164	928	22%	1,134	5%	2	2
Osmium tetroxide	20816-12-0	15.00	164	683	22%	834	1%	0.763	0
Pentachlorophenol	87-86-5	2.9	31	176	22%	215	1%	0.20	0.20
Pentane	109-66-0	0,924	164	1,096	22%	1,338	5%	0,377	0,377
Phenol	108-95-2	145	164	1,131	22%	1,381	5%	61	61
Phosgene	75-44-5	0.32	164	0	22%	0	100%	0	0
Phosphoric acid	7664-38-2	221	164	1,271	22%	1,552	5%	105	105
Propylene oxide	75-56-9	59	164	0	22%	0	5%	0	0
Pyridine	110-86-1	0,412	164	1,204	22%	1,470	5%	185	185
Sodium hydroxide	1310-73-2	0,566	164	1,276	22%	1,559	1%	54	0
Styrene	100-42-5	45	164	637	22%	777	5%	11	11
t-Butyl alcohol	75-65-0	111	164	1,104	22%	1,348	5%	46	46
tert-Butylbenzene	98-06-6	28	164	377	22%	461	5%	4.0	4.0
Tetrachloroethylene	127-18-4	29	164	531	22%	648	5%	6	6
Tetrahydrofuran	109-99-9	1,856	164	1,168	22%	1,427	5%	0,807	0,807
Toluene	108-88-3	1,012	164	1,271	22%	1,552	5%	0,479	0,479
Trichloroethylene	79-01-6	119	164	814	22%	994	5%	36	0
Trichlorotrifluroethane	76-13-1	51	164	583	22%	711	5%	11.1	0.0
Triethylamine	121-44-8	0,424	164	1,173	22%	1,432	5%	185	185
Valeraldehyde	110-62-3	12	164	325	22%	397	5%	1.5	1.5

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Table 3-4-15
Fall 2035 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (Fall 2018)[2]	Scaling for Fall 2035[3]	Fume Hoods on Campus with Chemical (Fall 2035)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
Vinyl chloride	75-01-4	132	164	236	22%	288	100%	232	232
Xylenes	1330-20-7	0,496	164	1,176	22%	1,436	5%	217	217
Zinc and compounds	7440-66-6	625	164	1,071	22%	1,308	1%	50	0
Total for Fall 2035								**180,525**	**37,503**

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from a Stanford 2001 inventory for the ChemBio building, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)

   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. The quantity of chemicals used in Fall 2018 is assumed to scale linearly with the number of fume hoods in each laboratory as shown in Table 3-4-14. The exception to this assumption is for isopropanol and acetone where the emissions are assumed to scale by wet laboratory square footage.

3. Scaling for Fall 2035 is based on the increase in academic square footage expected from Fall 2018 to full buildout of the 2018 GUP, with the assumption that the increase in laboratory space is proportional to the increase in overall academic space.

4. Emission factors represent what percentage of the mass usage of the chemical is emitted into the air. Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%

   Emission Factor for Liquids = 5%

   Emission Factor for Solids/Metals = 1%

   Emission Factor for Methylene Chloride = 20%

5. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

6. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

7. ROGs are identified by ARB. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf

Abbreviations:

ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstracts Service
HHRA - human health risk assessment
lb - pound
ROG - reactive organic gas
TAC - toxic air contaminants
yr - year

RAMBOLL ENVIRON

Table 3-4-16
2014 ROG Emissions - Fuel Station
Stanford University
Stanford, CA

Source	Maximum Gasoline Annual Throughput[1]	Emission Factor	Emissions
		VOC[2]	VOC
	[gal/yr]	[lb/1000 gal]	[ton/yr]
Bonair	147,671	1.06	7.8E-02
Valero	1,013,866	1.06	5.4E-01
		Total [ton/yr]	**6.2E-01**

Notes:

1. Gasoline annual throughput is obtained from Stanford University. Valero throughput scaled from 13-month to 12-month period.
2. Controlled VOC emission factors (EF) are obtained from the source specific guidance section for the petroleum industry from BAAQMD's Permit Handbook. Controlled baseline EF is estimated by multiplying the uncontrolled baseline EF by the percent of the emissions which would not be controlled by a fully functional Phase II system. Uncontrolled VOC emissions are due to tank filling, vehicle fueling, and minor spillage.

   Equation Used:

   Controlled VOC EF = 21.2 lb/1000 gal of gasoline * (1.00 - 0.95)

Abbreviations:

BAAQMD - Bay Area Air Quality Management District

EF - emission factor

gal - gallon

lb - pound

ROG - reactive organic gas

ton - short tons

VOC - volatile organic compounds

yr - year

RAMBOLL ENVIRON

Table 3-4-17
2015 ROG Emissions - Fuel Station
Stanford University
Stanford, CA

Source	Maximum Gasoline Annual Throughput[1] [gal/yr]	Emission Factor VOC[2] [lb/1000 gal]	Emissions VOC [ton/yr]
Bonair	147,671	1.06	7.8E-02
Valero	1,013,866	1.06	5.4E-01
		Total [ton/yr]	**6.2E-01**

Notes:

1. Gasoline annual throughput is obtained from Stanford University.
2. Controlled VOC emission factors (EF) are obtained from the source specific guidance section for the petroleum industry from BAAQMD's Permit Handbook. Controlled baseline EF is estimated by multiplying the uncontrolled baseline EF by the percent of the emissions which would not be controlled by a fully functional Phase II system. Uncontrolled VOC emissions are due to tank filling, vehicle fueling, and minor spillage.

   Equation Used:

   Controlled VOC EF = 21.2 lb/1000 gal of gasoline * (1.00 - 0.95)

Abbreviations:

BAAQMD - Bay Area Air Quality Management District

EF - emission factor

gal - gallon

ROG - reactive organic gas

ton - short tons

VOC - volatile organic compounds

yr - year

RAMBOLL ENVIRON

Table 3-4-18
Fall 2018 ROG Emissions - Fuel Station
Stanford University
Stanford, CA

Source	Maximum Gasoline Annual Throughput[1,2]	Emission Factor	Emissions
		VOC[3]	VOC
	[gal/yr]	[lb/1000 gal]	[ton/yr]
Bonair	140,288	1.06	7.4E-02
		Total [ton/yr]	**7.4E-02**

Notes:

1. Gasoline annual throughput is obtained from Stanford University.
2. By fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles. This will also result in a 5% reduction in annual gasoline throughput at the Bonair fuel station.
3. Controlled VOC emission factors (EF) are obtained from the source specific guidance section for the petroleum industry from BAAQMD's Permit Handbook. Controlled baseline EF is estimated by multiplying the uncontrolled baseline EF by the percent of the emissions which would not be controlled by a fully functional Phase II system. Uncontrolled VOC emissions are due to tank filling, vehicle fueling, and minor spillage.

   Equation Used:

   Controlled VOC EF = 21.2 lb/1000 gal of gasoline * (1.00 - 0.95)

Abbreviations:

BAAQMD - Bay Area Air Quality Manageme
EF - emission factors
gal - gallon
GUP - general use permit
lb - pound
ton - short tons
ROG - reactive organic gas
VOC - volatile organic compounds
yr - year

RAMBOLL ENVIRON

Table 3-4-19
Fall 2035 ROG Emissions - Fuel Station
Stanford University
Stanford, CA

Source	Fall 2018 Maximum Gasoline Annual Throughput[1]	Scaling Factor for Increase in Electric Vehicles in the Campus Fleet[2]	Fall 2035 Maximum Gasoline Annual Throughput[1]	Emission Factor	Emissions
				VOC[3]	VOC
	[gal/yr]	[%]	[gal/yr]	[lb/1000 gal]	[ton/yr]
Bonair	140,288	-50%	70,144	1.06	3.7E-02
				Total for Fall 2035 [ton/yr]	**3.7E-02**

Notes:

1. Fall 2018 gasoline annual throughput is shown in Table 3-4-18.
2. By Fall 2035, 70% of campus fleet is expected to be electric; 40% was electric by Fall 2018, so the 2018 fuel consumption was assumed to represent the emissions for the 60% of the campus fleet that use internal combustion engines. Therefore, the fuel usage was scaled down by (1-40%)/(1-70%) since the remaining vehicles are assumed to use electricity.
3. Controlled VOC emission factors (EF) are obtained from the source specific guidance section for the petroleum industry from BAAQMD's Permit Handbook. Controlled baseline EF is estimated by multiplying the uncontrolled baseline EF by the percent of the emissions which would not be controlled by a fully functional Phase II system. Uncontrolled VOC emissions are due to tank filling, vehicle fueling, and minor spillage.

   Equation Used:

   Controlled VOC EF = 21.2 lb/1000 gal of gasoline * (1.00 - 0.95)

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
EF - emission factors
gal - gallon
GUP - general use permit
lb - pound
ton - short tons
ROG - reactive organic gas
VOC - volatile organic compounds
yr - year

RAMBOLL ENVIRON

Table 4-1-1
2014 TAC Emissions - Cardinal Cogen
Stanford University
Stanford, CA

Facility	Emissions Sources	Average Daily Emissions [lbs/day]			Annual Emissions [lbs/year]		
		Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
Cardinal Cogen	Cogen Total Emissions[1,2]	0.39	2.7	0.0033	143	978	1.2

Notes:

1. BAAQMD 2014 Cardinal Cogen Criteria Air Pollutant Emissions (For 2014 calendar year emissions) presents annual average emissions in lbs/day for criteria pollutants. Ramboll Environ assumed 365 days/year to calculate total annual emissions.

2. Although the Cardinal Cogen exports electricity and steam to outside the study area, all CAP and TAC emissions are assumed to contribute to local air quality.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CAP - criteria air pollutants
GUP - General Use Permit
lb - pound
TAC - toxic air contaminants

Table 4-1-2
2014 TAC Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Annual Natural Gas Usage		TAC Emission Factors[3]			TAC Emissions[3]		
			Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
	[therms]	[MMBtu]	[lb/MMBTu]			[lbs/yr]		
Other Natural Gas - Total	**1,461,298**	**146,130**				**0.30**	**10.74**	**0.49**
PGE Residential[1]	632,937	63,294	2.1E-06	7.4E-05	3.3E-06	0.13	4.65	0.21
PGE Commercial[1]	814,953	81,495				0.17	5.99	0.27
PGE Other Housing[2]	13,408	1,341				0.003	0.099	0.004

Notes:

1. Annual Natural Gas usage provided by Stanford. Addresses were geocoded, and natural gas use from addresses outside of unincorporated Santa Clara County was removed. Cardinal Cogen emissions are shown separately in Table 4-1-1.
2. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
3. Benzene, formaldehyde and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion from boilers. Emission factors were taken from the BAAQMD Permit Handbook, Section 2.1, Miscellaneous Natural Gas Combustion. http://hank.baaqmd.gov/pmt/handbook/rev02/PH_00_05_02_01.pdf

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emission Estimator Model
lb - pound
MMBTU - million British thermal units
PGE - Pacific Gas & Electric
TAC - toxic air contaminants
therms - 100,000 British thermal units
yr - year

Table 4-1-3
2015 TAC Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Total NG Throughput	Emission Factors[1]			Emissions		
		Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
	MMBtu/yr	[lb/MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/yr]	[lb/yr]	[lb/yr]
Hot Water Generators	101,408	2.1E-06	7.4E-05	3.3E-06	0.21	7.5	0.34
Replacement Process Steam Plant	82,363	2.1E-06	7.4E-05	3.3E-06	0.17	6.1	0.27
Other Natural Gas - Total	354,139	2.1E-06	7.4E-05	3.3E-06	0.73	26	1.2
PGE Residential	56,643	2.1E-06	7.4E-05	3.3E-06	0.12	4	0.2
PGE Commercial	296,155	2.1E-06	7.4E-05	3.3E-06	0.61	22	1.0
PGE Searsville/Olmstead[3]	1,341	2.1E-06	7.4E-05	3.3E-06	0.00	0	0.0

Notes:

1. Benzene, formaldehyde and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion from boilers. Emission factors were taken from the BAAQMD Permit Handbook, Section 2.1, Miscellaneous Natural Gas Combustion. http://hank.baaqmd.gov/pmt/handbook/rev02/PH_00_05_02_01.pdf

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
lb - pound
MMBTU - million British thermal units
NG - natural gas
TAC - toxic air contaminants
yr - year

RAMBOLL ENVIRON

Table 4-1-4
Fall 2018 TAC Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	2015 Annual Natural Gas Usage[1]	Scaling for Fall 2018[2]	Fall 2018 Annual Natural Gas Usage	Emission Factors[3]			Emissions		
				Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
	[MMBtu/yr]	[%]	[MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/yr]	[lb/yr]	[lb/yr]
Hot Water Generators	101,408	8%	109,605	2.1E-06	7.4E-05	3.3E-06	0.23	8.1	0.37
Replacement Process Steam Plant	82,363	8%	89,021				0.18	6.5	0.30
Other Natural Gas - Total	354,139		379,172				0.78	28	1.3
PGE Residential	56,643	4%	58,626				0.12	4.3	0.20
PGE Commercial - Individual Replacement Boilers[4]	11,007	0%	11,007				0.023	0.81	0.037
PGE Commercial - Remaining[4]	285,148	8%	308,198				0.63	23	1.0
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				0.0028	0.10	0.0045

Notes:

1. 2015 Annual Natural Gas usage details are shown in **Table 4-1-3.**
2. Scaling for Fall 2018 is primarily based on the increase in academic square footage and student beds expected from December 2015 to Fall 2018. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the CEF, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; i.e., efficiency and use in new buildings is assumed equal to current buildings.
3. Benzene, formaldehyde and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion from boilers. Emission factors were taken from the BAAQMD Permit Handbook, Section 2.1, Miscellaneous Natural Gas Combustion. http://hank.baaqmd.gov/pmt/handbook/rev02/PH_00_05_02_01.pdf
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
GUP - general usage plan
lb - pound
MMBTU - million British thermal units
PGE - Pacific Gas & Electric
TAC - toxic air contaminants
yr - year

Table 4-1-5
Fall 2035 TAC Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Fall 2018 Annual Natural Gas Usage[1]	Scaling for Fall 2035[2]	Fall 2035 Annual Natural Gas Usage	Emission Factors[3]			Emissions		
				Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
	[MMBtu/yr]	[%]	[MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/yr]	[lb/yr]	[lb/yr]
Hot Water Generators	109,605	22%	133,845	2.1E-06	7.4E-05	3.3E-06	0.28	9.8	0.45
Replacement Process Steam Plant	89,021	22%	108,709				0.22	8.0	0.36
Other Natural Gas - Total	379,172		475,887				0.98	35	1.6
PGE Residential	58,626	38%	80,651				0.17	5.9	0.27
PGE Commercial - Individual Replacement Boilers[4]	11,007	0%	11,007				0.023	0.81	0.037
PGE Commercial - Remaining[4]	308,198	22%	376,358				0.77	28	1.3
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				0.0028	0.10	0.0045
PGE New Faculty/Staff Housing[6]	0	N/A	6,531				0.0134	0.48	0.0218

Notes:

1. Fall 2018 Annual Natural Gas usage details are shown in **Table 4-1-4.**
2. Scaling for Fall 2035 is primarily based on the increase in academic square footage and student beds expected from Fall 2018 to full buildout of the 2018 GUP. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the Hot Water Generators, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. Estimates for new faculty/staff housing are added. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; i.e., efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.
3. Benzene, formaldehyde and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion from boilers. Emission factors were taken from the BAAQMD Permit Handbook, Section 2.1, Miscellaneous Natural Gas Combustion. http://hank.baaqmd.gov/pmt/handbook/rev02/PH_00_05_02_01.pdf
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® version 2013.2.2 default for single family homes built to 2008 Title 24 standards in climate zone 4.
6. This represents the natural gas consumption from the 550 new faculty/staff high density homes to be constructed within the study boundary. The annual natural gas use is based on the CalEEMod® version 2013.2.2 default for condo/townhouse built to 2008 Title 24 standards in climate zone 4. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
GUP - general usage plan
lb - pound
MMBTU - million British thermal units
PGE - Pacific Gas & Electric
TAC - toxic air contaminants
yr - year

Table 4-1-6
2014 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Speciated Total Emissions[9] [ton/year]					Total Emissions[9,12] [ton/year]		
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	Benzene (Diesel)	Benzene (Gas)	1,3-butadiene (Diesel)	1,3-butadiene (Gas)	DPM	Benzene	1,3-butadiene	DPM
Off-Campus (Worker) Trips[3,11]	Undergraduate	234	2.0	70,286		512,385		0.0022		3.8E-04		0.0022	3.8E-04	
	Graduate	1,259	2.0	523,894		4,793,631		0.018		0.0031		0.018	0.0031	
	Post-doc	555	2.0	246,412		2,335,983		0.0084		0.0015		0.0084	0.0015	
	Faculty/Staff	5,443	2.0	2,416,714		27,803,160		0.089		0.016		0.089	0.016	
	Casual Employees	302	2.0	133,960		1,793,719		0.0052		9.3E-04		0.0052	9.3E-04	
	Contingent Employees	294	2.0	130,354		1,596,836		0.0049		8.7E-04		0.0049	8.7E-04	
	Temporary Employees	604	2.0	268,165		3,421,786		0.010		0.0018		0.010	0.0018	
	Non-Employee Affiliates: 20% FTEs	169	2.0	75,118		892,407		0.0028		4.9E-04		0.0028	4.9E-04	
	Non-Employee Affiliates: FTEs	925	2.0	410,795		4,880,239		0.015		0.0027		0.015	0.0027	
	Third Party Contractors	244	2.0	108,178		1,537,214		0.0043		7.8E-04		0.0043	7.8E-04	
	Janitorial Shift Workers	195	2.0	86,543		1,229,771		0.0035		6.2E-04		0.0035	6.2E-04	
	First Mile to Transit (all Workers + Students)	2,039	2.0	903,934		3,707,596		0.025		0.0041		0.025	0.0041	
	Construction	975	2.0	432,713		6,148,856		0.017		0.0031		0.017	0.0031	
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**		**0.21**		**0.036**		**0.21**	**0.036**	
On-Campus (Resident) Trips[3,11]	Undergraduate	1,582	5.9	1,962,450		7,612,107		0.052		0.0087		0.052	0.0087	
	Graduate	3,648	4.5	5,264,378		27,554,538		0.15		0.025		0.15	0.025	
	Post-doc	28	3.7	33,580		168,975		9.5E-04		1.6E-04		9.5E-04	1.6E-04	
	Faculty/Staff	98	3.1	109,500		616,735		0.0032		5.4E-04		0.0032	5.4E-04	
	Sub-Total	**5,356**		**7,369,908**		**35,952,355**		**0.20**		**0.035**		**0.20**	**0.035**	
Campus Vehicles - On-road[4]	Bonair on-road - gas[7]	470	2.7	454,946	7.3	3,321,104		0.011		0.0021		0.011	0.0021	
	Bonair on-road - diesel[7]	11	3.2	12,890	7.3	94,099	4.7E-05		2.9E-06		0.0070	4.7E-05	2.9E-06	0.0070
	Bonair on-road buses - diesel[7]	10	1.1	4,075	7.3	29,749	3.3E-04		2.0E-05		0.030	3.3E-04	2.0E-05	0.030
	Bonair Unfiltered - on-road - gas[7]	74	1.7	45,317	7.3	330,811		0.0012		2.1E-04		0.0012	2.1E-04	
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.0072		4.4E-04		0.36	0.0072	4.4E-04	0.36
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	8.9E-05		5.5E-06		0.013	8.9E-05	5.5E-06	0.013
	Marguerite[10]	66				1,983,931	0.010		6.3E-04		1.3	0.010	6.3E-04	1.3
	Public Safety	31	2.8	31,879	7.3	232,720		7.9E-04		1.5E-04		7.9E-04	1.5E-04	
	Sub-Total	**700**		**614,290**		**8,594,006**	**0.018**	**0.013**	**0.0011**	**0.0025**	**1.7**	**0.031**	**0.0036**	**1.7**
Other Trips[3]	General Visitors (Vendor)[11]	2,016,204	2.0	4,032,408		25,001,480		0.12		0.020		0.12	0.020	
	Worker Non-Commute Trips[11]			301,920		935,952		0.0049		9.1E-04		0.0049	9.1E-04	
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443		0.0069		0.0014		0.0069	0.0014	
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.0040		2.5E-04		0.39	0.0040	2.5E-04	0.39
	Event Visitor Traffic[11]	149,958	2.0	299,917		6,652,357		0.015		0.0028		0.015	0.0028	
	Deliveries - Trucks	168,054	2.0	336,108		2,083,870	0.0064		4.0E-04		0.31	0.0064	4.0E-04	0.31
	Construction Vendor Trucks[13]		*2.4*	*8,510*		*62,123*	*1.9E-04*		*1.2E-05*		*0.0092*	*1.9E-04*	*1.2E-05*	*0.0092*
	Construction Haul Trucks[13]		*2.4*	*7,987*		*159,740*	*4.8E-04*		*3.0E-05*		*0.024*	*4.8E-04*	*3.0E-05*	*0.024*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**	**0.010**	**0.15**	**6.5E-04**	**0.025**	**0.70**	**0.16**	**0.026**	**0.70**
					Total VMT	**143,212,045**								
Campus Vehicles - Off-road Equip[6]						**[bhp-hr/yr][5]**								
	Siebel and Red Barn equip - gas[8]					38,837		0.084		0.0082		0.084	0.0082	
	Siebel and Red Barn equip - diesel[8]					52,854	0.0011		7.0E-05		0.031	0.0011	7.0E-05	0.031
	Off-road equip - gas					6,553		0.014		0.0014		0.014	0.0014	
	Off-road equip - diesel					102,593	0.0022		1.4E-04		0.060	0.0022	1.4E-04	0.060
	Light Towers - gas					2,925		0.0063		6.1E-06		0.0063	6.1E-06	
	Light Towers - diesel					186,791	0.0021		1.3E-04		0.053	0.0021	1.3E-04	0.053
	Sub-Total					**390,554**	**0.0054**	**0.10**	**3.4E-04**	**0.010**	**0.14**	**0.11**	**0.010**	**0.14**

RAMBOLL ENVIRON

Table 4-1-6
2014 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and NEVES.
6. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
7. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
8. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
9. Benzene and 1,3-butadiene speciation percentages for gasoline exhaust and evaporative are from BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards 2011, Table 14 (http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx?la=en), and for diesel exhaust from MOVES 2007. Gasoline is speciated from TOG emissions and diesel is speciated from ROG emissions. DPM is equivalent to PM10 emissions (see Mobile CAPs tab) for diesel vehicles. For Benzene, gasoline exhaust speciation percentage of 2.47% is used, gasoline evaporative speciation percentage of 0.36% is used, and diesel speciation percentage of 1.29% is used. For 1,3-Butadiene, gasoline speciation percentage of 0.55% is used and diesel speciation percentage of 0.08% is used. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 offrom the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011) Table 14: Toxic Speciation of TOG due to Tailpipe Emissions. Therefore, so only those two compounds are included for gasoline TAC calculations.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. The vehicle fleet is comprised of 99% gasoline-powered vehicles so only a gasoline speciation was used for these entries and chemicals from non-gasoline vehicles were assumed to be negligible.
12. EMFAC emission factors for 2015 are used for calculating on-road emissions and are summarized in Mobile Appendix C.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
CARB - California Air Resources Board
DPM - diesel particulate matter
equip - equipment
FTE - full-time equivalent
GUP - general use permit
hp - horsepower
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
PM_{10} - particulate matter less than 10 μm in diameter
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
USEPA - United States Environmental Protection Agency
TAC - toxic air contaminants
TBD - to be determined
TOG - total organic gas
ton - short tons
μm - micrometer
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 4-1-7
2015 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Speciated Total Emissions[9] [ton/year]					Total Emissions[9,12] [ton/year]		
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	Benzene (Diesel)	Benzene (Gas)	1,3-butadiene (Diesel)	1,3-butadiene (Gas)	DPM	Benzene	1,3-butadiene	DPM
Off-Campus (Worker) Trips[3,11]	Undergraduate	234	2.0	70,286		512,385		0.0022		3.8E-04		0.0022	3.8E-04	
	Graduate	1,259	2.0	523,894		4,793,631		0.018		0.0031		0.018	0.0031	
	Post-doc	555	2.0	246,412		2,335,983		0.0084		0.0015		0.0084	0.0015	
	Faculty/Staff	5,443	2.0	2,416,714		27,803,160		0.089		0.016		0.089	0.016	
	Casual Employees	302	2.0	133,960		1,793,719		0.0052		9.3E-04		0.0052	9.3E-04	
	Contingent Employees	294	2.0	130,354		1,596,836		0.0049		8.7E-04		0.0049	8.7E-04	
	Temporary Employees	604	2.0	268,165		3,421,786		0.010		0.0018		0.010	0.0018	
	Non-Employee Affiliates: 20% FTEs	169	2.0	75,118		892,407		0.0028		4.9E-04		0.0028	4.9E-04	
	Non-Employee Affiliates: FTEs	925	2.0	410,795		4,880,239		0.015		0.0027		0.015	0.0027	
	Third Party Contractors	244	2.0	108,178		1,537,214		0.0043		7.8E-04		0.0043	7.8E-04	
	Janitorial Shift Workers	195	2.0	86,543		1,229,771		0.0035		6.2E-04		0.0035	6.2E-04	
	First Mile to Transit (all Workers + Students)	2,039	2.0	903,934		3,707,596		0.025		0.0041		0.025	0.0041	
	Construction	975	2.0	432,713		6,148,856		0.017		0.0031		0.017	0.0031	
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**		**0.21**		**0.036**		**0.21**	**0.036**	
On-Campus (Resident) Trips[3,11]	Undergraduate	1,582	5.9	1,962,450		7,612,107		0.052		0.0087		0.052	0.0087	
	Graduate	3,648	4.5	5,264,378		27,554,538		0.15		0.025		0.15	0.025	
	Post-doc	28	3.7	33,580		168,975		9.5E-04		1.6E-04		9.5E-04	1.6E-04	
	Faculty/Staff	98	2.6	94,698		619,941		0.0029		4.9E-04		0.0029	4.9E-04	
	Sub-Total	**5,356**		**7,355,106**		**35,955,561**		**0.20**		**0.035**		**0.20**	**0.035**	
Campus Vehicles - On-road[4]	Bonair on-road - gas[7]	470	2.7	454,946	7.3	3,321,104		0.011		0.0021		0.011	0.0021	
	Bonair on-road - diesel[7]	11	3.2	12,890	7.3	94,099	4.7E-05		2.9E-06		0.0070	4.7E-05	2.9E-06	0.0070
	Bonair on-road buses - diesel[7]	10	1.1	4,075	7.3	29,749	3.3E-04		2.0E-05		0.030	3.3E-04	2.0E-05	0.030
	Bonair Unfiltered - on-road - gas[7]	74	1.7	45,317	7.3	330,811		0.0012		2.1E-04		0.0012	2.1E-04	
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.0072		4.4E-04		0.36	0.0072	4.4E-04	0.36
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	8.9E-05		5.5E-06		0.013	8.9E-05	5.5E-06	0.013
	Marguerite[10]	66				1,983,931	0.010		6.3E-04		1.3	0.010	6.3E-04	1.3
	Public Safety	31	2.8	31,879	7.3	232,720		7.9E-04		1.5E-04		7.9E-04	1.5E-04	
	Sub-Total	**700**		**614,290**		**8,594,006**	**0.018**	**0.013**	**0.0011**	**0.0025**	**1.7**	**0.031**	**0.0036**	**1.7**
Other Trips[3]	General Visitors (Vendor)[11]	2,016,204	2.0	4,032,408		25,001,480		0.12		0.020		0.12	0.020	
	Worker Non-Commute Trips[11]			301,920		935,952		0.0049		9.1E-04		0.0049	9.1E-04	
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443		0.0069		0.0014		0.0069	0.0014	
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.0040		2.5E-04		0.39	0.0040	2.5E-04	0.39
	Event Visitor Traffic[11]	149,958	2.0	299,917		6,652,357		0.015		0.0028		0.015	0.0028	
	Deliveries - Trucks	168,054	2.0	336,108		2,083,870	0.0064		4.0E-04		0.31	0.0064	4.0E-04	0.31
	Construction Vendor Trucks[13]		*2.4*	*8,510*		*62,123*	*1.9E-04*		*1.2E-05*		*0.0092*	*1.9E-04*	*1.2E-05*	*0.0092*
	Construction Haul Trucks[13]		*2.4*	*7,987*		*159,740*	*4.8E-04*		*3.0E-05*		*0.024*	*4.8E-04*	*3.0E-05*	*0.024*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**	**0.010**	**0.15**	**6.5E-04**	**0.025**	**0.70**	**0.16**	**0.026**	**0.70**
					Total VMT	**143,215,251**								
Campus Vehicles - Off-road Equip[6]						**[bhp-hr/yr][5]**								
	Siebel and Red Barn equip - gas[8]					38,837		0.084		0.0082		0.084	0.0082	
	Siebel and Red Barn equip - diesel[8]					52,854	0.0011		7.0E-05		0.031	0.0011	7.0E-05	0.031
	Off-road equip - gas					6,553		0.014		0.0014		0.014	0.0014	
	Off-road equip - diesel					102,593	0.0022		1.4E-04		0.060	0.0022	1.4E-04	0.060
	Light Towers - gas					2,925		0.0063		6.1E-06		0.0063	6.1E-06	
	Light Towers - diesel					186,791	0.0021		1.3E-04		0.053	0.0021	1.3E-04	0.053
	Sub-Total					**390,554**	**0.0054**	**0.10**	**3.4E-04**	**0.010**	**0.14**	**0.11**	**0.010**	**0.14**

RAMBOLL ENVIRON

Table 4-1-7
2015 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and NEVES.
6. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
7. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
8. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
9. Benzene and 1,3-butadiene speciation percentages for gasoline exhaust and evaporative are from BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards 2011, Table 14 (http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx?la=en), and for diesel exhaust from MOVES 2007. Gasoline is speciated from TOG emissions and diesel is speciated from ROG emissions. DPM is equivalent to PM10 emissions (see Mobile CAPs tab) for diesel vehicles. For Benzene, gasoline exhaust speciation percentage of 2.47% is used, gasoline evaporative speciation percentage of 0.36% is used, and diesel speciation percentage of 1.29% is used. For 1,3-Butadiene, gasoline speciation percentage of 0.55% is used and diesel speciation percentage of 0.08% is used. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 offrom the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011) Table 14: Toxic Speciation of TOG due to Tailpipe Emissions. Therefore, so only those two compounds are included for gasoline TAC calculations.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. The vehicle fleet is comprised of 99% gasoline-powered vehicles so only a gasoline speciation was used for these entries and chemicals from non-gasoline vehicles were assumed to be negligible.
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
CARB - California Air Resources Board
DPM - diesel particulate matter
equip - equipment
FTE - full-time equivalent
GUP - general use permit
hp - horsepower
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
PM_{10} - particulate matter less than 10 µm in diameter
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
USEPA - United States Environmental Protection Agency
TAC - toxic air contaminants
TBD - to be determined
TOG - total organic gas
ton - short tons
µm - micrometer
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 4-1-8
Fall 2018 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Speciated Total Emissions[9] [ton/year]					Total Emissions[9,13] [ton/year]		
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	Benzene (Diesel)	Benzene (Gas)	1,3-butadiene (Diesel)	1,3-butadiene (Gas)	DPM	Benzene	1,3-butadiene	DPM
Off-Campus (Worker) Trips[3,12]	Undergraduate	185	2.0	55,470		404,378		0.0007		1.2E-04		0.0007	1.2E-04	
	Graduate	1286	2.0	534,884		4,894,189		0.0076		1.3E-03		0.008	1.3E-03	
	Post-doc	589	2.0	261,730		2,481,198		0.0038		6.5E-04		0.004	6.5E-04	
	Faculty/Staff	5,682	2.0	2,522,720		28,678,561		0.0397		0.0071		0.04	0.0071	
	Casual Employees	314	2.0	139,563		1,868,744		0.0024		4.3E-04		0.002	4.3E-04	
	Contingent Employees	306	2.0	135,808		1,663,642		0.0022		4.0E-04		0.0022	4.0E-04	
	Temporary Employees	629	2.0	279,355		3,564,566		0.0047		8.4E-04		0.005	8.4E-04	
	Non-Employee Affiliates: 20% FTEs	176	2.0	78,281		929,974		0.0013		2.3E-04		0.0013	2.3E-04	
	Non-Employee Affiliates: FTEs	964	2.0	428,097		5,085,797		0.0069		1.2E-03		0.007	1.2E-03	
	Third Party Contractors	263	2.0	116,833		1,660,191		0.0021		3.8E-04		0.0021	3.8E-04	
	Janitorial Shift Workers	210	2.0	93,394		1,327,128		0.0017		3.0E-04		0.0017	3.0E-04	
	First Mile to Transit (all Workers + Students)	2,125	2.0	941,983		3,864,416		0.0100		1.6E-03		0.0100	1.6E-03	
	Construction	975	2.0	432,713		6,148,856		0.0077		1.4E-03		0.008	1.4E-03	
	Sub-Total	**13,705**		**6,020,830**		**62,571,641**		**0.09**		**0.0159**		**0.091**	**0.0159**	
On-Campus (Resident) Trips[3,12]	Sub-Total	1,654	5.8	2,028,810		7,869,489		0.0197		3.3E-03		0.020	0.0033	
	Undergraduate	3,829	4.4	5,479,152		28,680,441		0.0592		1.0E-02		0.06	0.0100	
	Post-doc	28	3.7	33,580		168,975		3.6E-04		6.1E-05		3.6E-04	6.1E-05	
	Post-doc	98	2.6	94,698		619,941		0.0011		1.9E-04		0.0011	1.9E-04	
	Faculty/Staff	**5,609**		**7,636,240**		**37,338,845**		**0.08**		**0.0136**		**0.08**	**0.0136**	
Campus Vehicles - On-road[4]	Bonair on-road - gas[7]	470	2.5	432,198	7.3	3,155,049		0.008		1.4E-03		0.0075	0.0014	
	Bonair on-road - diesel[7]	11	3.0	12,246	7.3	89,394	2.9E-05		1.8E-06		0.0058	2.9E-05	1.8E-06	0.0058
	Bonair on-road buses - diesel[7]	10	1.1	3,871	7.3	28,261	2.2E-04		1.4E-05		0.025	2.2E-04	1.4E-05	0.025
	Bonair Unfiltered - on-road - gas[7]	74	1.6	43,051	7.3	314,270		0.0008		1.4E-04		7.7E-04	1.4E-04	
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	6.4E-03		4.0E-04		0.3342	6.4E-03	4.0E-04	0.3342
	PSSI - Company Vehicles - diesel	10	6.66	24,303	7.3	177,409	5.8E-05		3.6E-06		0.0115	5.8E-05	3.6E-06	0.0115
	Marguerite[10]	66				2,144,233	0.0087		5.4E-04		1.3	0.0087	5.4E-04	1.3
	Public Safety	31	2.8	31,879	7.3	232,720		0.0005		1.0E-04		0.0005	1.0E-04	
	Public Safety	**700**		**588,428**		**8,565,520**	**0.0154**	**0.009**	**9.5E-04**	**1.6E-03**	**1.6**	**0.024**	**0.0026**	**1.6**
Other Trips[3]	General Visitors (Vendor)[12]	2,177,501	2.0	4,355,001		27,001,599		0.05		0.0086		0.053	0.0086	
	Worker Non-Commute Trips[12]			326,074		1,010,828		0.0037		6.5E-04		0.0037	6.5E-04	
	Non-event Visitor Trips - Passenger	61,835	2.0	147,705		3,130,985		0.0051		1.0E-03		0.0051	0.0010	
	Non-event Visitor Trips - Buses	5,250	2.0	11,074		390,000	0.0029		1.8E-04		0.34	0.0029	1.8E-04	0.34
	Event Visitor Traffic[12]	67,085	2.0	301,862		6,695,507		0.007		1.4E-03		0.0071	0.0014	
	Deliveries - Trucks	181,499	2.0	362,997		2,250,579	0.0062		3.9E-04		0.32	0.0062	3.9E-04	0.32
	Construction Vendor Trucks[14]		*2.4*	*8,510*	*7.3*	*62,123*	*0.0002*		*1.1E-05*		*0.01*	*0.0002*	*1.1E-05*	*0.01*
	Construction Haul Trucks[14]		*2.4*	*7,987*	*20*	*159,740*	*0.0004*		*2.6E-05*		*0.02*	*0.0004*	*2.6E-05*	*0.02*
	Off-road equip - diesel	**2,493,169**		**5,504,713**		**40,479,498**	**0.009**	**0.07**	**5.7E-04**	**0.0117**	**0.65**	**0.078**	**0.0122**	**0.65**
					Total VMT	**148,955,504**								
Campus Vehicles - Off-road Equip[6]						**[bhp-hr/yr][5]**								
	Siebel and Red Barn equip - gas[8]					38,837		0.084		0.0187		0.084	0.0187	
	Siebel and Red Barn equip - diesel[8]					52,854	0.0011		7.0E-05		0.031	0.0011	7.0E-05	0.031
	Off-road equip - gas					6,553		0.014		0.0032		0.014	0.0032	
	Off-road equip - diesel					102,570	0.0022		1.4E-04		0.060	0.0022	1.4E-04	0.060
	Light Towers - gas					2,925		6.3E-05		1.4E-05		6.3E-05	1.4E-05	
	Light Towers - diesel					186,791	0.0021		1.3E-04		0.053	0.0021	1.3E-04	0.053
	Deliveries - Trucks (total)					**390,532**	**0.0054**	**0.098**	**3.4E-04**	**0.0219**	**0.14**	**0.104**	**0.0223**	**0.14**

RAMBOLL ENVIRON

Table 4-1-8
Fall 2018 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix B1. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B1 (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix B1. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2018 inventory based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix B1.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites is adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA NEVES.
6. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
7. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
8. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
9. Benzene and 1,3-butadiene speciation percentages for gasoline exhaust and evaporative are from BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards 2011, Table 14 (http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx?la=en), and for diesel exhaust from MOVES 2007. Gasoline is speciated from TOG emissions and diesel is speciated from ROG emissions. DPM is equivalent to PM_{10} emissions (see Mobile CAPs tab) for diesel vehicles. For Benzene, gasoline exhaust speciation percentage of 2.47% is used, gasoline evaporative speciation percentage of 0.36% is used, and diesel speciation percentage of 1.29% is used. For 1,3-Butadiene, gasoline speciation percentage of 0.55% is used and diesel speciation percentage of 0.08% is used. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 offrom the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011) Table 14: Toxic Speciation of TOG due to Tailpipe Emissions. Therefore, so only those two compounds are included for gasoline TAC calculations.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C. By Fall 2018, Ramboll Environ assumed that the 10 oldest buses in the Marguerite fleet were converted from diesel-powered to electric-powered. These calculation are shown in Appendix C.
11. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles.
12. The vehicle fleet is comprised of 99% gasoline-powered vehicles so only a gasoline speciation was used for these entries and chemicals from non-gasoline vehicles were assumed to be negligible.
13. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
14. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
DPM - diesel particulate matter
EMFAC - emissions factors
FTE - full-time equivalent
GUP - general usage plan
hp - horsepower
hr - hour
PSSI - Peninsula Sanitary Service, Inc.
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
PM_{10} - particulate matter less than 10 microns in diameter
RE - Ramboll Environ
ROG - reactive organic gas
TAC - toxic air contaminants
TOG - total organic gases
ton - short tons
USEPA - United States Environmental Protection Agency
VMT - vehicle miles travelled
yr - year

Table 4-1-9
Fall 2035 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Speciated Total Emissions[2] [ton/year]					Total Emissions[3] [ton/year]		
	Group	Number of Vehicles[4]	Trips per Day per Vehicle[4]	Total Vehicle Trips per Year[4]	Trip Length [mile]	Total VMT [mile/year]	Benzene (Diesel)	Benzene (Gas)	1,3-butadiene (Diesel)	1,3-butadiene (Gas)	DPM	Benzene	1,3-butadiene	DPM
Off-Campus (Worker) Trips[5,6]	Undergraduate	185	2.0	55,470		404,378		2.3E-04		3.2E-05		2.3E-04	3.2E-05	
	Graduate	764	2.0	317,833		2,908,174		0.0014		2.1E-04		0.0014	2.1E-04	
	Post-doc	828	2.0	367,634		3,485,170		0.0017		2.5E-04		0.0017	2.5E-04	
	Faculty/Staff	7,220	2.0	3,205,524		35,698,523		0.016		0.0024		0.016	0.0024	
	Casual Employees	398	2.0	176,826		2,367,699		0.0010		1.5E-04		0.0010	1.5E-04	
	Contingent Employees	388	2.0	172,068		2,107,835		9.0E-04		1.4E-04		9.0E-04	1.4E-04	
	Temporary Employees	797	2.0	353,942		4,516,305		0.0019		3.0E-04		0.0019	3.0E-04	
	Non-Employee Affiliates: 20% FTEs	223	2.0	99,182		1,178,277		5.1E-04		7.9E-05		5.1E-04	7.9E-05	
	Non-Employee Affiliates: FTEs	1,222	2.0	542,399		6,443,705		0.0028		4.3E-04		0.0028	4.3E-04	
	Third Party Contractors	321	2.0	142,671		2,027,352		8.1E-04		1.3E-04		8.1E-04	1.3E-04	
	Janitorial Shift Workers	257	2.0	114,049		1,620,630		6.4E-04		1.0E-04		6.4E-04	1.0E-04	
	First Mile to Transit (all Workers + Students)	2,654	2.0	1,177,343		4,853,984		0.0041		4.9E-04		0.0041	4.9E-04	
	Construction	975	2.0	432,713		6,148,856		0.0024		3.9E-04		0.0024	3.9E-04	
	Sub-Total	**16,231**		**7,157,654**		**73,760,888**		**0.034**		**0.0052**		**0.034**	**0.0052**	
On-Campus (Resident) Trips[5,6]	Sub-Total	2,079	5.8	2,550,030		9,891,078		0.0078		0.0010		0.0078	0.0010	
	Undergraduate	5,974	4.5	8,613,822		45,087,773		0.029		0.0041		0.029	0.0041	
	Post-doc	28	3.7	33,580		168,975		1.1E-04		1.6E-05		1.1E-04	1.6E-05	
	Post-doc	1511	2.7	1,463,463		9,574,762		0.0056		7.9E-04		0.0056	7.9E-04	
	Faculty/Staff	**9,592**		**12,660,895**		**64,722,587**		**0.043**		**0.0059**		**0.043**	**0.0059**	
Campus Vehicles - On-road[7]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049		0.0038		6.8E-04		0.0019	3.4E-04	
	Bonair on-road - diesel[8]	11	3.0	12,246	7.3	89,394	7.6E-06		4.7E-07		0.0046	3.8E-06	2.4E-07	0.0023
	Bonair on-road buses - diesel[8]	10	1.1	3,871	7.3	28,261	7.4E-05		4.6E-06		0.017	3.7E-05	2.3E-06	0.0085
	Bonair Unfiltered - on-road - gas[8]	74	1.6	43,051	7.3	314,270		3.9E-04		6.7E-05		2.0E-04	3.4E-05	
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.0047		2.9E-04		0.29	0.0047	2.9E-04	0.29
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	1.5E-05		9.4E-07		0.0091	1.5E-05	9.4E-07	
	Marguerite[9]	66				2,618,108	0		0		0	0	0	0
	Public Safety	31	2.8	31,879	7.3	232,720		2.6E-04		5.0E-05		2.6E-04	5.0E-05	
	Public Safety	**700**		**588,428**		**9,039,395**	**0.0048**	**0.0045**	**3.0E-04**	**7.9E-04**	**0.32**	**0.0071**	**7.2E-04**	**0.30**
Other Trips[5]	General Visitors (Vendor)	2,656,551	2.0	5,313,101		32,968,952		0.021		0.0028		0.021	0.0028	
	Worker Non-Commute Trips			397,810		1,234,221		0.0021		3.5E-04		0.0021	3.5E-04	
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		3,675,599		0.0032		6.5E-04		0.0032	6.5E-04	
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	9.4E-04		5.9E-05		0.23	9.4E-04	5.9E-05	0.23
	Event Visitor Traffic	67,085	2.0	299,917		6,980,045		0.0023		4.1E-04		0.0023	4.1E-04	
	Deliveries - Trucks	221,428	2.0	442,856		2,747,957	0.0057		3.5E-04		0.33	0.0057	3.5E-04	0.33
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*	*1.25E-04*		*7.8E-06*		*0.01*	*0.0001*	*7.8E-06*	*0.01*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20*	*159,740*	*3.14E-04*		*1.9E-05*		*0.02*	*0.0003*	*1.9E-05*	*0.02*
	Off-road equip - gas	**3,012,148**		**6,604,231**		**47,996,774**	**0.0066**	**0.028**	**4.1E-04**	**0.0042**	**0.56**	**0.035**	**0.0046**	**0.56**
						Total VMT	**195,519,644**							
Campus Vehicles - Off-road Equip[10]						**[bhp-hr/yr][11]**								
	Siebel and Red Barn equip - gas[12]					38,837		0.084		0.019		0.084	0.019	
	Siebel and Red Barn equip - diesel[12]					52,854	0.0011		7.0E-05		0.031	0.0011	7.0E-05	0.031
	Off-road equip - gas					6,553		0.014		0.0032		0.014	0.0032	
	Off-road equip - diesel					102,570	0.0022		1.4E-04		0.060	0.0022	1.4E-04	0.060
	Light Towers - gas					2,925		6.3E-05		1.4E-05		6.3E-05	1.4E-05	
	Light Towers - diesel					186,791	0.0021		1.3E-04		0.053	0.0021	1.3E-04	0.053
	Deliveries - Trucks (total)					**390,532**	**0.0054**	**0.10**	**3.4E-04**	**0.022**	**0.14**	**0.10**	**0.022**	**0.14**

RAMBOLL ENVIRON

Table 4-1-9
Fall 2035 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix C. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix C (e.g., trip lengths for workers).
2. Benzene and 1,3-butadiene speciation percentages for gasoline exhaust and evaporative are from BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards 2011, Table 14 (http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx?la=en), and for diesel exhaust from MOVES 2007. Gasoline is speciated from TOG emissions and diesel is speciated from ROG emissions. DPM is equivalent to PM10 emissions (see Mobile CAPs tab) for diesel vehicles. For Benzene, gasoline exhaust speciation percentage of 2.47% is used, gasoline evaporative speciation percentage of 0.36% is used, and diesel speciation percentage of 1.29% is used. For 1,3-Butadiene, gasoline speciation percentage of 0.55% is used and diesel speciation percentage of 0.08% is used. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 offrom the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011) Table 14: Toxic Speciation of TOG due to Tailpipe Emissions. Therefore, so only those two compounds are included for gasoline TAC calculations.
3. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
4. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix C. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
5. VMT per year for Fall 2035 inventory based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix C.
6. The vehicle fleet is comprised of 99% gasoline-powered vehicles so only a gasoline speciation was used for these entries and chemicals from non-gasoline vehicles were assumed to be negligible.
7. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the 2018 inventory was estimated to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2018 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are estimated by scaling assuming only 30% non-electric vehicles contribute to emissions in 2035 versus 60% in 2018. This scaling is done in the "Total Emissions" column. Additionally, Stanford expects the entire Marguerite fleet to be electric by 2035. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption. Emission factors are shown in Mobile Appendix C.
9. Marguerite buses are assumed to all be electric by 2035. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles; this is kept constant through 2035.
10. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
11. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
12. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
DPM - diesel particulate matter
EMFAC - emissions factors
FTE - full-time equivalent
GUP - general usage plan
hp - horsepower
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
PM_{10} - particulate matter less than 10 microns in diameter
PSSI - Peninsula Sanitary Service, Inc.
RE - Ramboll Environ
ROG - reactive organic gas
TAC - toxic air contaminants
TOG - total organic gases
ton - short tons
USEPA - United States Environmental Protection Agency
VMT - vehicle miles travelled
yr - year

Table 4-2
2014, 2015, Fall 2018, and Fall 2035 TAC Emissions - Summary
Stanford University
Stanford, CA

Sources	Toxic Air Contaminant Emissions																			
	2014 Inventory					2015 Inventory					Fall 2018 (Baseline) Inventory					Fall 2035 (Project) Inventory[1]				
	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM
	[ton/yr]																			
Stationary Sources																				
Cardinal Cogen	0.072	0.49	5.9E-04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water Generators	-	-	-	-	-	1.0E-04	0.0037	1.7E-04	-	-	1.1E-04	0.0040	1.8E-04	-	-	1.4E-04	4.92E-03	2.2E-04	-	-
Replacement Process Steam	-	-	-	-	-	8.5E-05	0.0030	1.4E-04	-	-	9.2E-05	0.0033	1.5E-04	-	-	1.1E-04	4.00E-03	1.8E-04	-	-
Other Natural Gas (e.g., PGE boilers)	1.5E-04	0.0054	2.4E-04	-	-	3.6E-04	0.013	5.9E-04	-	-	3.9E-04	0.014	6.3E-04	-	-	4.9E-04	1.75E-02	7.9E-04	-	-
Emergency Generators	-	-	-	-	0.15	-	-	-	-	0.20	-	-	-	-	0.21	-	-	-	-	0.26
Laboratories	0.20	7.0E-04	0.18	0.089	-	0.20	7.0E-04	0.18	0.089	-	0.22	7.5E-04	0.20	0.10	-	2.7E-01	9.21E-04	2.4E-01	0	-
Valero Fuel Station	0.0016	-	-	-	-	0.0016	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bonair Fuel Station	2.3E-04					2.3E-04					1.1E-07					5.6E-08	-	-	-	-
Subtotal [ton/yr]	**0.28**	**0.50**	**0.18**	**0.089**	**0.15**	**0.21**	**0.020**	**0.18**	**0.089**	**0.20**	**0.22**	**0.022**	**0.20**	**0.096**	**0.21**	**0.27**	**0.027**	**0.24**	**0.12**	**0.26**
Mobile Sources																				
Worker Trips	0.21	-	-	0.036	-	0.21	-	-	0.036	-	0.091	-	-	0.016	-	0.034	-	-	0.0052	-
Resident Trips	0.20	-	-	0.035	-	0.20	-	-	0.035	-	0.08	-	-	0.014	-	0.043	-	-	0.0059	--
Campus Vehicles - On Road	0.031	-	-	0.0036	1.7	0.031	-	-	0.0036	1.7	0.024	-	-	0.0026	1.6	0.0071	-	-	7.2E-04	0.30
Campus Vehicles - Off Road	0.110	-	-	0.0099	0.14	0.110	-	-	0.0099	0.14	0.104	-	-	0.0223	0.14	0.10	-	-	0.022	0.14
Other Trips	0.16	-	-	0.026	0.70	0.16	-	-	0.026	0.70	0.078	-	-	0.012	0.65	0.035	-	-	0.0046	0.56
Construction Off-Road Equipment[2]	-	-	-	-	0.02	-	-	-	-	0.02	-	-	-	-	0.018	-	-	-	-	0.010
Subtotal [ton/yr]	**0.71**	**-**	**-**	**0.11**	**2.6**	**0.71**	**-**	**-**	**0.11**	**2.6**	**0.38**	**-**	**-**	**0.067**	**2.5**	**0.22**	**-**	**-**	**0.039**	**1.01**

Notes:

1. Fall 2035 represents full buildout of the Project. Mobile emission factors are conservatively used from year 2030, to be consistent with the GHG report and comparison to State 2030 targets.

2. Construction emissions are estimated using CalEEMod® 2013.2.2 using the average annual square footage of construction and demolition and estimated excavation from fiscal year 2001 through fiscal year 2015 with default construction schedules and equipment lists. Construction equipment is all assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment. All PM_{10} exhaust emissions are assumed to be DPM.

Abbreviations:

CalEEMod® - California Emission Estimator Model
DPM - diesel particulate matter
PGE - Pacific Gas & Electric
PM_{10} - particulate matter under 10 microns
ton - short tons
yr - year

FIGURES

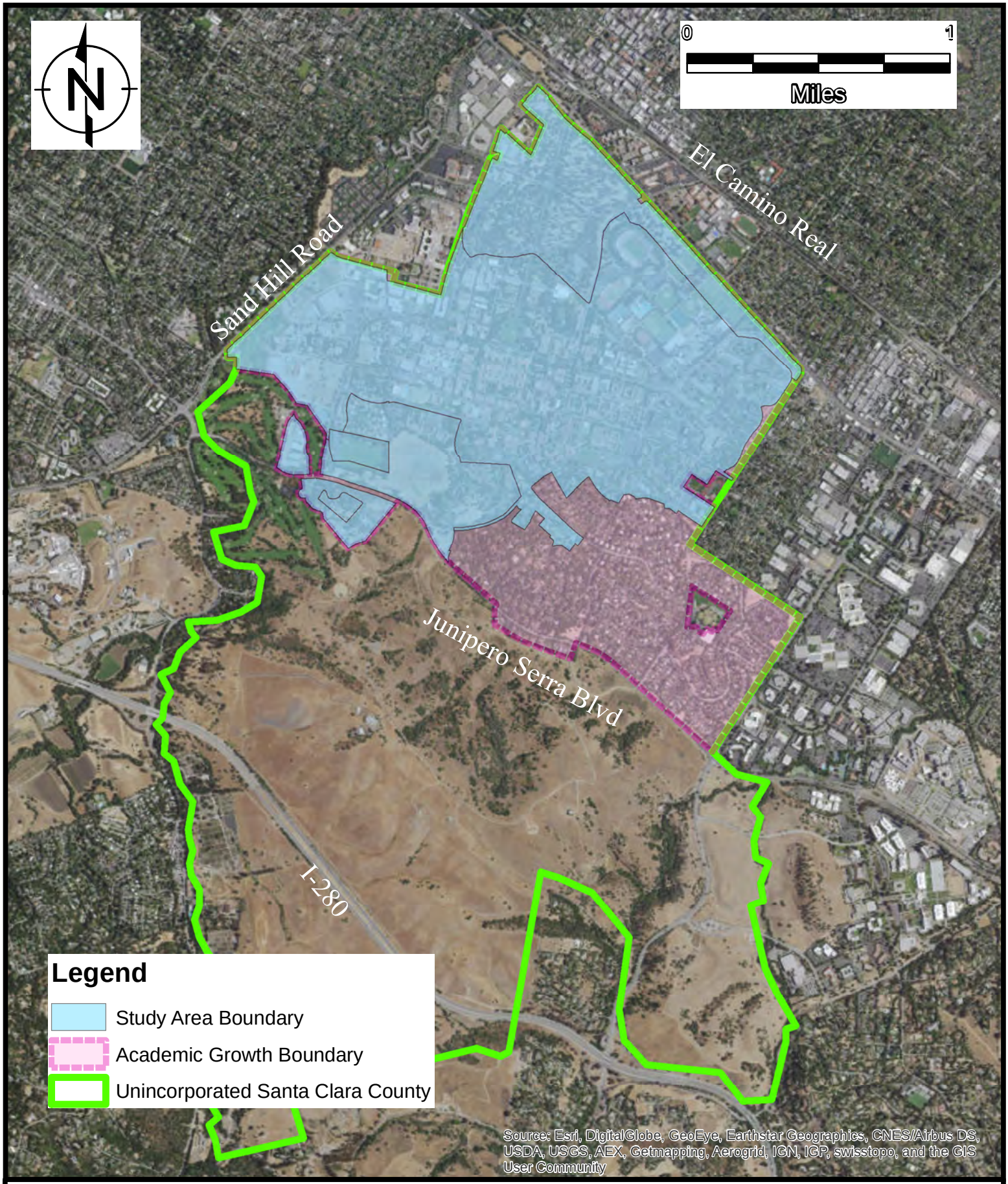

Figure 1-2 Study Area Boundaries
Stanford University
Stanford, CA

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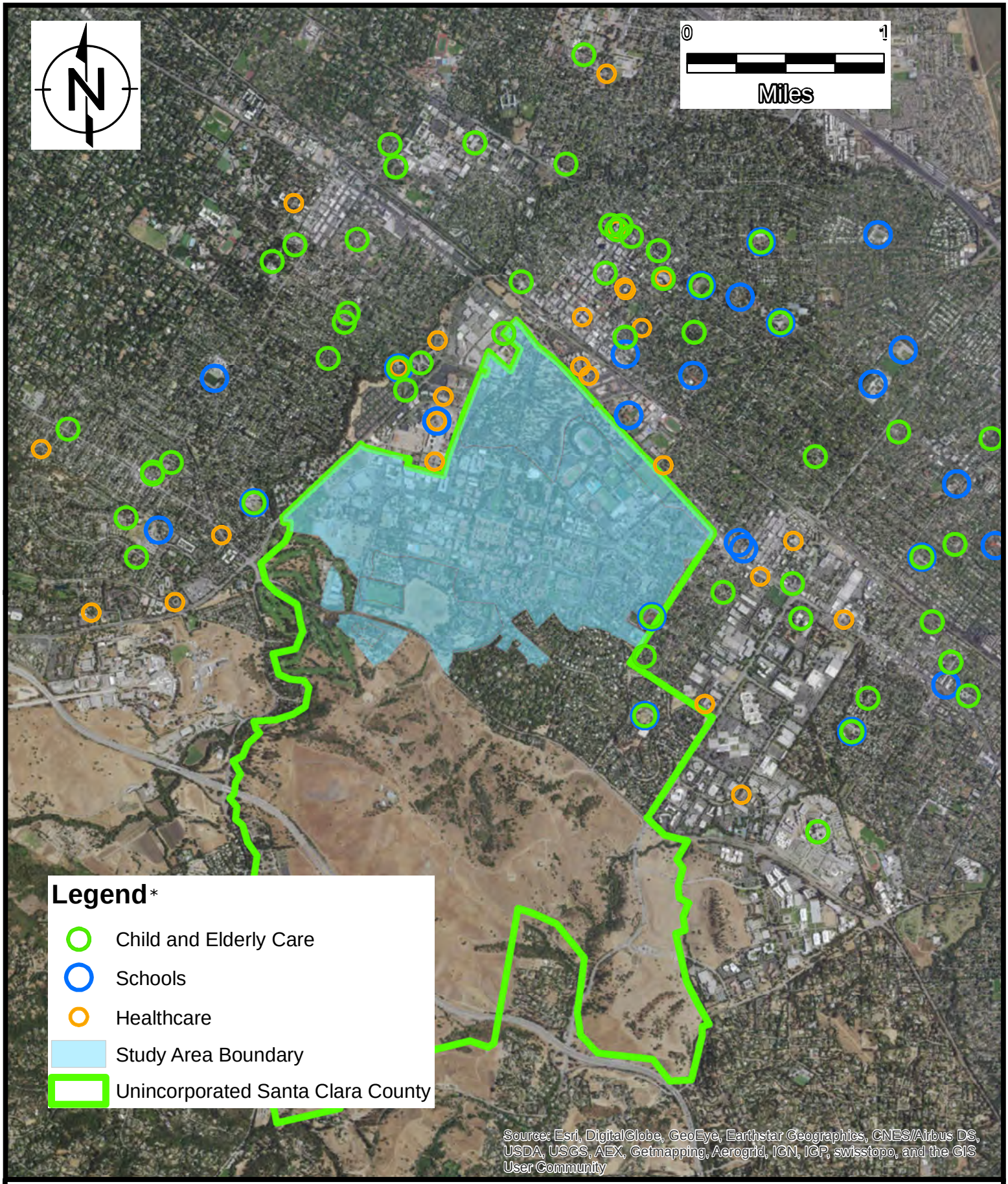

Figure 2-1 Sensitive Receptor Locations

RAMBOLL ENVIRON

Stanford University
Stanford, CA

*Residential areas where children may live are also in the vicinity of Stanford and constitute additional sensitive receptors.

APPENDIX A
RAMBOLL ENVIRON AIR QUALITY TECHNICAL APPENDIX

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APPENDIX A
STANFORD 2018 GENERAL USE PERMIT: AIR QUALITY TECHNICAL REPORT
STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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Figure 1-4-1 2015 Natural Gas Account Locations

ACRONYMS AND ABBREVIATIONS

ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
bhp-hr	brake horsepower-hour
CalEEMod®	California Emissions Estimator Model
CAP	criteria air pollutant
CAPCOA	California Air Pollution Control Officers Association
CEF	Central Energy Facility
CO	carbon monoxide
CY	Cubic yards
DPM	diesel particulate matter
EMFAC	EMission FACtor model
GHG	greenhouse gas
GUP	General Use Permit
MMBtu	million British thermal unit
NO_X	nitrogen oxides
OFFROAD	Emissions Inventory Program model
PGE	Pacific Gas & Electric
Ramboll Environ	Ramboll Environ US Corporation
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 micron in diameter
PM_{10}	particulate matter less than 10 micron in diameter
PSSI	Peninsula Sanitary Service, Inc.
ROG	reactive organic gas
SCAQMD	South Coast Air Quality Management District
SESI	Stanford Energy Systems Innovations
SO_2	sulfur dioxide
sq ft	square feet
TAC	toxic air contaminant
US	United States
USEPA	Unites States Environmental Protection Agency
VMT	vehicle miles traveled

VOC	volatile organic compound

1. CRITERIA POLLUTANT EMISSIONS INVENTORIES

1.1 Methodology for Calculating Emissions

This section describes the methodology that Ramboll Environ US Corporation (Ramboll Environ) used to develop the existing conditions and Project criteria air pollutant (CAP) and toxic air contaminant (TAC) emission inventories, for construction and operational emissions. Sub-categories of criteria pollutant operational emissions within the study area at Stanford University include: onsite electricity generation, boilers, mobile sources, emergency generator use, laboratories, and fuel stations. The section provides the methodology for the inventories developed for the existing conditions analysis years (i.e., 2014, 2015, and Fall 2018) and Project year (2035). The three existing conditions analysis years were selected based on the following factors: 2014 represents the actual historic annual emissions before implementation of the Stanford Energy Systems Innovations (SESI), 2015 represents current campus emissions after the implementation of SESI, and Fall 2018 represents the annualized emissions expected to exist immediately prior to commencement of the proposed 2018 General Use Permit (GUP). For the Fall 2018 analysis, it is assumed that the development authorized by the 2000 GUP is permitted. The Fall 2035 ("Project") analysis includes the anticipated construction and operation of the additional academic buildings and residences proposed in the 2018 GUP.

1.1.1 Units of measurement: Tons of criteria pollutant

As discussed in Section 2 of the Air Quality Technical Report, Federal and State air quality laws identify CAPs, including particulate matter (PM), ground-level ozone, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_X), and lead. Volatile organic compounds (VOCs) as a precursor to ozone is also quantified as a CAP. In this report, pollutant emissions are presented in United States (US) short tons. A ton refers to 2,000 pounds (907.2 kilograms). Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

1.1.2 Resources

1.1.2.1 CalEEMod®

Ramboll Environ primarily utilized the methodology from the California Emissions Estimator Model (CalEEMod®) version 2013.2.2[1] to assist in quantifying the criteria pollutant emissions in the inventories presented in this report. CalEEMod® is a statewide program designed to calculate both criteria and greenhouse gas (GHG) emissions from development projects in California. This model was developed under the auspices of the South Coast Air Quality Management District (SCAQMD) and received input from other California air districts, and is currently supported by numerous lead agencies for use in quantifying the emissions associated with development projects undergoing environmental review. CalEEMod® utilizes widely accepted models for emission estimates combined with appropriate default data that can be used if site-specific information is not available.

CalEEMod® provides a platform to calculate annual operational criteria pollutant emissions from a land use development project. The model also provides default values for water and energy use. Specifically, the model aids the user in estimating emissions from operational

[1] SCAQMD. 2013. California Emissions Estimator Model®. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

emissions associated with the fully built out land use development. This includes emissions from on-road mobile vehicle traffic associated with the land uses, emissions from landscaping equipment and other off-road mobile sources, emissions from natural gas usage in the buildings, emissions associated with electricity usage in the buildings and electricity use associated with water usage. This also includes emissions associated with solid waste disposal.

CalEEMod® uses sources such as the US Environmental Protection Agency (USEPA) AP-42 emission factors,[2] California Air Resources Board's (ARB's) approved on-road and off-road equipment emission models such as the EMission FACtor model (EMFAC) and the Emissions Inventory Program model (OFFROAD), and studies commissioned by California agencies such as the California Energy Commission and CalRecycle. OFFROAD[3] is an emission factor model used to calculate emission rates from off-road mobile sources (e.g., construction equipment, agricultural equipment). The off-road diesel emission factors used by CalEEMod® are based on the ARB OFFROAD2011 program. EMFAC[4] is an emission factor model used to calculate emissions rates from on-road vehicles (e.g., passenger vehicles). The emission factors used by CalEEMod® are based on the ARB EMFAC2011 program. ARB has released an updated EMFAC2014 version that includes various updates, notably the incorporation of USEPA and ARB regulations and standards (e.g., Advanced Clean Cars and the Truck and Bus Rule). To more accurately assess the mobile CAP emission inventories, EMFAC2014 was incorporated into the analysis.

In addition, CalEEMod® contains default values and existing regulatory methodologies to use in each specific local air district or county. Appropriate statewide default values can be utilized if regional default values are not defined. Ramboll Environ used default factors for Santa Clara County for the CAP emission inventory, unless otherwise noted in the methodology descriptions below.

1.1.2.2 Other Resources

Ramboll Environ directly or indirectly relied on emissions estimation guidance from government-sponsored organizations, government-commissioned studies of energy use patterns, Project specific studies, and emission estimation software as described above. In cases noted below, third-party studies were also relied upon to support analyses and assumptions made outside of the approach described above. Where Stanford-specific data were available, it was used preferentially instead of model defaults. The methodology used to calculate this emissions inventory is described in detail in the following sections, including citations to information used in this inventory.

1.2 Construction Emissions

This section describes the estimation of CAP and TAC emissions from construction activities within the study area. Average annual construction and demolition square footage from fiscal year 2001 through fiscal year 2015 were used to estimate the annual emissions from

[2] The USEPA maintains a compilation of Air Pollutant Emission Factors and process information for several air pollution source categories. The data is based on source test data, material balance studies, and engineering estimates. Available at: http://epa.gov/ttnchie1/ap42/. Accessed: May 2016.

[3] ARB. 2011. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: May 2016.

[4] ARB. 2011. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: May 2016.

construction and demolition for all existing conditions inventory years and the Project year. The major construction phases included in this analysis are:

- Demolition: involves demolishing/removing existing buildings.
- Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- Paving: involves the laying of concrete or asphalt such as in parking lots or roads.
- Building Construction: involves the construction of structures and buildings.
- Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

CAP and TAC emissions from these construction activities are largely attributable to fuel use from off-road construction equipment and vendor vehicles. VOCs can be emitted from architectural coating activities. CAP and TAC emissions from construction worker, vendor, and hauling vehicles are already included separately in the mobile emissions section. All particulate matter less than 10 µm in diameter (PM_{10}) is assumed to be diesel particulate matter (DPM) for purposes of health risk calculations.

Ramboll Environ used CalEEMod® version 2013.2.2 to quantify the construction emissions. The construction schedule, off-road equipment lists, and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 square feet (sq ft),demolition of 50,306 sq ft of buildings, and excavation of 62,062 cubic yards (CY) of soil per year, with the default start and end dates of the phases moved such that the annual construction activities occur each year while maintaining the total default number of equipment-hours. This annual average is based on the average construction and demolition on the Stanford campus from 2001 to 2015. If this constant annual construction activity is projected forward from Fall 2018 to Fall 2035, the total construction square footage will be similar to the total anticipated in the 2018 GUP. Approximately 200,000 net sq ft per year of construction is proposed in the 2018 GUP, on average. Annual demolition square footage is likely to be lower than in the 2000 GUP because most of the in-fill development under the 2000 GUP has been in the denser core campus, whereas much of the 2018 GUP development would occur as redevelopment at the less dense fringes or on parking lots. Overall, this analysis is likely to be conservative because the total disturbed area (and thus construction emissions) in the 2018 GUP are likely to be lower than in this analysis.

1.2.1 Emissions from Construction Equipment

The emission calculations associated with construction equipment are from off-road equipment engine use based on the equipment list and phase length, and on-road vehicle trips and phase length.

Since the majority of the off-road construction equipment used for construction projects are diesel fueled, CalEEMod® assumes all of the equipment operates on diesel fuel. The calculations associated with this screen include the running exhaust emissions from off-road equipment. Since the equipment is assumed to be diesel, there are no starting emissions associated with the equipment, as these are de minimis for diesel-fueled equipment.

CalEEMod® calculates the exhaust emissions based on ARB's OFFROAD2011 methodology using the equation presented below.[5]

$$Emissions_{Diesel} = \sum_{i} (EF_i \times Pop_i \times AvgHP_i \times Load_i \times Activity_i)$$

Where:

EF = Emission factor in grams per horsepower-hour (g/bhp-hr) as processed from OFFROAD2011

Pop = Population, or the number of pieces of equipment

AvgHp = Maximum rated average horsepower

Load = Load factor

Activity = Hours of operation

i = equipment type

Ramboll Environ understands based on communications with Stanford's construction project managers that the majority of construction equipment used by contractors building projects at Stanford meets final Tier 4 emissions standards. All construction equipment is assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment.

1.2.1.1 Emissions from On-Road Construction Trips

Construction generates on-road vehicle CAP emissions trucks for soil and material hauling. These emissions are based on the number of trips and vehicle miles traveled (VMT) along with emission factors from EMFAC2011. Emissions associated with on-road worker, vendor, and hauling vehicles are captured separately in the operational mobile category, as these vehicle trips are included in the traffic analysis by Fehr & Peers (see **SB 743 VMT Analysis Appendices A, B, and C**).

The emissions from mobile sources were calculated in Excel with the trip rates, trip lengths and emission factors for running from EMFAC2014 as follows:[6]

$$Emissions_{pollutant} = VMT * EF_{running,\ pollutant}$$

Where:

$Emissions_{pollutant}$ = emissions from vehicle running for each pollutant

VMT = vehicle miles traveled

$EF_{running,\ pollutant}$ = emission factor for running emissions

Starting and idling emissions were also calculated in Excel by multiplying the number of trips by the respective emission factor for each pollutant.

[5] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

[6] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

1.2.1.2 Total Construction Emissions

The total emissions from construction are summarized in Air Quality Technical Report Table 3-1-1. The construction emissions vary slightly based on the scenario analysis years (i.e., 2014, 2015, Fall 2018, and Fall 2035 Project) because the emission factors for the off-road equipment and hauling trucks become cleaner over time. The Project inventory conservatively uses 2030 vehicle emission factors; if 2035 vehicle emission factors were used instead, it is expected that emissions would decrease. Detailed emission inventories from the CalEEMod® output files are included in **Air Quality Technical Report Appendix B**.

1.3 Annual Operational Emissions: 2014

1.3.1 Natural Gas

1.3.1.1 PGE Residential

Monthly natural gas consumption for all Pacific Gas and Electricity (PGE) residential addresses associated with Stanford University were provided. This includes addresses outside the study area, such as the Redwood City campus and Stanford-owned accounts as far away as Livermore and Monterey. It does not include private staff/faculty residences in the Searsville Block and Olmsted Staff Rental subdivisions located within the study area. All addresses are geocoded using Batchgeo[7] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE residential accounts within the study area, mainly concentrated in Escondido Village. The locations with residential PGE accounts are shown in **Figure 1-3-1**. The total gas consumption is the sum of the gas consumption from each of these addresses.

The resulting energy use (in million British thermal units [MMBtu]) are converted to criteria pollutant emissions. Emissions are calculated based on NO_X, VOC, CO, SO_2, and PM_{10} emission factors (on a per MMBtu basis) presented in Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. Emissions are summarized in **Air Quality Technical Report Table 3-3-1.**

1.3.1.2 PGE Commercial

Monthly natural gas consumption for all PGE commercial addresses associated with Stanford University were provided. PGE commercial accounts include addresses outside the study area, such as the Redwood City campus and Stanford-owned accounts as far away as Livermore and Monterey. All addresses are geocoded using Batchgeo[8] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE commercial accounts within the study area. The locations with commercial PGE accounts are shown in **Figure 1-3-1.** The total gas consumption is the sum of the gas consumption from each of these addresses.

The resulting energy use (in MMBtu) are converted to criteria pollutant emissions. Emissions are calculated based on NO_X, VOC, CO, SO_2, and PM_{10} emission factors (on a per MMBtu basis) presented in Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. Emissions are summarized in **Air Quality Technical Report Table 3-3-1.**

[7] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

[8] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

1.3.1.3 PGE Other Housing

Natural gas consumption and emissions from the private faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions, which are included in the study area, are estimated using CalEEMod® default assumptions. CalEEMod® can be used to estimate CAPs from buildings from natural gas use. CalEEMod® defaults are used to calculate the residential energy use, with the assumption that the average faculty/staff unit uses a similar amount of natural gas as a single-family home built to 2008 Title 24 standards in Santa Clara County.

The resulting energy use (in MMBtu) is converted to criteria pollutant emissions. Emissions are calculated based on NO_X, VOC, CO, SO_2, and PM_{10} emission factors (on a per MMBtu basis) presented in Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. Emissions are summarized in **Air Quality Technical Report Table 3-4-1.**

1.3.1.4 Cardinal Cogen

The Cardinal Cogen emitted criteria pollutants through combustion of natural gas. Emissions are summarized in **Air Quality Technical Report Table 3-4-2.**

1.3.1.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **Air Quality Technical Report Tables 3-4-1** and **3-4-2**.

1.3.2 Mobile Sources

Criteria pollutant emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford. The types of emissions processes contributing to criteria pollutant emissions include running exhaust emissions, idle exhaust emissions, start exhaust tailpipe emissions, diurnal evaporative hydrocarbon emissions, resting evaporative losses, hot soak evaporative hydrocarbon emissions, running loss evaporative hydrocarbon emissions, tire wear particulate matter emissions, and brake wear particulate matter emissions. Running exhaust, tire wear particulate matter, and brake wear particulate emissions are dependent on VMT. Starting exhaust, hot soak evaporative, and running loss evaporative emissions are dependent on the number of starts or trips that a vehicle makes. Idle exhaust, resting evaporative, and diurnal evaporative emissions are dependent on the number vehicles. Assumptions and calculations used to determine these values are described below. Ramboll Environ estimated trip rates and trip length information specified by Fehr & Peers as described in **SB 743 VMT Analysis Appendix A**, with the exception of the on-campus fleet, for which Stanford provided data.

The criteria pollutant emission factors for the emission processes mentioned above were generated with the most recently approved version of ARB's EMission FACtor model (EMFAC2014), approved by the USEPA on December 14, 2015. This version reflects the emissions benefits of ARB's recent rulemakings including on-road diesel fleet rules, and Pavley Clean Car Standards.[9] The model also includes updated information on California's car and truck fleets and travel activity. Mobile emissions were estimated for the following

[9] Assembly Bill 1493 ("the Pavley Standard" or AB 1493) required ARB to, among other things, adopt regulations by January 1, 2005, to reduce GHG emissions from non-commercial passenger vehicles and light duty trucks of model year 2009 through 2016. More information is available online at: http://www.arb.ca.gov/cc/ccms/ccms.htm.

pollutants: reactive organic gas (ROG), CO, NO_X, PM_{10}, particulate matter less than 2.5 µm in diameter ($PM_{2.5}$), sulfur oxide. Detailed emission factor calculations and fleet breakdowns are shown in **Air Quality Technical Report Appendix C.**

1.3.2.1 Off-campus (Worker) Trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix A**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **Air Quality Technical Report Table 3-4-6**.

1.3.2.2 On-campus (Resident) trips

Fehr & Peers calculated on-campus trips and VMT associated with workers or residents who travel from campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix A**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **Air Quality Technical Report Table 3-4-6**.

1.3.2.3 Campus fleet: On-road

Stanford-owned on-road vehicles can be split into the following fleets: Bonair fueling station fleet, Peninsula Sanitary Service, Inc. (PSSI) fleet, Marguerite shuttle/buses, and Public Safety vehicles. Methodologies used for estimating emissions from each fleet are described in the sections below.

Bonair Fueling Station Fleet

Stanford provided a vehicles list with annual fuel totals for each vehicle using the Bonair fuel station for refueling. This list of vehicles was filtered using keywords to generate four major categories of vehicles: light passenger/mid-duty, buses, off-road/landscaping equipment, and light towers/generators. Stanford also provided additional "off-ledger" fuel totals that include gasoline and diesel purchases made outside the Bonair fueling station but used to fuel the campus fleet. This off-ledger fuel usage was added to the Bonair fuel totals to calculate GHG emissions. Annual fuel usage was converted to annual VMT using ARB's EMission FACtor model (EMFAC2014) average miles per gallons based on the specific vehicle category. Vehicle miles traveled, number of vehicles, and an assumed trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) were used to calculate emissions. Fuel usage from off-road equipment and light towers/generators was converted to brake horsepower-hour (bhp-hr) in order to calculate emissions. More detail on off-road vehicle estimates can be found in Section 1.3.2.4.

PSSI Fleet

Peninsula Sanitary Service, Inc. (PSSI) operates an aboveground diesel storage tank within the Bonair fuel station service yard to fuel its own fleet of recycling, compost, and garbage collection and hauling trucks, as well as some light duty company vehicles. Stanford provided fuel usage and fleet size for this fleet as well as an estimate of the trip length and frequency for the collection trucks. To estimate emissions, the fleet was split into larger hauling trucks and light duty company vehicles. Based on communication with Stanford, large trucks were assumed to travel 4 one-way 52-mile trips per day to the end-use facility plus the default trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) for collection. This information was used to estimate annual VMT and estimate emissions using ARB's EMission FACtor model (EMFAC2014). Only fuel usage information was available for the light duty company vehicle fleet, so annual fuel usage was converted to annual VMT

using ARB's EMission FACtor model (EMFAC2014) average miles per gallons for light duty diesel vehicles. Vehicle miles traveled, number of vehicles, and an assumed trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) were used to calculate emissions.

Marguerite Bus/Shuttle Fleet

Stanford provided detailed data on vehicles and mileage traveled for each vehicle in this fleet. Emissions were estimated for each bus and shuttle individually based on the vehicle classification, model year, fuel type, total VMT, and a fleet average trip length. Some routes never cross into the study area, so the VMT for the entire fleet was adjusted to remove mileage from routes that never cross into the boundary. Only brake and tire wear particulate matter emissions were estimated for electric buses. Hybrid bus fuel efficiency is 33% greater than that of a normal bus so VMT for hybrid buses was reduced by 33% to account for the higher fuel efficiency.[10,11] By calculating emissions for each vehicle individually, future changes in the Marguerite fleet can be easily incorporated.

Public Safety Fleet

Stanford provided total VMT (cumulative for all vehicles in the fleet) and the total number of vehicles. Criteria pollutant emissions were calculated using the data provided and an assumed fleet population of light duty vehicles and trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County).

1.3.2.4 Campus fleet: Off-road

Off-road equipment, including landscaping equipment and light towers/generators is also fueled at the Bonair fueling station. Annual fuel totals for the off-road equipment were used to estimate total bhp-hr using conversion factors that originate from the USEPA Nonroad Engine and Vehicle Emission Study. CalEEMod® off-road emission factors for the represented equipment type category were used to estimate criteria pollutant emissions.

Additionally, although the Stanford golf course (and fuel tanks at the golf course) is located outside of the study area boundary, some of the off-road equipment that fuel at the golf course also service parts of the campus within the study area boundary. To be conservative, emissions were included from equipment activity at the Siebel Varsity Golf Training Complex and Red Barn, which are both within the study area boundary. Equipment activity occurring in these two areas was estimated from a location-based allocation of total fuel usage from the golf course fuel tanks, provided by Stanford. Emissions were estimated using this annual fuel consumption estimate provided by Stanford to estimate total bhp-hr using conversion factors that originate from the USEPA Nonroad Engine and Vehicle Emission Study. CalEEMod® off-road emission factors for the represented equipment type category were used to estimate criteria pollutant emissions.

1.3.2.5 Visitors

Ramboll Environ calculated the trips and VMT associated with various types of campus visitors based on Stanford-specific information and assumptions. These visitor categories are divided below on whether they represent regular weekday trips or one-time weekend trips to

[10] Duluth Transit Authority, 2016. http://www.duluthtransit.com/green/hybrid

[11] Iowa State University Institute for Transportation, 2012. Assessing the Costs for Hybrid versus Regular Transit Buses. http://www.intercitytransit.com/SiteCollectionDocuments/HybridFactSheet20120802.pdf

allow a determination of whether they should be considered in the total weekday cordon count.

- One-time visitor events primarily on weekends include the following types of events:
- Athletic events
- Milestone events (Graduation, Parent's Weekend, Homecoming, etc.)
- Camps
- Stanford Live performances

Frequent visitor trips that happen throughout the year include the following categories:

- Alumni center
- Conferences
- Walking tours
- Tour bus visitors
- Executive education

Emissions are shown in **Air Quality Technical Report Table 3-4-6.** VMT data and trip assumptions are shown in Fehr & Peers **SB 743 VMT Analysis Appendix A**.

1.3.2.6 Vendors

Vendor trips include deliveries and other commercial-nonwork visitors not described above. Fehr & Peers estimated the number of vendor trips as described in **SB 743 VMT Analysis Appendix A**. Emissions are shown in **Air Quality Technical Report Table 3-4-6.**

1.3.2.7 Emissions Summary

Mobile emissions are summarized in **Air Quality Technical Report Table 3-4-6.**

1.3.3 Emergency Generators

A list of campus-wide emergency generators along with their Bay Area Air Quality Management District (BAAQMD) Source ID, year, engine rating, and actual non-emergency and emergency run hours in 2014 was provided by Stanford. There are three generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.

Criteria pollutant emissions are calculated by multiplying the engine rating, hours of operation, and emission factors for NO_x, CO, POC, SO_2, and PM_{10}. Emissions are shown in **Air Quality Technical Report Table 3-4-10.**

1.3.4 Laboratories

A single estimate of laboratory emissions is prepared to represent the 2014 and 2015 inventories, since it is assumed laboratory operations do not change significantly between these years. Laboratory emissions are estimated for 93 chemicals, the list of which was approved in BAAQMD protocols and provided by Stanford in a 2001 chemical inventory. Chemicals include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments. The objective of the chemicals of potential concern selection methodology was to consider the comprehensive list of chemicals used in normal operations at the laboratories and to

identify those chemicals that have the potential to contribute at least 90 to 95 percent of the estimated risk for the building. ROG emissions are calculated based on the chemical type and volatility, as shown in **Air Quality Technical Report Table 3-4-12.**

Detailed chemical inventory data was not available for all laboratories on campus. To estimate usage across all labs, Ramboll Environ derived a representative chemical usage per fume hood based on a 2001 chemical inventory provided by Stanford for the ChemBio building, and then scaled this usage by the total number of fume hoods assumed to contain the chemical in 2015. For any chemical that was not present in the 2001 inventory, usage per fume hood was estimated from the largest of four laboratory buildings. Detailed 2015 chemical inventory information was provided for four buildings that contain the bulk of the large laboratories, including the Lokey Laboratory Building (ChemBio), the Shriram Center (BioE/ChemE), Mudd (Seeley G) Chemistry, and the Environment and Energy building. The same methodology as used in the 2001 inventory is used to develop estimates for annual usage of each chemical for the four laboratory buildings listed above. To develop these estimates, Ramboll Environ assumed the quantity of each chemical in the inventory snapshot represents a one-month supply of the chemical, plus adds an extra 10% buffer for any reporting errors in the inventory. Archival chemicals that are used only very rarely (ethylene dibromide and hexachlorobenzene) are assumed to be used over the course of the year. These usage estimates are conservative, as laboratory questionnaires have indicated that actual annual usage of most chemicals is lower than assumed with the scaling methodology above.

Using this methodology, an estimated representative usage is established for each of the 93 chemicals. The estimated usage per fume hood of a chemical is derived from the 2001 inventory (as this is the most complete inventory), but if the 2001 inventory did not report usage of that chemical, usage is based on one of the other four laboratory buildings in 2015; for example, if the Lokey Laboratory uses a particular chemical, that quantity is used to develop the chemical usage metric. If Lokey Laboratory does not have that chemical, the quantity for the ChemBio study is used, then Shriram, then Mudd, then Environment and Energy. This methodology ensures that each of the 93 chemicals is represented in the inventory and can be scaled up for future inventories.

To estimate the chemical usage across all labs on campus, the representative usage described above is multiplied by the total fume hoods on campus expected to contain the chemical. Stanford provided a list of 51 campus laboratories, including the number of fume hoods and net wet laboratory square footage. SmartMart chemical purchasing records were provided for all of these campus laboratories for the first half of 2015. These records are then used to determine whether or not each laboratory contains a given chemical. This is an approximation, since the SmartMart procurement records do not contain all laboratory purchases. The TAC emissions are calculated by normalizing the representative usage to the number of fume hoods in the parent lab, multiplying by the number of total fume hoods in all laboratories on campus that purchased that chemical in the SmartMart data, then multiplying by an emission factor. Solids are assumed to emit 1%, liquids 5%, and gases 100%.

For example, the estimated usage for 1,3-butadiene is based on 101 lbs used in a month from the 2001 inventory. The 101 lbs is divided by 164 fume hoods for the Lokey Lab Building, multiplied by the 288 fume hoods that use this chemical, then multiplied by a 100% emission factor (because it is gas) to estimate emissions. This is used to calculate final

campus-wide TAC emissions of 177 lbs. ROG emissions are only estimated for chemicals identified as ROGs by the ARB.[12]

1.3.5 Fuel Stations

In 2014, two fuel stations existed on the Stanford campus: the Valero fuel station and the Bonair fuel station. The Valero fuel station was accessible to the public while the Bonair fuel station is used to fuel campus vehicles. Evaporative VOC emissions from gasoline fueling were estimated using the annual gasoline throughput provided by Stanford for all fueling stations and a VOC emission factor from the source specific guidance for gasoline dispensing facilities from BAAQMD Permit Handbook.[13] VOC emissions from the fueling stations are shown in **Air Quality Technical Report Table 3-4-16.**

1.3.6 Emissions Summary

A summary of emissions from the 2014 inventory are shown in **Air Quality Technical Report Table 3-1-1.**

1.4 Annual Operational Emissions: 2015

1.4.1 Natural Gas

The emission factors for natural gas usage are from the same source as described in the 2015 calculations.

1.4.1.1 PGE Residential

The same methodology is used as that for the 2014 inventory, except usage data from July through December 2015 is doubled to represent the 2015 natural gas consumption. The locations of PGE residential gas accounts for the 2015 inventory, which are slightly different than for 2014 inventory are shown in **Figure 1-4-1**. Emissions are summarized in **Air Quality Technical Report Table 3-4-3.**

1.4.1.2 PGE Commercial

The same methodology is used as that for the 2014 inventory, except data from July through December 2015 is doubled to represent the 2015 natural gas consumption. The individual replacement boilers are included in the PGE commercial invoices. The locations of PGE commercial gas accounts for the 2015 inventory, which are slightly different than for the 2014 inventory are shown in **Figure 1-4-1**. Emissions are summarized in **Air Quality Technical Report Table 3-4-3.**

1.4.1.3 PGE, Other Housing

The same methodology is used as that for the 2014 inventory, with CalEEMod® assumptions for the number of single-family homes and gas consumption per home remaining constant. Emissions are summarized in **Air Quality Technical Report Table 3-4-3.**

1.4.1.4 New CEF and Replacement Process Steam Plant

Natural gas throughputs were provided for the hot water generators of the new Central Energy Facility (CEF) and Replacement Process Steam Plant. This natural gas usage served

[12] ARB. 2009. Definitions of VOC and ROG. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf. Accessed: July 2016.

[13] BAAQMD. Engineering Division Permit Handbook. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en

as a replacement to the natural gas usage from the Cardinal Cogen in 2014. Throughput from July through December 2015 is doubled to represent the 2015 natural gas consumption. Emissions are summarized in **Air Quality Technical Report Table 3-4-3.**

1.4.1.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **Air Quality Technical Report Table 3-4-3**.

1.4.2 Mobile Sources

The same methodology is used as that for the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-7.**

1.4.3 Emergency Generators

The same methodology is used as that for the 2014 inventory (that uses 2014 data), except 2015 actual hours of operation are used and certain generators are added or retired. Emissions are summarized in **Air Quality Technical Report Table 3-4-11.**

1.4.4 Laboratories

No changes were made in laboratory emissions from the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-13.**

1.4.5 Fuel Stations

The same methodology is used as that for the 2014 inventory. The same throughput was assumed for 2015 as in 2014 for the Bonair and Valero fuel stations. Emissions are summarized in **Air Quality Technical Report Table 3-4-17.**

1.4.6 Emissions Summary

A summary of emissions from the 2015 inventory are shown in **Air Quality Technical Report Table 3-1-1.**

1.5 Annual Operational Emissions: Fall 2018

The Fall 2018 inventory is based on the assumption that the remaining 2000 GUP square footage is permitted by Fall 2018. The 2015 inventory emissions are based on all the buildings and residences constructed as of December 2015. The electricity, natural gas, and laboratory chemical consumption for Fall 2018 are assumed to increase proportionally with academic square footage or number of residential beds, depending on sub-category. The mobile emissions are updated to account for fleet turnover and changes in VMT as described in **SB 743 VMT Analysis Appendix B** prepared by Fehr & Peers.

1.5.1 Natural Gas

1.5.1.1 PGE Residential

Natural gas usage for Fall 2018 is based on the ratio of natural gas usage per bed in 2015, scaled for the increase in beds from new graduate and undergraduate housing projects by 2018 (8%). Natural gas will be used for purposes such as water heating and laundry for these housing projects, so it is assumed that the amount of gas per bed remains constant. This natural gas consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings. Natural gas consumption and scaling ratios are summarized in **Air Quality Technical Report Table 3-4-4.**

1.5.1.2 PGE Commercial

Natural gas usage for Fall 2018 is based on the ratio of natural gas usage to built-and-occupied academic GUP square footage by December 2015, scaled by the remaining GUP square footage allocation to be used by 2018. Six individual replacement boilers included in the 2015 inventory serve select locations that do not connect to the new CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Natural gas consumption and scaling ratios are summarized in **Air Quality Technical Report Table 3-4-4.**

1.5.1.3 PGE, Other Housing

The same methodology is used as that for the 2014 and 2015 inventories, with CalEEMod® assumptions for the number of single-family homes and gas consumption per home remaining constant. Emissions are summarized in **Air Quality Technical Report Table 3-4-4.**

1.5.1.4 New CEF and Replacement Process Steam Plant

The same methodology is used as that for the 2015 inventory. The throughputs for the new CEF and the Process Steam Plant are expected to linearly increase based on the total academic square footage increase by 2018. Emissions are summarized in **Air Quality Technical Report Table 3-4-4.**

1.5.1.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **Air Quality Technical Report Table 3-4-4.**

1.5.2 Mobile Sources

1.5.2.1 Off-Campus (Worker) and On-Campus (Resident) Trips

Number of trips and VMT for workers and residents are scaled up for Fall 2018 based on scaled values provided by Fehr & Peers. Values are scaled by increase in academic square footage or number of residents (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix B**. The methodology used to estimate emissions remained unchanged from the 2015 inventory.

1.5.2.2 Campus Fleet

No changes will be made to emissions estimates for the Public Safety fleets from the 2015 inventory. The 10 oldest vehicles from the Marguerite fleet will be replaced with electric vehicles by Fall 2018, so only tire and brake wear particulate matter emissions will be considered from those 10 vehicles. Additionally, to accommodate for growth, Marguerite VMT was scaled up by the remaining GUP square footage allocation to be used by 2018. The Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, reducing the mileage that the fleet drives. This reduction program is assumed to reduce VMT from Bonair vehicles by 5%. Emission factors for operational year 2018 are used. Emissions are summarized in **Air Quality Technical Report Table 3-4-8**.

1.5.2.3 Visitors

Only those visitor trip categories expected to change with increased academic square footage or population are scaled up for Fall 2018, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by

increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix B**.

1.5.3 Emergency Generators

Emissions from emergency generators are assumed to scale linearly with the increase in academic square footage by Fall 2018 (8% increase). Emissions are summarized in **Air Quality Technical Report Table 3-4-12.**

1.5.4 Laboratories

Laboratory emissions are assumed to increase proportionally with total academic square footage increase from December 2015 to 2018, approximately 8%. Research laboratories constituted approximately 20% of Stanford academic space in 2015. Emissions are summarized in **Air Quality Technical Report Table 3-4-14.**

1.5.5 Fuel Stations

No changes were made to fuel station emissions since campus fleet VMT is assumed to remain constant. The same methodology is used as that for the 2015 inventory except that the Valero fuel station was removed because it is now closed. Emissions are summarized in **Air Quality Technical Report Table 3-4-18.**

1.5.6 Emissions Summary

Emissions from the Fall 2018 inventory are summarized in **Air Quality Technical Report Table 3-1-1.**

1.6 Annual Operational Emissions: Fall 2035 (Project) Inventory

1.6.1 Natural Gas

1.6.1.1 PGE Residential

Natural gas usage for Fall 2035 is scaled based on the percent increase in total number of student beds from Fall 2018 to full buildout of the 2018 GUP (an increase of 38%). Natural gas will be used for purposes such as water heating and laundry for these housing projects, so it is assumed that the amount of gas per bed remains constant. This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24. Natural gas consumption and scaling ratios are summarized in **Air Quality Technical Report Table 3-4-5.**

1.6.1.2 PGE Commercial

Natural gas usage for Fall 2035 is based on the percent increase in academic square footage from Fall 2018 to full buildout of the 2018 GUP (an increase of 22%). Six individual replacement boilers included in the 2018 inventory serve select locations that do not connect to the CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Natural gas consumption and scaling ratios are summarized in **Air Quality Technical Report Table 3-4-5.**

1.6.1.3 PGE, Other Housing

No changes in natural gas use were assumed for the Searsville/Olmstead housing units, which is estimated based on CalEEMod® default values for single family homes built to 2008 Title 24 standards in climate zone 4.

Five hundred fifty (550) new faculty/staff high density homes are to be constructed within the study boundary by 2030. The annual natural gas use is based on the CalEEMod® default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown in **Air Quality Technical Report Table 3-4-5**. This natural gas consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.

Emissions are summarized in **Air Quality Technical Report Table 3-4-5.**

1.6.1.4 CEF and Replacement Process Steam Plant

The throughput for the CEF hot water generators and the Process Steam Plant is expected to linearly increase based on the total academic square footage increase from Fall 2018 to full buildout of the 2018 GUP in 2035 (an increase of 22%). Emissions are summarized in **Air Quality Technical Report Table 3-4-5.**

1.6.1.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **Air Quality Technical Report Table 3-5-5.**

1.6.2 Mobile Sources

1.6.2.1 Off-Campus (Worker) and On-Campus (Resident) Trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus and on-campus trips and VMT associated with workers or residents who travel from campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix C**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **Air Quality Technical Report Table 3-4-9**. Detailed emission factors and fleet breakdowns are shown in **Air Quality Technical Report Appendix C.**

1.6.2.2 Campus Fleet

Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the 2018 inventory was assumed to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2018 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are estimated by scaling down emissions assuming only 30% non-electric vehicles contribute to emissions versus 60% contributing to emissions in 2018. Additionally, Stanford expects the entire Marguerite fleet to be electric vehicles by 2035. Although running emissions from the entire Marguerite fleet are assumed to be zero, the tire and brake wear particulate matter emissions are still incorporated into emissions estimates. Additionally, to accommodate for growth, Marguerite VMT is scaled up based on the percent increase in academic square footage from Fall 2018 to full buildout of the 2018 GUP (an increase of 22%). Emission factors for operational year 2030 are used for all campus fleet vehicles. Emissions are summarized in **Air Quality Technical Report Table 3-4-9**.

1.6.2.3 Visitors

Only those visitor trip categories expected to change with increased academic square footage and housing are scaled up for Fall 2035, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by

increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix C**.

1.6.3 Emergency Generators

Emergency generator emissions for Fall 2035 is based on the increase in academic square footage from Fall 2018 to the buildout of the 2018 GUP (a 22% increase). Emissions are summarized in **Air Quality Technical Report Table 3-4-13.**

1.6.4 Laboratories

Laboratory emissions are assumed to linearly increase based on the total academic square footage increase from Fall 2018 to full buildout of the 2018 GUP in 2035 (an increase of 22%). Research laboratories constituted approximately 20% of Stanford academic space in 2015. Emissions are summarized in **Air Quality Technical Report Table 3-4-15.**

1.6.5 Fuel Stations

Fuel station emissions are assumed to decrease by the growing number of electric vehicles that are part of the Stanford on-campus fleet. Seventy percent of the campus fleet is expected to be electric by 2035. Forty percent was electric by 2018, so the 2018 fuel consumption was assumed to represent the emissions for the 60% of the campus fleet that use internal combustion engines. Therefore, the fuel usage was scaled down by (1-40%)/(1-70%) since the remaining vehicles are assumed to use electricity. Emissions are summarized in **Air Quality Technical Report Table 3-4-19.**

1.6.6 Emissions Summary

Emissions from the Fall 2035 inventory are summarized in **Air Quality Technical Report Table 3-1-1.**

1.7 Criteria Pollutant Inventories in Context

This section compares the three existing conditions inventories and one Project inventory. A category-by-category comparison of emissions between the three existing conditions and Project inventory inventories is shown in **Air Quality Technical Report Table 3-1-1.**

2. TOXIC AIR CONTAMINANT EMISSIONS INVENTORIES

2.1 Construction Emissions

Construction activities also result in the emissions of DPM, a recognized TAC in California. Since DPM is conservatively assumed to be all PM_{10}, and PM_{10} is discussed and calculated in the CAP section, construction emissions are not further discussed here.

2.2 Annual Operational Emissions: 2014

2.2.1 Natural Gas

TACs were evaluated from natural gas sources within the study area. Benzene, formaldehyde, and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion. Emission factors originate from the BAAQMD Permit Handbook, Section 2.1: Miscellaneous Natural Gas Combustion.[14] TAC emissions from natural gas sources are summarized in **Air Quality Technical Report Table 4-1-2**.

2.2.2 Cardinal Cogen

BAAQMD 2015 Cardinal Cogen Criteria Air Pollutant Emissions presents annual average emissions in lbs/day for criteria pollutants in the 2014 calendar year.[15] Ramboll Environ assumed 365 days/year to calculate total annual emissions. TAC emissions from Cardinal Cogen are summarized in **Air Quality Technical Report Table 4-1-1**.

2.2.3 Mobile Sources

DPM, benzene, and 1,3-butadiene emissions were estimated from fuel combustion of mobile sources. BAAQMD California Environmental Quality Act Guidelines indicate that these three pollutants represent a substantial portion of the ambient background risk from TACs in the San Francisco Air Bay Area Air Basin.[16] DPM emissions were assumed to be equivalent to PM_{10} emissions from diesel-powered mobile sources. The methodology for calculating PM_{10} emissions are presented in Section 1.3.2. Benzene and 1,3-butadiene are components of ROG and total organic gas (TOG) emissions (presented in Section 1.3.2), so emissions from total ROG (for diesel mobile sources) or TOG emissions (for gasoline mobile sources) were speciated to determine the benzene and 1,3-butadiene emissions. Speciation percentages for benzene and 1,3-butadiene for gasoline exhaust are from the ARB Profile "OG2303",[17] for gasoline evaporation from ARB Profile "OG2315",[18] and for diesel exhaust from MOVES2007.[19] TAC emissions from mobile sources are summarized in **Air Quality Technical Report Table 4-1-6**.

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[14] BAAQMD. Engineering Division Permit Handbook. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en

[15] BAAQMD. Stationary Source Information Request for Plant #15128. Received on October 21st, 2015.

[16] BAAQMD California Environmental Quality Act: Air Quality Guidelines (Updated May 2012). http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/baaqmd-ceqa-guidelines_final_may-2012.pdf?la=en

[17] Organic Gas Speciation Profiles for Catalyzed Gasoline-Powered Vehicle Stabilized Running Exhaust—E6 Fuel (OG2303 & OG2304) Wenli Yang, PhD, PE Air Quality Planning and Science Division December 12, 2013

[18] Organic Gas Speciation Profile for Gasoline-Powered Vehicles Hot Soak Evaporations—E10 Summer Fuel (OG2315), Wenli Yang, PhD, PE, Air Quality Planning and Science Division, (1/28/2015)

[19] USEPA Motor Vehicle Emission Simulator (MOVES), Draft 2007. https://www3.epa.gov/otaq/models/ngm/movesdemo/420p07002.pdf

2.2.4 Emergency Generators

DPM emissions were assumed to be equivalent to PM_{10} emissions from emergency generators. Methodology for calculating PM_{10} emissions are presented in Section 1.3.3 and emissions can be found in **Air Quality Technical Report Table 3-4-10**, under PM_{10} emissions.

2.2.5 Laboratories

Emissions from laboratory chemicals for the 93 chemicals listed in the BAAQMD Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants were estimated using the methodology described in Section 1.3.4. TAC emissions from laboratories are summarized in **Air Quality Technical Report Table 3-4-12**.

2.2.6 Fuel Stations

ROG emissions estimated in Section 1.3.5 were speciated to assume that 0.3% of total emissions are benzene.[20] California Air Pollution Control Officers Association (CAPCOA) Gasoline Service Station Industrywide Risk Assessment Guidelines state that benzene is the most important substance driving risk and therefore only provides information on speciation of benzene in gasoline vapor.[21] TAC emissions from fuel stations are summarized in **Air Quality Technical Report Table 4-2.**

2.3 Annual Operational Emissions: 2015

2.3.1 New CEF, Replacement Process Steam Plant, and Boilers

TACs were evaluated from natural gas sources within the study area. Benzene, formaldehyde, and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion. Emission factors originate from the BAAQMD Permit Handbook, Section 2.1: Miscellaneous Natural Gas Combustion.[22] TAC emissions from natural gas sources are summarized in **Air Quality Technical Report Table 4-1-3**.

2.3.2 Mobile Sources

The same emission factors and methodology were used as in the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 4-1-7**.

2.3.3 Emergency Generators

The same emission factors and methodology were used as in the 2014 inventory (that uses 2014 data), except 2015 actual hours of operation are used and certain generators are added or retired. Emissions are summarized in **Air Quality Technical Report Table 3-4-11.**

2.3.4 Laboratories

The same emission factors and methodology were used as in the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-13**.

[20] Speciation from Table 1 in CAPCOA Air Toxics "Hot Spots" Program: Gasoline Service Station Industrywide Risk Assessment Guidelines. http://www.arb.ca.gov/ab2588/rrap-iwra/gasiwra.pdf

[21] CAPCOA. 1997. Air Toxics "Hot Spots" Program. Gasoline Service Station Industrywide Risk Assessment Accessed July 8, 2016. Guidelines. http://www.arb.ca.gov/ab2588/rrap-iwra/gasiwra.pdf

[22] BAAQMD. Engineering Division Permit Handbook. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en

2.3.5 Fuel Stations

The same emission factors and methodology were used as in the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 4-2**.

2.4 Annual Operational Emissions: Fall 2018

2.4.1 New CEF, Replacement Process Steam Plant, and Boilers

The same methodology is used as that for the 2015 inventory. The throughputs for the hot water generators of the new CEF, Process Steam Plant, and boilers are expected to increase proportionally with the total academic square footage increase by 2018. Emissions are summarized in **Air Quality Technical Report Table 4-1-4.**

2.4.2 Mobile Sources

No changes will be made to emissions estimates for the Public Safety fleets from the 2015 inventory. The 10 oldest vehicles from the Marguerite fleet will be electric by Fall 2018, so only tire and brake wear particulate matter emissions will be considered from those 10 vehicles. The Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, while reducing the total number of vehicles. This fleet reduction program is assumed to reduce emissions from Bonair vehicles by 5%. Emission factors for operational year 2018 are used. Emissions are summarized in **Air Quality Technical Report Table 4-1-8**.

2.4.3 Emergency Generators

Emissions from emergency generators are assumed to scale linearly with the increase in academic square footage by Fall 2018 (8% increase). Emissions are summarized in **Air Quality Technical Report Table 3-4-12.**

2.4.4 Laboratories

Laboratory emissions are assumed to increase proportionally with total academic square footage increase from December 2015 to 2018, approximately 8%. Research laboratories constituted approximately 20% of Stanford academic space in 2015, and this percentage is assumed to hold constant in 2018. Emissions estimates are shown in **Air Quality Technical Report Table 3-4-14**.

2.4.5 Fuel Stations

The same emission factors and methodology were used as in the 2015 inventory. Emissions are summarized in **Air Quality Technical Report Table 4-2**.

2.5 Annual Operational Emissions: Fall 2035 (Project)

2.5.1 Natural Gas

Throughputs for the hot water generators of the CEF, Process Steam Plant, and boilers are expected to increase proportionally with the total academic square footage increase by 2035. Six individual replacement boilers included in the 2018 inventory serve select locations that do not connect to the CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Residential natural gas usage for Fall 2035 is scaled based on the percent increase in total number of student beds from Fall 2018 to full buildout of the 2018 GUP (an increase of 38%). Emissions are summarized in **Air Quality Technical Report Table 4-1-5.**

2.5.2 Mobile Sources

2.5.2.1 Off-Campus (Worker) and On-Campus (Resident) Trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus and on-campus trips and VMT associated with workers or residents who travel from campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix C**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **Air Quality Technical Report Table 3-4-9**. Detailed emission factors and fleet breakdowns are shown in **Air Quality Technical Report Appendix C.** The same speciation percentages are used as in the 2018 inventory.

2.5.2.2 Campus Fleet

Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the 2018 inventory was assumed to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2018 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are scaled down assuming only 30% non-electric vehicles contribute to emissions versus 60% in 2018. Emission factors for operational year 2030 are used for all campus fleet vehicles. The same speciation percentages are used as in the 2018 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-9**.

2.5.2.3 Visitors

Only those visitor trip categories expected to change with increased academic square footage and housing are scaled up for Fall 2035, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix C**. The same speciation percentages are used as in the 2018 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-9**.

2.5.3 Emergency Generators

Emergency generator emissions for Fall 2035 is based on the increase in academic square footage from Fall 2018 to the buildout of the 2018 GUP (a 22% increase). All PM_{10} emissions are assumed to be DPM. Emissions are summarized in **Air Quality Technical Report Table 3-4-13.**

2.5.4 Laboratories

Laboratory emissions are assumed to increase proportionally with total academic square footage increase from Fall 2018 to the buildout of the 2018 GUP (a 22% increase). Research laboratories constituted approximately 20% of Stanford academic space in 2015, and this percentage is assumed to hold constant in 2035. Emissions estimates are shown in **Air Quality Technical Report Table 3-4-15**.

2.5.5 Fuel Stations

Fuel station emissions are assumed to decrease by the growing number of electric vehicles that are part of the Stanford on-campus fleet. Seventy percent of the campus fleet is expected to be electric by 2035. Forty percent was electric by 2018, so the 2018 fuel consumption was assumed to represent the emissions for the 60% of the campus fleet that use internal combustion engines. Therefore, the fuel usage was scaled down by (1-40%)/(1-70%) since the remaining vehicles are assumed to use electricity. The same speciation

percentages and methodology were used as in the 2018 inventory. Emissions are summarized in **Air Quality Technical Report Table 4-2**.

2.6 Toxic Air Contaminant Inventories

A summary of TAC emissions for the 2014, 2015, Fall 2018, and Fall 2035 inventories can be found in **Air Quality Technical Report Table 4-2**.

FIGURES

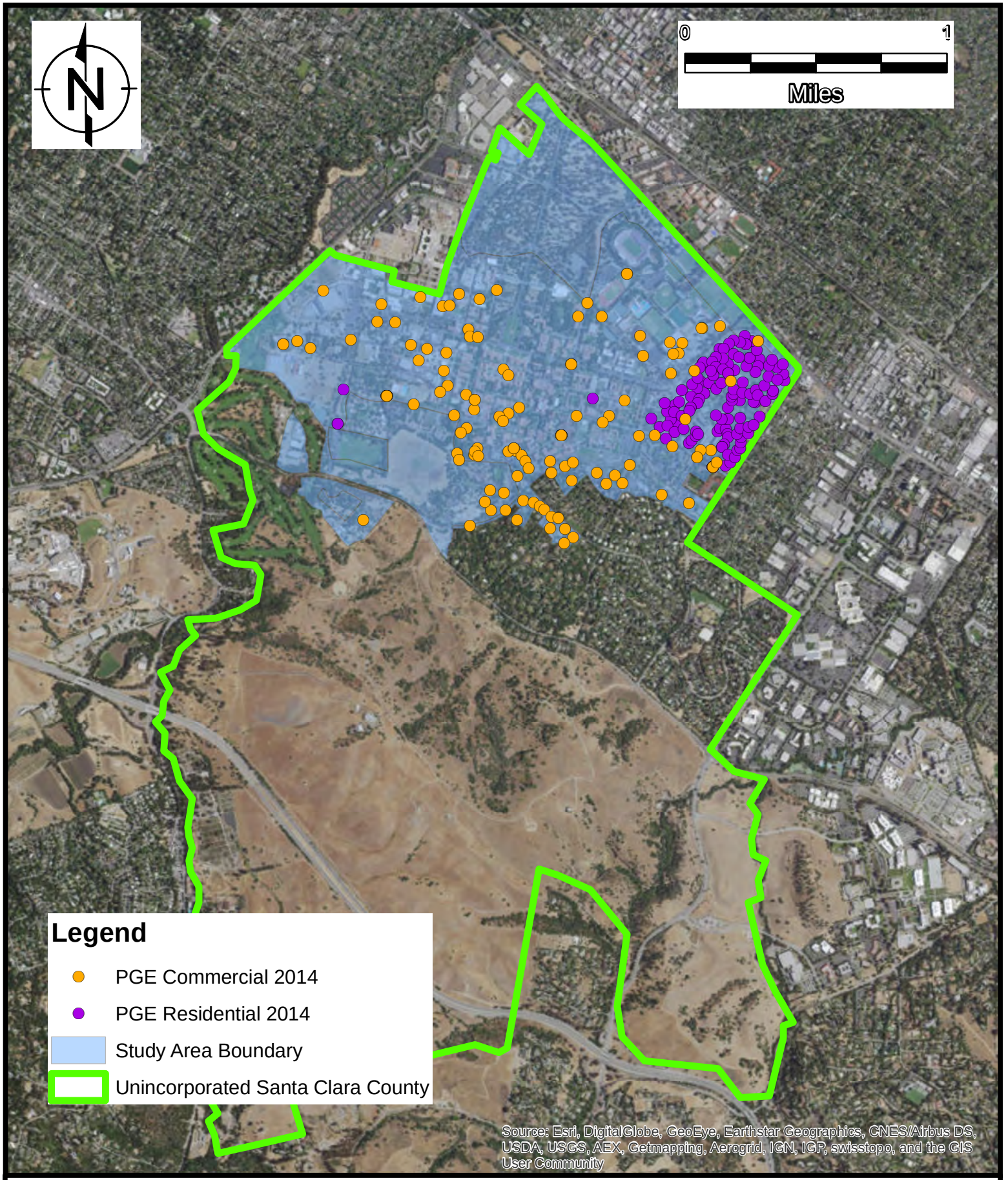

Figure 1-3-1 2014 Natural Gas Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

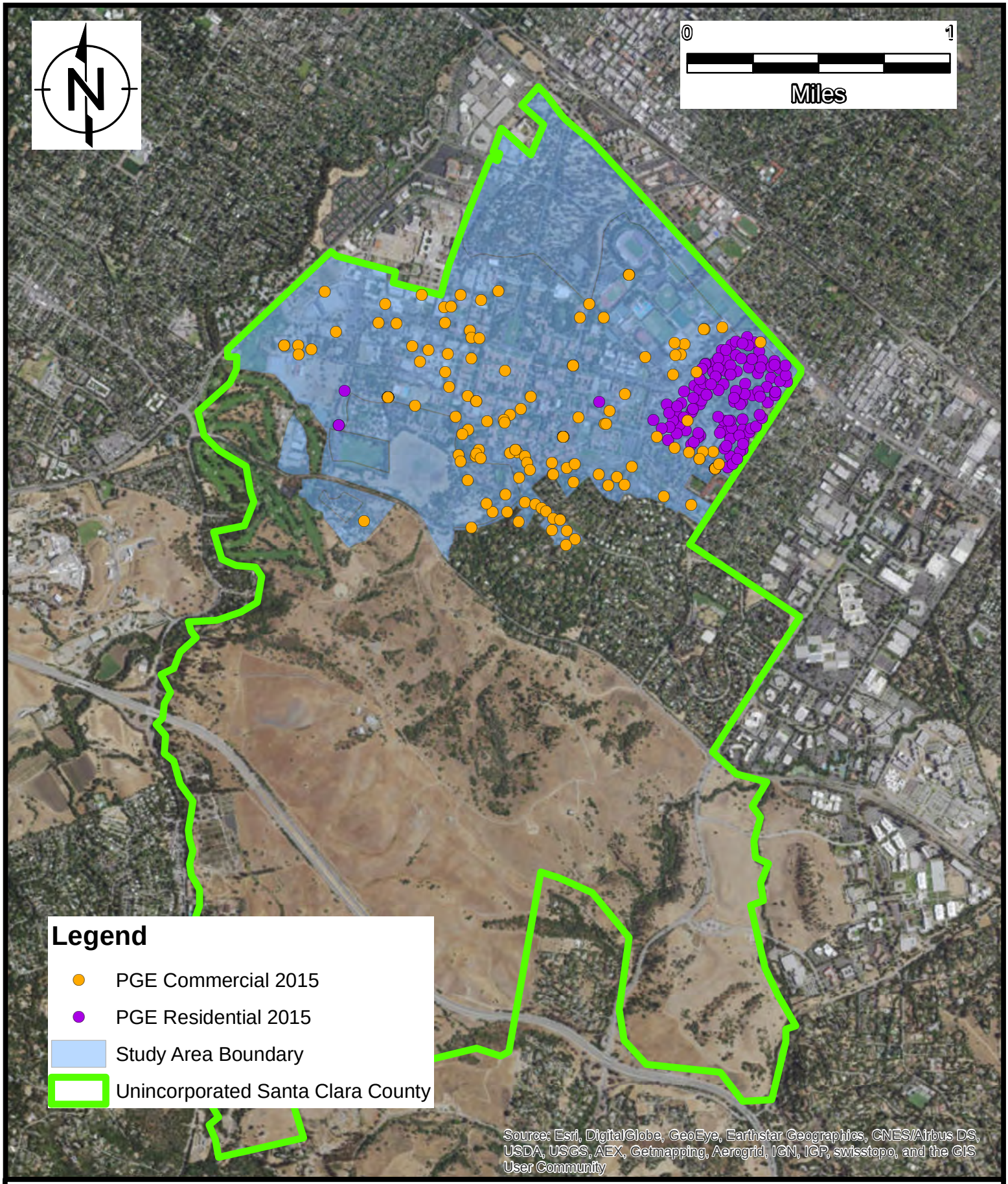

Figure 1-4-1 2015 Natural Gas Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

APPENDIX B
CALEEMOD® CONSTRUCTION OUTPUT FILES

Table B-1. CalEEMod® Model Outputs Descriptions
Stanford University
Stanford, California

Construction CalEEMod® Runs	
Output	**Scenario**
2014 Average Output	2014 Annual Average Off-Road Construction Emissions
2015 Average Output	2015 Annual Average Off-Road Construction Emissions
2018 Average Output	2018 Annual Average Off-Road Construction Emissions
2030 Average Output	2030 Annual Average Off-Road Construction Emissions
2018 Peak Output	2018 Peak Construction Emissions
2023 Peak Output	2023 Peak Construction Emissions

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel

Stanford Construction/Demolition, Average Year (2014)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2014
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2014. Made schedule fit in 1 year

Trips and VMT - Worker/vendor trips already captured in other mobile emissions calcs. - Hauling trips also captured in mobile emission calcs

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	5/6/2014	12/31/2014
tblConstructionPhase	PhaseEndDate	1/13/2015	12/31/2014
tblConstructionPhase	PhaseEndDate	1/14/2015	3/11/2014
tblConstructionPhase	PhaseStartDate	4/9/2014	12/4/2014
tblConstructionPhase	PhaseStartDate	2/26/2014	2/13/2014
tblConstructionPhase	PhaseStartDate	1/1/2015	2/26/2014

tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Year	tons/yr										MT/yr					
2014	1.7598	5.0773	3.1910	4.2300e-003	0.1841	0.3379	0.5220	0.0876	0.3168	0.4045	0.0000	391.9506	391.9506	0.1028	0.0000	394.1099
Total	**1.7598**	**5.0773**	**3.1910**	**4.2300e-003**	**0.1841**	**0.3379**	**0.5220**	**0.0876**	**0.3168**	**0.4045**	**0.0000**	**391.9506**	**391.9506**	**0.1028**	**0.0000**	**394.1099**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.2552	0.6161	2.7110	4.2300e-003	0.1841	0.0249	0.2090	0.0876	0.0237	0.1113	0.0000	391.9502	391.9502	0.1028	0.0000	394.1095
Total	**1.2552**	**0.6161**	**2.7110**	**4.2300e-003**	**0.1841**	**0.0249**	**0.2090**	**0.0876**	**0.0237**	**0.1113**	**0.0000**	**391.9502**	**391.9502**	**0.1028**	**0.0000**	**394.1095**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**28.67**	**87.87**	**15.04**	**0.00**	**0.00**	**92.64**	**59.96**	**0.00**	**92.51**	**72.48**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Area	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2014	1/28/2014	5	20	
2	Paving	Paving	1/29/2014	2/25/2014	5	20	
3	Building Construction	Building Construction	2/13/2014	12/31/2014	5	230	
4	Site Preparation	Site Preparation	2/26/2014	3/11/2014	5	10	
5	Grading	Grading	3/12/2014	4/8/2014	5	20	
6	Architectural Coating	Architectural Coating	12/4/2014	12/31/2014	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0460	0.4954	0.3629	4.0000e-004		0.0253	0.0253		0.0236	0.0236	0.0000	37.7760	37.7760	0.0102	0.0000	37.9903

Total	**0.0460**	**0.4954**	**0.3629**	**4.0000e-004**	**0.0248**	**0.0253**	**0.0500**	**3.7500e-003**	**0.0236**	**0.0273**	**0.0000**	**37.7760**	**37.7760**	**0.0102**	**0.0000**	**37.9903**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0119	0.0716	0.2380	4.0000e-004		4.8500e-003	4.8500e-003		4.8500e-003	4.8500e-003	0.0000	37.7759	37.7759	0.0102	0.0000	37.9903
Total	**0.0119**	**0.0716**	**0.2380**	**4.0000e-004**	**0.0248**	**4.8500e-003**	**0.0296**	**3.7500e-003**	**4.8500e-003**	**8.6000e-003**	**0.0000**	**37.7759**	**37.7759**	**0.0102**	**0.0000**	**37.9903**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.2609	0.1497	2.2000e-004		0.0145	0.0145		0.0134	0.0134	0.0000	21.4412	21.4412	6.3400e-003	0.0000	21.5743
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0236**	**0.2609**	**0.1497**	**2.2000e-004**		**0.0145**	**0.0145**		**0.0134**	**0.0134**	**0.0000**	**21.4412**	**21.4412**	**6.3400e-003**	**0.0000**	**21.5743**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.2609	0.1497	2.2000e-004		0.0145	0.0145		0.0134	0.0134	0.0000	21.4412	21.4412	6.3400e-003	0.0000	21.5743
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0236**	**0.2609**	**0.1497**	**2.2000e-004**		**0.0145**	**0.0145**		**0.0134**	**0.0134**	**0.0000**	**21.4412**	**21.4412**	**6.3400e-003**	**0.0000**	**21.5743**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4448	3.5942	2.1769	3.0900e-003		0.2562	0.2562		0.2412	0.2412	0.0000	282.6403	282.6403	0.0719	0.0000	284.1495
Total	**0.4448**	**3.5942**	**2.1769**	**3.0900e-003**		**0.2562**	**0.2562**		**0.2412**	**0.2412**	**0.0000**	**282.6403**	**282.6403**	**0.0719**	**0.0000**	**284.1495**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0900e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	282.6400	282.6400	0.0719	0.0000	284.1492
Total	**0.0376**	**0.2563**	**2.0023**	**3.0900e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**282.6400**	**282.6400**	**0.0719**	**0.0000**	**284.1492**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Site Preparation - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2881	0.2148	2.0000e-004		0.0157	0.0157		0.0144	0.0144	0.0000	18.8508	18.8508	5.5700e-003	0.0000	18.9678
Total	**0.0265**	**0.2881**	**0.2148**	**2.0000e-004**	**0.0903**	**0.0157**	**0.1060**	**0.0497**	**0.0144**	**0.0641**	**0.0000**	**18.8508**	**18.8508**	**5.5700e-003**	**0.0000**	**18.9678**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	18.8508	18.8508	5.5700e-003	0.0000	18.9678
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**18.8508**	**18.8508**	**5.5700e-003**	**0.0000**	**18.9678**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0387	0.4110	0.2675	3.0000e-004		0.0237	0.0237		0.0218	0.0218	0.0000	28.6891	28.6891	8.4800e-003	0.0000	28.8671
Total	**0.0387**	**0.4110**	**0.2675**	**3.0000e-004**	**0.0690**	**0.0237**	**0.0927**	**0.0342**	**0.0218**	**0.0560**	**0.0000**	**28.6891**	**28.6891**	**8.4800e-003**	**0.0000**	**28.8671**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	28.6890	28.6890	8.4800e-003	0.0000	28.8671
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**28.6890**	**28.6890**	**8.4800e-003**	**0.0000**	**28.8671**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.4600e-003	0.0278	0.0192	3.0000e-005		2.4500e-003	2.4500e-003		2.4500e-003	2.4500e-003	0.0000	2.5533	2.5533	3.6000e-004	0.0000	2.5609
Total	**1.1803**	**0.0278**	**0.0192**	**3.0000e-005**		**2.4500e-003**	**2.4500e-003**		**2.4500e-003**	**2.4500e-003**	**0.0000**	**2.5533**	**2.5533**	**3.6000e-004**	**0.0000**	**2.5609**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	3.6000e-004	0.0000	2.5609
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**3.6000e-004**	**0.0000**	**2.5609**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-...	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552333	0.058138	0.185246	0.125281	0.029961	0.004506	0.012317	0.020953	0.001764	0.001280	0.005920	0.000536	0.001765

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Unmitigated	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.2000e-004	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.2000e-004	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e

Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000

Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2015)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2015
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2015. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido.

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/26/2016	12/29/2015
tblConstructionPhase	PhaseEndDate	1/26/2016	12/29/2015
tblConstructionPhase	PhaseEndDate	1/28/2015	1/27/2015
tblConstructionPhase	PhaseEndDate	2/24/2015	2/23/2015
tblConstructionPhase	PhaseEndDate	3/9/2015	2/10/2015
tblConstructionPhase	PhaseStartDate	12/30/2015	12/2/2015
tblConstructionPhase	PhaseStartDate	3/11/2015	2/11/2015
tblConstructionPhase	PhaseStartDate	1/28/2015	1/27/2015
tblConstructionPhase	PhaseStartDate	2/24/2015	1/28/2015
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2015

tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.7313	4.8790	3.1470	4.2100e-003	0.1829	0.3218	0.5047	0.0874	0.3015	0.3889	0.0000	386.9797	386.9797	0.1008	0.0000	389.0955
Total	**1.7313**	**4.8790**	**3.1470**	**4.2100e-003**	**0.1829**	**0.3218**	**0.5047**	**0.0874**	**0.3015**	**0.3889**	**0.0000**	**386.9797**	**386.9797**	**0.1008**	**0.0000**	**389.0955**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.2535	0.5998	2.6990	4.2100e-003	0.1829	0.0239	0.2068	0.0874	0.0227	0.1102	0.0000	386.9792	386.9792	0.1008	0.0000	389.0951
Total	**1.2535**	**0.5998**	**2.6990**	**4.2100e-003**	**0.1829**	**0.0239**	**0.2068**	**0.0874**	**0.0227**	**0.1102**	**0.0000**	**386.9792**	**386.9792**	**0.1008**	**0.0000**	**389.0951**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**27.60**	**87.71**	**14.24**	**0.00**	**0.00**	**92.59**	**59.03**	**0.00**	**92.46**	**71.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2015	1/27/2015	5	20	
2	Paving	Paving	1/27/2015	2/23/2015	5	20	
3	Site Preparation	Site Preparation	1/28/2015	2/10/2015	5	10	
4	Grading	Grading	2/11/2015	3/10/2015	5	20	
5	Building Construction	Building Construction	2/11/2015	12/29/2015	5	230	
6	Architectural Coating	Architectural Coating	12/2/2015	12/29/2015	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0235	0.0000	0.0235	3.5600e-003	0.0000	3.5600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0428	0.4595	0.3427	3.8000e-004		0.0233	0.0233		0.0217	0.0217	0.0000	35.5692	35.5692	9.6400e-003	0.0000	35.7717
Total	**0.0428**	**0.4595**	**0.3427**	**3.8000e-004**	**0.0235**	**0.0233**	**0.0468**	**3.5600e-003**	**0.0217**	**0.0253**	**0.0000**	**35.5692**	**35.5692**	**9.6400e-003**	**0.0000**	**35.7717**

3.2 Demolition - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0235	0.0000	0.0235	3.5600e-003	0.0000	3.5600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0107	0.0644	0.2258	3.8000e-004		4.2100e-003	4.2100e-003		4.2100e-003	4.2100e-003	0.0000	35.5692	35.5692	9.6400e-003	0.0000	35.7717
Total	**0.0107**	**0.0644**	**0.2258**	**3.8000e-004**	**0.0235**	**4.2100e-003**	**0.0277**	**3.5600e-003**	**4.2100e-003**	**7.7700e-003**	**0.0000**	**35.5692**	**35.5692**	**9.6400e-003**	**0.0000**	**35.7717**

3.2 Demolition - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0232	0.2518	0.1498	2.2000e-004		0.0142	0.0142		0.0130	0.0130	0.0000	21.2272	21.2272	6.3400e-003	0.0000	21.3603
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0232**	**0.2518**	**0.1498**	**2.2000e-004**		**0.0142**	**0.0142**		**0.0130**	**0.0130**	**0.0000**	**21.2272**	**21.2272**	**6.3400e-003**	**0.0000**	**21.3603**

3.3 Paving - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0232	0.2518	0.1498	2.2000e-004		0.0142	0.0142		0.0130	0.0130	0.0000	21.2272	21.2272	6.3400e-003	0.0000	21.3603
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0232**	**0.2518**	**0.1498**	**2.2000e-004**		**0.0142**	**0.0142**		**0.0130**	**0.0130**	**0.0000**	**21.2272**	**21.2272**	**6.3400e-003**	**0.0000**	**21.3603**

3.3 Paving - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0263	0.2845	0.2132	2.0000e-004		0.0154	0.0154		0.0142	0.0142	0.0000	18.6506	18.6506	5.5700e-003	0.0000	18.7675
Total	**0.0263**	**0.2845**	**0.2132**	**2.0000e-004**	**0.0903**	**0.0154**	**0.1058**	**0.0497**	**0.0142**	**0.0639**	**0.0000**	**18.6506**	**18.6506**	**5.5700e-003**	**0.0000**	**18.7675**

3.4 Site Preparation - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	18.6505	18.6505	5.5700e-003	0.0000	18.7675
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**18.6505**	**18.6505**	**5.5700e-003**	**0.0000**	**18.7675**

3.4 Site Preparation - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0383	0.4042	0.2667	3.0000e-004		0.0233	0.0233		0.0214	0.0214	0.0000	28.3860	28.3860	8.4700e-003	0.0000	28.5639
Total	**0.0383**	**0.4042**	**0.2667**	**3.0000e-004**	**0.0690**	**0.0233**	**0.0923**	**0.0342**	**0.0214**	**0.0556**	**0.0000**	**28.3860**	**28.3860**	**8.4700e-003**	**0.0000**	**28.5639**

3.5 Grading - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	28.3859	28.3859	8.4700e-003	0.0000	28.5639
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**28.3859**	**28.3859**	**8.4700e-003**	**0.0000**	**28.5639**

3.5 Grading - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Building Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4208	3.4534	2.1556	3.0800e-003		0.2434	0.2434		0.2289	0.2289	0.0000	280.5935	280.5935	0.0704	0.0000	282.0719
Total	**0.4208**	**3.4534**	**2.1556**	**3.0800e-003**		**0.2434**	**0.2434**		**0.2289**	**0.2289**	**0.0000**	**280.5935**	**280.5935**	**0.0704**	**0.0000**	**282.0719**

3.6 Building Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	280.5932	280.5932	0.0704	0.0000	282.0716
Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**280.5932**	**280.5932**	**0.0704**	**0.0000**	**282.0716**

3.6 Building Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.0700e-003	0.0257	0.0190	3.0000e-005		2.2100e-003	2.2100e-003		2.2100e-003	2.2100e-003	0.0000	2.5533	2.5533	3.3000e-004	0.0000	2.5602
Total	**1.1799**	**0.0257**	**0.0190**	**3.0000e-005**		**2.2100e-003**	**2.2100e-003**		**2.2100e-003**	**2.2100e-003**	**0.0000**	**2.5533**	**2.5533**	**3.3000e-004**	**0.0000**	**2.5602**

3.7 Architectural Coating - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	3.3000e-004	0.0000	2.5602
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**3.3000e-004**	**0.0000**	**2.5602**

3.7 Architectural Coating - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552608	0.057937	0.185322	0.124470	0.029726	0.004465	0.012479	0.021685	0.001768	0.001276	0.005971	0.000530	0.001762

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Unmitigated	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.1000e-004	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.1000e-004	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2018)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2018. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	5/4/2018	12/28/2018
tblConstructionPhase	PhaseEndDate	1/25/2019	12/28/2018
tblConstructionPhase	PhaseEndDate	1/25/2019	4/6/2018
tblConstructionPhase	PhaseStartDate	4/7/2018	12/2/2018
tblConstructionPhase	PhaseStartDate	3/10/2018	2/10/2018
tblConstructionPhase	PhaseStartDate	12/29/2018	3/10/2018

tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2018
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	1.5889	3.7737	2.9182	4.2300e-003	0.1841	0.2299	0.4140	0.0876	0.2153	0.3029	0.0000	376.3667	376.3667	0.0972	0.0000	378.4085
Total	**1.5889**	**3.7737**	**2.9182**	**4.2300e-003**	**0.1841**	**0.2299**	**0.4140**	**0.0876**	**0.2153**	**0.3029**	**0.0000**	**376.3667**	**376.3667**	**0.0972**	**0.0000**	**378.4085**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	1.2451	0.5122	2.7052	4.2300e-003	0.1841	0.0181	0.2022	0.0876	0.0174	0.1050	0.0000	376.3663	376.3663	0.0972	0.0000	378.4080
Total	**1.2451**	**0.5122**	**2.7052**	**4.2300e-003**	**0.1841**	**0.0181**	**0.2022**	**0.0876**	**0.0174**	**0.1050**	**0.0000**	**376.3663**	**376.3663**	**0.0972**	**0.0000**	**378.4080**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**21.64**	**86.43**	**7.30**	**0.00**	**0.00**	**92.12**	**51.15**	**0.00**	**91.93**	**65.34**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	
2	Site Preparation	Site Preparation	1/27/2018	2/9/2018	5	10	
3	Grading	Grading	2/10/2018	3/9/2018	5	20	
4	Building Construction	Building Construction	2/10/2018	12/28/2018	5	230	
5	Paving	Paving	3/10/2018	4/6/2018	5	20	
6	Architectural Coating	Architectural Coating	12/2/2018	12/28/2018	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Paving	Pavers	2	8.00	125	0.42

Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0356	0.3683	0.3173	4.0000e-004		0.0181	0.0181		0.0169	0.0169	0.0000	36.1362	36.1362	9.9900e-003	0.0000	36.3460
Total	**0.0356**	**0.3683**	**0.3173**	**4.0000e-004**	**0.0248**	**0.0181**	**0.0429**	**3.7500e-003**	**0.0169**	**0.0206**	**0.0000**	**36.1362**	**36.1362**	**9.9900e-003**	**0.0000**	**36.3460**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.3100e-003	0.0570	0.2369	4.0000e-004		3.2200e-003	3.2200e-003		3.2200e-003	3.2200e-003	0.0000	36.1361	36.1361	9.9900e-003	0.0000	36.3459
Total	**9.3100e-003**	**0.0570**	**0.2369**	**4.0000e-004**	**0.0248**	**3.2200e-003**	**0.0280**	**3.7500e-003**	**3.2200e-003**	**6.9700e-003**	**0.0000**	**36.1361**	**36.1361**	**9.9900e-003**	**0.0000**	**36.3459**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0215	0.2280	0.1812	2.0000e-004		0.0118	0.0118		0.0109	0.0109	0.0000	17.8705	17.8705	5.5600e-003	0.0000	17.9873
Total	**0.0215**	**0.2280**	**0.1812**	**2.0000e-004**	**0.0903**	**0.0118**	**0.1022**	**0.0497**	**0.0109**	**0.0605**	**0.0000**	**17.8705**	**17.8705**	**5.5600e-003**	**0.0000**	**17.9873**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	17.8705	17.8705	5.5600e-003	0.0000	17.9873
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**17.8705**	**17.8705**	**5.5600e-003**	**0.0000**	**17.9873**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0300	0.3107	0.2400	3.0000e-004		0.0172	0.0172		0.0158	0.0158	0.0000	27.1530	27.1530	8.4500e-003	0.0000	27.3305
Total	**0.0300**	**0.3107**	**0.2400**	**3.0000e-004**	**0.0690**	**0.0172**	**0.0862**	**0.0342**	**0.0158**	**0.0500**	**0.0000**	**27.1530**	**27.1530**	**8.4500e-003**	**0.0000**	**27.3305**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	27.1529	27.1529	8.4500e-003	0.0000	27.3304
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**27.1529**	**27.1529**	**8.4500e-003**	**0.0000**	**27.3304**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.6750	2.0163	3.0800e-003		0.1718	0.1718		0.1616	0.1616	0.0000	272.2851	272.2851	0.0666	0.0000	273.6844
Total	**0.3069**	**2.6750**	**2.0163**	**3.0800e-003**		**0.1718**	**0.1718**		**0.1616**	**0.1616**	**0.0000**	**272.2851**	**272.2851**	**0.0666**	**0.0000**	**273.6844**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	272.2848	272.2848	0.0666	0.0000	273.6841

Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**272.2848**	**272.2848**	**0.0666**	**0.0000**	**273.6841**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0161	0.1716	0.1449	2.2000e-004		9.3900e-003	9.3900e-003		8.6400e-003	8.6400e-003	0.0000	20.3687	20.3687	6.3400e-003	0.0000	20.5019
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0161**	**0.1716**	**0.1449**	**2.2000e-004**		**9.3900e-003**	**9.3900e-003**		**8.6400e-003**	**8.6400e-003**	**0.0000**	**20.3687**	**20.3687**	**6.3400e-003**	**0.0000**	**20.5019**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0161	0.1716	0.1449	2.2000e-004		9.3900e-003	9.3900e-003		8.6400e-003	8.6400e-003	0.0000	20.3687	20.3687	6.3400e-003	0.0000	20.5019
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0161**	**0.1716**	**0.1449**	**2.2000e-004**		**9.3900e-003**	**9.3900e-003**		**8.6400e-003**	**8.6400e-003**	**0.0000**	**20.3687**	**20.3687**	**6.3400e-003**	**0.0000**	**20.5019**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.9900e-003	0.0201	0.0185	3.0000e-005		1.5100e-003	1.5100e-003		1.5100e-003	1.5100e-003	0.0000	2.5533	2.5533	2.4000e-004	0.0000	2.5584
Total	**1.1788**	**0.0201**	**0.0185**	**3.0000e-005**		**1.5100e-003**	**1.5100e-003**		**1.5100e-003**	**1.5100e-003**	**0.0000**	**2.5533**	**2.5533**	**2.4000e-004**	**0.0000**	**2.5584**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	2.4000e-004	0.0000	2.5584
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**2.4000e-004**	**0.0000**	**2.5584**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551461	0.058468	0.185554	0.123211	0.029507	0.004440	0.012712	0.023230	0.001775	0.001270	0.006089	0.000516	0.001766

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Unmitigated	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2030)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2030
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2030. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/24/2031	12/27/2030
tblConstructionPhase	PhaseEndDate	1/13/2031	12/20/2030
tblConstructionPhase	PhaseEndDate	1/17/2031	12/27/2030
tblConstructionPhase	PhaseEndDate	1/10/2031	12/27/2030
tblConstructionPhase	PhaseStartDate	12/28/2030	12/2/2030
tblConstructionPhase	PhaseStartDate	2/26/2030	2/2/2030

tblConstructionPhase	PhaseStartDate	12/21/2030	12/2/2030
tblConstructionPhase	PhaseStartDate	12/28/2030	12/14/2030
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2030
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2030	1.3898	1.2250	2.4831	4.8400e-003	0.1841	0.0284	0.2125	0.0876	0.0284	0.1160	0.0000	419.4097	419.4097	0.0173	0.0000	419.7725
Total	**1.3898**	**1.2250**	**2.4831**	**4.8400e-003**	**0.1841**	**0.0284**	**0.2125**	**0.0876**	**0.0284**	**0.1160**	**0.0000**	**419.4097**	**419.4097**	**0.0173**	**0.0000**	**419.7725**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2030	1.2396	0.3886	2.7145	4.8400e-003	0.1841	9.6700e-003	0.1938	0.0876	9.6700e-003	0.0973	0.0000	419.4092	419.4092	0.0173	0.0000	419.7720
Total	**1.2396**	**0.3886**	**2.7145**	**4.8400e-003**	**0.1841**	**9.6700e-003**	**0.1938**	**0.0876**	**9.6700e-003**	**0.0973**	**0.0000**	**419.4092**	**419.4092**	**0.0173**	**0.0000**	**419.7720**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**10.81**	**68.27**	**-9.32**	**0.00**	**0.00**	**65.94**	**8.81**	**0.00**	**65.94**	**16.14**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e

Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2030	1/28/2030	5	20	
2	Paving	Paving	1/29/2030	2/25/2030	5	20	
3	Building Construction	Building Construction	2/2/2030	12/20/2030	5	230	
4	Grading	Grading	12/2/2030	12/27/2030	5	20	
5	Architectural Coating	Architectural Coating	12/2/2030	12/27/2030	5	20	
6	Site Preparation	Site Preparation	12/14/2030	12/27/2030	5	10	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74

Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0208	0.0941	0.1962	4.4000e-004		3.4300e-003	3.4300e-003		3.4300e-003	3.4300e-003	0.0000	40.7184	40.7184	1.6900e-003	0.0000	40.7538
Total	**0.0208**	**0.0941**	**0.1962**	**4.4000e-004**	**0.0248**	**3.4300e-003**	**0.0282**	**3.7500e-003**	**3.4300e-003**	**7.1800e-003**	**0.0000**	**40.7184**	**40.7184**	**1.6900e-003**	**0.0000**	**40.7538**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.4200e-003	0.0352	0.2360	4.4000e-004		9.2000e-004	9.2000e-004		9.2000e-004	9.2000e-004	0.0000	40.7184	40.7184	1.6900e-003	0.0000	40.7538
Total	**6.4200e-003**	**0.0352**	**0.2360**	**4.4000e-004**	**0.0248**	**9.2000e-004**	**0.0257**	**3.7500e-003**	**9.2000e-004**	**4.6700e-003**	**0.0000**	**40.7184**	**40.7184**	**1.6900e-003**	**0.0000**	**40.7538**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0698	0.1552	2.7000e-004		3.2300e-003	3.2300e-003		3.2300e-003	3.2300e-003	0.0000	23.5867	23.5867	1.1100e-003	0.0000	23.6099
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0136**	**0.0698**	**0.1552**	**2.7000e-004**		**3.2300e-003**	**3.2300e-003**		**3.2300e-003**	**3.2300e-003**	**0.0000**	**23.5867**	**23.5867**	**1.1100e-003**	**0.0000**	**23.6099**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0698	0.1552	2.7000e-004		3.2300e-003	3.2300e-003		3.2300e-003	3.2300e-003	0.0000	23.5867	23.5867	1.1100e-003	0.0000	23.6099
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0136**	**0.0698**	**0.1552**	**2.7000e-004**		**3.2300e-003**	**3.2300e-003**		**3.2300e-003**	**3.2300e-003**	**0.0000**	**23.5867**	**23.5867**	**1.1100e-003**	**0.0000**	**23.6099**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1500	0.9106	1.8551	3.5400e-003		0.0170	0.0170		0.0170	0.0170	0.0000	300.9635	300.9635	0.0121	0.0000	301.2172
Total	**0.1500**	**0.9106**	**1.8551**	**3.5400e-003**		**0.0170**	**0.0170**		**0.0170**	**0.0170**	**0.0000**	**300.9635**	**300.9635**	**0.0121**	**0.0000**	**301.2172**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.5400e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	300.9631	300.9631	0.0121	0.0000	301.2168
Total	**0.0376**	**0.2563**	**2.0023**	**3.5400e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**300.9631**	**300.9631**	**0.0121**	**0.0000**	**301.2168**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0163	0.0766	0.1739	3.4000e-004		2.4500e-003	2.4500e-003		2.4500e-003	2.4500e-003	0.0000	31.1492	31.1492	1.3100e-003	0.0000	31.1768
Total	**0.0163**	**0.0766**	**0.1739**	**3.4000e-004**	**0.0690**	**2.4500e-003**	**0.0715**	**0.0342**	**2.4500e-003**	**0.0367**	**0.0000**	**31.1492**	**31.1492**	**1.3100e-003**	**0.0000**	**31.1768**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	3.6300e-003	0.0157	0.1966	3.4000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	31.1491	31.1491	1.3100e-003	0.0000	31.1767
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.4000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**31.1491**	**31.1491**	**1.3100e-003**	**0.0000**	**31.1767**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Architectural Coating - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.3100e-003	8.5600e-003	0.0180	3.0000e-005		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	2.5533	2.5533	1.0000e-004	0.0000	2.5554
Total	**1.1771**	**8.5600e-003**	**0.0180**	**3.0000e-005**		**2.0000e-004**	**2.0000e-004**		**2.0000e-004**	**2.0000e-004**	**0.0000**	**2.5533**	**2.5533**	**1.0000e-004**	**0.0000**	**2.5554**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	1.0000e-004	0.0000	2.5554
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**1.0000e-004**	**0.0000**	**2.5554**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Site Preparation - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0121	0.0653	0.0847	2.1000e-004		2.1100e-003	2.1100e-003		2.1100e-003	2.1100e-003	0.0000	20.4388	20.4388	9.9000e-004	0.0000	20.4595
Total	**0.0121**	**0.0653**	**0.0847**	**2.1000e-004**	**0.0903**	**2.1100e-003**	**0.0924**	**0.0497**	**2.1100e-003**	**0.0518**	**0.0000**	**20.4388**	**20.4388**	**9.9000e-004**	**0.0000**	**20.4595**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.1000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	20.4387	20.4387	9.9000e-004	0.0000	20.4594
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.1000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**20.4387**	**20.4387**	**9.9000e-004**	**0.0000**	**20.4594**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552333	0.058808	0.184358	0.118913	0.029447	0.004459	0.013404	0.026791	0.001843	0.001224	0.006259	0.000436	0.001725

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Unmitigated	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.9000e-004	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.9000e-004	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Peak with project info, 2018

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	3,270.00	1000sqft	18.30	3,270,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Designated Construction Size for Peak Scenario

Construction Phase - Project specific phasing

Off-road Equipment - Project specific

Off-road Equipment - Stanford Escondido Village

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Trips and VMT - Project-specific vendor and haul trips. Default worker trips. Site Prep and Grading 15 mi avg haul trip length

Demolition - Project specific

Grading - Project specific

Architectural Coating -

Vehicle Trips - not modeling operation here

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws.

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	12.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	7.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	20.00	131.00
tblConstructionPhase	NumDays	300.00	129.00

tblConstructionPhase	NumDays	300.00	261.00
tblConstructionPhase	NumDays	300.00	175.00
tblConstructionPhase	NumDays	20.00	44.00
tblConstructionPhase	NumDays	30.00	152.00
tblConstructionPhase	NumDays	20.00	86.00
tblConstructionPhase	NumDays	10.00	87.00
tblConstructionPhase	PhaseEndDate	3/3/2021	7/1/2020
tblConstructionPhase	PhaseEndDate	3/29/2019	12/31/2018
tblConstructionPhase	PhaseEndDate	1/30/2019	10/1/2018
tblConstructionPhase	PhaseEndDate	10/29/2020	12/31/2020
tblConstructionPhase	PhaseStartDate	9/2/2020	1/1/2020
tblConstructionPhase	PhaseStartDate	10/2/2018	7/4/2018
tblConstructionPhase	PhaseStartDate	7/3/2018	3/2/2018
tblConstructionPhase	PhaseStartDate	7/2/2020	9/3/2020
tblEnergyUse	LightingElect	4.41	0.00
tblEnergyUse	NT24E	7.84	0.00
tblEnergyUse	NT24NG	0.06	0.00
tblEnergyUse	T24E	7.46	0.00
tblEnergyUse	T24NG	17.16	0.00
tblGrading	MaterialExported	0.00	900,000.00
tblLandUse	LotAcreage	75.07	18.30
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	UsageHours	6.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91

tblProjectCharacteristics	OperationalYear	2014	2018
tblSolidWaste	SolidWasteGenerationRate	3,041.10	0.00
tblTripsAndVMT	HaulingTripLength	20.00	15.00
tblTripsAndVMT	HaulingTripLength	20.00	15.00
tblTripsAndVMT	HaulingTripNumber	781.00	1,408.00
tblTripsAndVMT	HaulingTripNumber	0.00	69,600.00
tblTripsAndVMT	HaulingTripNumber	112,500.00	121,600.00
tblTripsAndVMT	HaulingTripNumber	0.00	10,320.00
tblTripsAndVMT	HaulingTripNumber	0.00	20,880.00
tblTripsAndVMT	HaulingTripNumber	0.00	1,310.00
tblTripsAndVMT	HaulingTripNumber	0.00	14,000.00
tblTripsAndVMT	HaulingTripNumber	0.00	8,600.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	581,189,355.94	0.00
tblWater	OutdoorWaterUseRate	356,212,831.06	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					

2018	2.3535	24.3059	27.0612	0.0739	2.1888	0.4731	2.6619	0.5805	0.4381	1.0186	0.0000	6,401.4238	6,401.4238	0.1638	0.0000	6,404.8637
2019	1.1763	8.9005	13.2218	0.0344	1.6593	0.2640	1.9233	0.4478	0.2429	0.6907	0.0000	2,728.8943	2,728.8943	0.1544	0.0000	2,732.1375
2020	17.8256	5.2520	9.6642	0.0273	1.3248	0.1367	1.4616	0.3574	0.1258	0.4833	0.0000	2,106.1603	2,106.1603	0.0817	0.0000	2,107.8760
Total	**21.3554**	**38.4585**	**49.9473**	**0.1356**	**5.1729**	**0.8738**	**6.0468**	**1.3858**	**0.8068**	**2.1926**	**0.0000**	**11,236.4784**	**11,236.4784**	**0.3999**	**0.0000**	**11,244.8772**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	2.0368	21.6075	27.1123	0.0739	2.1888	0.3023	2.4911	0.5805	0.2790	0.8595	0.0000	6,401.4234	6,401.4234	0.1638	0.0000	6,404.8633
2019	0.9129	5.7911	13.3165	0.0344	1.6593	0.0909	1.7502	0.4478	0.0841	0.5319	0.0000	2,728.8940	2,728.8940	0.1544	0.0000	2,732.1372
2020	17.7686	4.6779	9.6624	0.0273	1.3248	0.0940	1.4188	0.3574	0.0866	0.4440	0.0000	2,106.1602	2,106.1602	0.0817	0.0000	2,107.8758
Total	**20.7184**	**32.0765**	**50.0912**	**0.1356**	**5.1729**	**0.4871**	**5.6601**	**1.3858**	**0.4497**	**1.8355**	**0.0000**	**11,236.4775**	**11,236.4775**	**0.3999**	**0.0000**	**11,244.8763**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**2.98**	**16.59**	**-0.29**	**0.00**	**0.00**	**44.25**	**6.40**	**0.00**	**44.26**	**16.29**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Area	12.7739	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**12.7739**	**2.9000e-004**	**0.0305**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.6000e-004**	**0.0000**	**0.0618**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	12.7739	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**12.7739**	**2.9000e-004**	**0.0305**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.6000e-004**	**0.0000**	**0.0618**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	3/1/2018	5	44	
2	Site Preparation	Site Preparation	3/2/2018	7/2/2018	5	87	
3	Grading	Grading	3/2/2018	10/1/2018	5	152	
4	Building Construction 1	Building Construction	7/4/2018	12/31/2018	5	129	
5	Building Construction 2	Building Construction	1/1/2019	12/31/2019	5	261	
6	Building Construction 3	Building Construction	1/1/2020	9/1/2020	5	175	
7	Architectural Coating	Architectural Coating	1/1/2020	7/1/2020	5	131	No AC equipment
8	Paving	Paving	9/3/2020	12/31/2020	5	86	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 4,905,000; Non-Residential Outdoor: 1,635,000 (Architectural

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	0	0.00	255	0.40
Site Preparation	Rubber Tired Dozers	0	0.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	162	0.38
Grading	Graders	0	0.00	174	0.41
Grading	Rubber Tired Dozers	0	0.00	255	0.40
Grading	Scrapers	0	0.00	361	0.48
Grading	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction 1	Cranes	3	7.00	226	0.29

Building Construction 1	Forklifts	4	8.00	89	0.20
Building Construction 1	Generator Sets	0	0.00	84	0.74
Building Construction 1	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction 1	Welders	4	8.00	46	0.45
Building Construction 2	Cranes	3	7.00	226	0.29
Building Construction 2	Forklifts	4	8.00	89	0.20
Building Construction 2	Generator Sets	0	0.00	84	0.74
Building Construction 2	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Building Construction 2	Welders	0	0.00	46	0.45
Architectural Coating	Air Compressors	0	0.00	78	0.48
Building Construction 3	Cranes	0	0.00	226	0.29
Building Construction 3	Forklifts	4	8.00	89	0.20
Building Construction 3	Generator Sets	0	0.00	84	0.74
Building Construction 3	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Building Construction 3	Welders	0	0.00	46	0.45
Paving	Pavers	1	8.00	125	0.42
Paving	Paving Equipment	1	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	1,408.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	4	10.00	0.00	69,600.00	12.40	7.30	15.00	LD_Mix	HDT_Mix	HHDT
Grading	2	5.00	0.00	121,600.00	12.40	7.30	15.00	LD_Mix	HDT_Mix	HHDT
Building Construction 1	11	1,046.00	285.00	10,320.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2	9	1,046.00	285.00	20,880.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	0	209.00	0.00	1,310.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 3	5	1,046.00	285.00	14,000.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	4	10.00	0.00	8,600.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Clean Paved Roads

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0845	0.0000	0.0845	0.0128	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0310	0.2956	0.3036	4.9000e-004		0.0160	0.0160		0.0152	0.0152	0.0000	43.7258	43.7258	0.0109	0.0000	43.9535
Total	**0.0310**	**0.2956**	**0.3036**	**4.9000e-004**	**0.0845**	**0.0160**	**0.1006**	**0.0128**	**0.0152**	**0.0280**	**0.0000**	**43.7258**	**43.7258**	**0.0109**	**0.0000**	**43.9535**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0129	0.1711	0.1472	5.3000e-004	0.0119	2.3900e-003	0.0143	3.2700e-003	2.2000e-003	5.4600e-003	0.0000	46.5952	46.5952	3.5000e-004	0.0000	46.6025
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.6000e-004	9.3000e-004	8.9700e-003	2.0000e-005	2.0000e-003	1.0000e-005	2.0200e-003	5.3000e-004	1.0000e-005	5.5000e-004	0.0000	1.6342	1.6342	8.0000e-005	0.0000	1.6359
Total	**0.0136**	**0.1720**	**0.1562**	**5.5000e-004**	**0.0139**	**2.4000e-003**	**0.0163**	**3.8000e-003**	**2.2100e-003**	**6.0100e-003**	**0.0000**	**48.2295**	**48.2295**	**4.3000e-004**	**0.0000**	**48.2384**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0845	0.0000	0.0845	0.0128	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0157	0.1048	0.3471	4.9000e-004		6.4500e-003	6.4500e-003		6.4500e-003	6.4500e-003	0.0000	43.7257	43.7257	0.0109	0.0000	43.9535
Total	**0.0157**	**0.1048**	**0.3471**	**4.9000e-004**	**0.0845**	**6.4500e-003**	**0.0910**	**0.0128**	**6.4500e-003**	**0.0193**	**0.0000**	**43.7257**	**43.7257**	**0.0109**	**0.0000**	**43.9535**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0129	0.1711	0.1472	5.3000e-004	0.0119	2.3900e-003	0.0143	3.2700e-003	2.2000e-003	5.4600e-003	0.0000	46.5952	46.5952	3.5000e-004	0.0000	46.6025
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.6000e-004	9.3000e-004	8.9700e-003	2.0000e-005	2.0000e-003	1.0000e-005	2.0200e-003	5.3000e-004	1.0000e-005	5.5000e-004	0.0000	1.6342	1.6342	8.0000e-005	0.0000	1.6359
Total	**0.0136**	**0.1720**	**0.1562**	**5.5000e-004**	**0.0139**	**2.4000e-003**	**0.0163**	**3.8000e-003**	**2.2100e-003**	**6.0100e-003**	**0.0000**	**48.2295**	**48.2295**	**4.3000e-004**	**0.0000**	**48.2384**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0463	0.4576	0.4066	5.4000e-004		0.0324	0.0324		0.0298	0.0298	0.0000	49.3717	49.3717	0.0154	0.0000	49.6945
Total	**0.0463**	**0.4576**	**0.4066**	**5.4000e-004**	**0.0000**	**0.0324**	**0.0324**	**0.0000**	**0.0298**	**0.0298**	**0.0000**	**49.3717**	**49.3717**	**0.0154**	**0.0000**	**49.6945**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.5428	6.5152	6.7179	0.0197	0.4412	0.0889	0.5300	0.1212	0.0818	0.2029	0.0000	1,740.8018	1,740.8018	0.0133	0.0000	1,741.0809
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.8400e-003	0.0177	5.0000e-005	3.9600e-003	3.0000e-005	3.9900e-003	1.0500e-003	3.0000e-005	1.0800e-003	0.0000	3.2314	3.2314	1.6000e-004	0.0000	3.2346
Total	**0.5441**	**6.5170**	**6.7357**	**0.0197**	**0.4451**	**0.0889**	**0.5340**	**0.1222**	**0.0818**	**0.2040**	**0.0000**	**1,744.0332**	**1,744.0332**	**0.0135**	**0.0000**	**1,744.3156**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	6.6100e-003	0.0286	0.4075	5.4000e-004		8.8000e-004	8.8000e-004		8.8000e-004	8.8000e-004	0.0000	49.3717	49.3717	0.0154	0.0000	49.6944
Total	**6.6100e-003**	**0.0286**	**0.4075**	**5.4000e-004**	**0.0000**	**8.8000e-004**	**8.8000e-004**	**0.0000**	**8.8000e-004**	**8.8000e-004**	**0.0000**	**49.3717**	**49.3717**	**0.0154**	**0.0000**	**49.6944**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.5428	6.5152	6.7179	0.0197	0.4412	0.0889	0.5300	0.1212	0.0818	0.2029	0.0000	1,740.8018	1,740.8018	0.0133	0.0000	1,741.0809
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.8400e-003	0.0177	5.0000e-005	3.9600e-003	3.0000e-005	3.9900e-003	1.0500e-003	3.0000e-005	1.0800e-003	0.0000	3.2314	3.2314	1.6000e-004	0.0000	3.2346
Total	**0.5441**	**6.5170**	**6.7357**	**0.0197**	**0.4451**	**0.0889**	**0.5340**	**0.1222**	**0.0818**	**0.2040**	**0.0000**	**1,744.0332**	**1,744.0332**	**0.0135**	**0.0000**	**1,744.3156**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0509	0.0000	0.0509	7.7100e-003	0.0000	7.7100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0451	0.4825	0.5105	8.0000e-004		0.0234	0.0234		0.0215	0.0215	0.0000	73.4605	73.4605	0.0229	0.0000	73.9408
Total	**0.0451**	**0.4825**	**0.5105**	**8.0000e-004**	**0.0509**	**0.0234**	**0.0743**	**7.7100e-003**	**0.0215**	**0.0292**	**0.0000**	**73.4605**	**73.4605**	**0.0229**	**0.0000**	**73.9408**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.9484	11.3829	11.7371	0.0344	0.7707	0.1553	0.9260	0.2117	0.1428	0.3546	0.0000	3,041.4009	3,041.4009	0.0232	0.0000	3,041.8885
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1400e-003	1.6000e-003	0.0155	4.0000e-005	3.4600e-003	3.0000e-005	3.4900e-003	9.2000e-004	2.0000e-005	9.4000e-004	0.0000	2.8228	2.8228	1.4000e-004	0.0000	2.8257
Total	**0.9495**	**11.3845**	**11.7526**	**0.0344**	**0.7742**	**0.1553**	**0.9295**	**0.2127**	**0.1429**	**0.3555**	**0.0000**	**3,044.2237**	**3,044.2237**	**0.0234**	**0.0000**	**3,044.7142**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0509	0.0000	0.0509	7.7100e-003	0.0000	7.7100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.9000e-003	0.0429	0.6106	8.0000e-004		1.3200e-003	1.3200e-003		1.3200e-003	1.3200e-003	0.0000	73.4604	73.4604	0.0229	0.0000	73.9407
Total	**9.9000e-003**	**0.0429**	**0.6106**	**8.0000e-004**	**0.0509**	**1.3200e-003**	**0.0522**	**7.7100e-003**	**1.3200e-003**	**9.0300e-003**	**0.0000**	**73.4604**	**73.4604**	**0.0229**	**0.0000**	**73.9407**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.9484	11.3829	11.7371	0.0344	0.7707	0.1553	0.9260	0.2117	0.1428	0.3546	0.0000	3,041.4009	3,041.4009	0.0232	0.0000	3,041.8885
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1400e-003	1.6000e-003	0.0155	4.0000e-005	3.4600e-003	3.0000e-005	3.4900e-003	9.2000e-004	2.0000e-005	9.4000e-004	0.0000	2.8228	2.8228	1.4000e-004	0.0000	2.8257
Total	**0.9495**	**11.3845**	**11.7526**	**0.0344**	**0.7742**	**0.1553**	**0.9295**	**0.2127**	**0.1429**	**0.3555**	**0.0000**	**3,044.2237**	**3,044.2237**	**0.0234**	**0.0000**	**3,044.7142**

3.5 Building Construction 1 - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2545	1.9700	1.2099	2.0100e-003		0.1106	0.1106		0.1041	0.1041	0.0000	171.8037	171.8037	0.0477	0.0000	172.8050
Total	**0.2545**	**1.9700**	**1.2099**	**2.0100e-003**		**0.1106**	**0.1106**		**0.1041**	**0.1041**	**0.0000**	**171.8037**	**171.8037**	**0.0477**	**0.0000**	**172.8050**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0945	1.2541	1.0792	3.8600e-003	0.0872	0.0175	0.1047	0.0240	0.0161	0.0400	0.0000	341.5219	341.5219	2.5400e-003	0.0000	341.5752
Vendor	0.1731	1.4877	2.1570	4.3600e-003	0.1187	0.0220	0.1407	0.0340	0.0202	0.0543	0.0000	383.8834	383.8834	2.9800e-003	0.0000	383.9460

Worker	0.2019	0.2849	2.7501	7.1100e-003	0.6143	4.5400e-003	0.6188	0.1634	4.2000e-003	0.1676	0.0000	501.1705	501.1705	0.0243	0.0000	501.6806
Total	**0.4695**	**3.0267**	**5.9863**	**0.0153**	**0.8201**	**0.0440**	**0.8642**	**0.2213**	**0.0405**	**0.2619**	**0.0000**	**1,226.5758**	**1,226.5758**	**0.0298**	**0.0000**	**1,227.2017**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0279	0.3310	1.1164	2.0100e-003		2.9700e-003	2.9700e-003		2.9700e-003	2.9700e-003	0.0000	171.8035	171.8035	0.0477	0.0000	172.8048
Total	**0.0279**	**0.3310**	**1.1164**	**2.0100e-003**		**2.9700e-003**	**2.9700e-003**		**2.9700e-003**	**2.9700e-003**	**0.0000**	**171.8035**	**171.8035**	**0.0477**	**0.0000**	**172.8048**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0945	1.2541	1.0792	3.8600e-003	0.0872	0.0175	0.1047	0.0240	0.0161	0.0400	0.0000	341.5219	341.5219	2.5400e-003	0.0000	341.5752
Vendor	0.1731	1.4877	2.1570	4.3600e-003	0.1187	0.0220	0.1407	0.0340	0.0202	0.0543	0.0000	383.8834	383.8834	2.9800e-003	0.0000	383.9460
Worker	0.2019	0.2849	2.7501	7.1100e-003	0.6143	4.5400e-003	0.6188	0.1634	4.2000e-003	0.1676	0.0000	501.1705	501.1705	0.0243	0.0000	501.6806
Total	**0.4695**	**3.0267**	**5.9863**	**0.0153**	**0.8201**	**0.0440**	**0.8642**	**0.2213**	**0.0405**	**0.2619**	**0.0000**	**1,226.5758**	**1,226.5758**	**0.0298**	**0.0000**	**1,227.2017**

3.6 Building Construction 2 - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3056	3.2926	1.9178	3.4400e-003		0.1787	0.1787		0.1644	0.1644	0.0000	309.0452	309.0452	0.0978	0.0000	311.0986
Total	**0.3056**	**3.2926**	**1.9178**	**3.4400e-003**		**0.1787**	**0.1787**		**0.1644**	**0.1644**	**0.0000**	**309.0452**	**309.0452**	**0.0978**	**0.0000**	**311.0986**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1796	2.3359	2.1092	7.7900e-003	0.1764	0.0349	0.2113	0.0485	0.0321	0.0806	0.0000	679.1891	679.1891	5.1200e-003	0.0000	679.2965
Vendor	0.3177	2.7474	4.1377	8.8000e-003	0.2401	0.0413	0.2815	0.0688	0.0380	0.1069	0.0000	763.1872	763.1872	5.8800e-003	0.0000	763.3107
Worker	0.3733	0.5246	5.0572	0.0144	1.2428	8.9900e-003	1.2518	0.3305	8.3300e-003	0.3388	0.0000	977.4728	977.4728	0.0457	0.0000	978.4318
Total	**0.8707**	**5.6080**	**11.3041**	**0.0310**	**1.6593**	**0.0853**	**1.7446**	**0.4478**	**0.0785**	**0.5263**	**0.0000**	**2,419.8491**	**2,419.8491**	**0.0567**	**0.0000**	**2,421.0390**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Off-Road	0.0423	0.1832	2.0124	3.4400e-003		5.6400e-003	5.6400e-003		5.6400e-003	5.6400e-003	0.0000	309.0449	309.0449	0.0978	0.0000	311.0982
Total	**0.0423**	**0.1832**	**2.0124**	**3.4400e-003**		**5.6400e-003**	**5.6400e-003**		**5.6400e-003**	**5.6400e-003**	**0.0000**	**309.0449**	**309.0449**	**0.0978**	**0.0000**	**311.0982**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1796	2.3359	2.1092	7.7900e-003	0.1764	0.0349	0.2113	0.0485	0.0321	0.0806	0.0000	679.1891	679.1891	5.1200e-003	0.0000	679.2965
Vendor	0.3177	2.7474	4.1377	8.8000e-003	0.2401	0.0413	0.2815	0.0688	0.0380	0.1069	0.0000	763.1872	763.1872	5.8800e-003	0.0000	763.3107
Worker	0.3733	0.5246	5.0572	0.0144	1.2428	8.9900e-003	1.2518	0.3305	8.3300e-003	0.3388	0.0000	977.4728	977.4728	0.0457	0.0000	978.4318
Total	**0.8707**	**5.6080**	**11.3041**	**0.0310**	**1.6593**	**0.0853**	**1.7446**	**0.4478**	**0.0785**	**0.5263**	**0.0000**	**2,419.8491**	**2,419.8491**	**0.0567**	**0.0000**	**2,421.0390**

3.7 Building Construction 3 - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0664	0.6153	0.5876	7.7000e-004		0.0440	0.0440		0.0405	0.0405	0.0000	67.8922	67.8922	0.0220	0.0000	68.3534
Total	**0.0664**	**0.6153**	**0.5876**	**7.7000e-004**		**0.0440**	**0.0440**		**0.0405**	**0.0405**	**0.0000**	**67.8922**	**67.8922**	**0.0220**	**0.0000**	**68.3534**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1178	1.3512	1.3986	5.2200e-003	0.1183	0.0231	0.1414	0.0325	0.0212	0.0537	0.0000	445.0635	445.0635	3.4400e-003	0.0000	445.1357
Vendor	0.2006	1.5696	2.6892	5.8900e-003	0.1610	0.0248	0.1858	0.0462	0.0228	0.0690	0.0000	500.0109	500.0109	3.8200e-003	0.0000	500.0912
Worker	0.2329	0.3238	3.1265	9.6400e-003	0.8333	5.9600e-003	0.8393	0.2216	5.5300e-003	0.2271	0.0000	629.0534	629.0534	0.0288	0.0000	629.6576
Total	**0.5513**	**3.2445**	**7.2142**	**0.0208**	**1.1126**	**0.0538**	**1.1664**	**0.3002**	**0.0496**	**0.3498**	**0.0000**	**1,574.1278**	**1,574.1278**	**0.0360**	**0.0000**	**1,574.8845**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.5000e-003	0.0412	0.5859	7.7000e-004		1.2700e-003	1.2700e-003		1.2700e-003	1.2700e-003	0.0000	67.8922	67.8922	0.0220	0.0000	68.3533
Total	**9.5000e-003**	**0.0412**	**0.5859**	**7.7000e-004**		**1.2700e-003**	**1.2700e-003**		**1.2700e-003**	**1.2700e-003**	**0.0000**	**67.8922**	**67.8922**	**0.0220**	**0.0000**	**68.3533**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1178	1.3512	1.3986	5.2200e-003	0.1183	0.0231	0.1414	0.0325	0.0212	0.0537	0.0000	445.0635	445.0635	3.4400e-003	0.0000	445.1357
Vendor	0.2006	1.5696	2.6892	5.8900e-003	0.1610	0.0248	0.1858	0.0462	0.0228	0.0690	0.0000	500.0109	500.0109	3.8200e-003	0.0000	500.0912
Worker	0.2329	0.3238	3.1265	9.6400e-003	0.8333	5.9600e-003	0.8393	0.2216	5.5300e-003	0.2271	0.0000	629.0534	629.0534	0.0288	0.0000	629.6576
Total	**0.5513**	**3.2445**	**7.2142**	**0.0208**	**1.1126**	**0.0538**	**1.1664**	**0.3002**	**0.0496**	**0.3498**	**0.0000**	**1,574.1278**	**1,574.1278**	**0.0360**	**0.0000**	**1,574.8845**

3.8 Architectural Coating - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	17.0510					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**17.0510**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0110	0.1264	0.1309	4.9000e-004	0.0111	2.1600e-003	0.0132	3.0400e-003	1.9900e-003	5.0300e-003	0.0000	41.6452	41.6452	3.2000e-004	0.0000	41.6520
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0348	0.0484	0.4676	1.4400e-003	0.1246	8.9000e-004	0.1255	0.0332	8.3000e-004	0.0340	0.0000	94.0882	94.0882	4.3000e-003	0.0000	94.1786
Total	**0.0459**	**0.1749**	**0.5985**	**1.9300e-003**	**0.1357**	**3.0500e-003**	**0.1388**	**0.0362**	**2.8200e-003**	**0.0390**	**0.0000**	**135.7335**	**135.7335**	**4.6200e-003**	**0.0000**	**135.8306**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	17.0510					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**17.0510**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0110	0.1264	0.1309	4.9000e-004	0.0111	2.1600e-003	0.0132	3.0400e-003	1.9900e-003	5.0300e-003	0.0000	41.6452	41.6452	3.2000e-004	0.0000	41.6520
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0348	0.0484	0.4676	1.4400e-003	0.1246	8.9000e-004	0.1255	0.0332	8.3000e-004	0.0340	0.0000	94.0882	94.0882	4.3000e-003	0.0000	94.1786

Total	**0.0459**	**0.1749**	**0.5985**	**1.9300e-003**	**0.1357**	**3.0500e-003**	**0.1388**	**0.0362**	**2.8200e-003**	**0.0390**	**0.0000**	**135.7335**	**135.7335**	**4.6200e-003**	**0.0000**	**135.8306**

3.9 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.3859	0.3900	5.9000e-004		0.0216	0.0216		0.0199	0.0199	0.0000	52.0553	52.0553	0.0168	0.0000	52.4088
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0376**	**0.3859**	**0.3900**	**5.9000e-004**		**0.0216**	**0.0216**		**0.0199**	**0.0199**	**0.0000**	**52.0553**	**52.0553**	**0.0168**	**0.0000**	**52.4088**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0724	0.8300	0.8592	3.2100e-003	0.0727	0.0142	0.0868	0.0200	0.0131	0.0330	0.0000	273.3961	273.3961	2.1100e-003	0.0000	273.4405
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0900e-003	1.5200e-003	0.0147	5.0000e-005	3.9200e-003	3.0000e-005	3.9400e-003	1.0400e-003	3.0000e-005	1.0700e-003	0.0000	2.9554	2.9554	1.4000e-004	0.0000	2.9582
Total	**0.0735**	**0.8315**	**0.8738**	**3.2600e-003**	**0.0766**	**0.0142**	**0.0908**	**0.0210**	**0.0131**	**0.0341**	**0.0000**	**276.3515**	**276.3515**	**2.2500e-003**	**0.0000**	**276.3987**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.3859	0.3900	5.9000e-004		0.0216	0.0216		0.0199	0.0199	0.0000	52.0552	52.0552	0.0168	0.0000	52.4088
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0376**	**0.3859**	**0.3900**	**5.9000e-004**		**0.0216**	**0.0216**		**0.0199**	**0.0199**	**0.0000**	**52.0552**	**52.0552**	**0.0168**	**0.0000**	**52.4088**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0724	0.8300	0.8592	3.2100e-003	0.0727	0.0142	0.0868	0.0200	0.0131	0.0330	0.0000	273.3961	273.3961	2.1100e-003	0.0000	273.4405
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0900e-003	1.5200e-003	0.0147	5.0000e-005	3.9200e-003	3.0000e-005	3.9400e-003	1.0400e-003	3.0000e-005	1.0700e-003	0.0000	2.9554	2.9554	1.4000e-004	0.0000	2.9582
Total	**0.0735**	**0.8315**	**0.8738**	**3.2600e-003**	**0.0766**	**0.0142**	**0.0908**	**0.0210**	**0.0131**	**0.0341**	**0.0000**	**276.3515**	**276.3515**	**2.2500e-003**	**0.0000**	**276.3987**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551461	0.058468	0.185554	0.123211	0.029507	0.004440	0.012712	0.023230	0.001775	0.001270	0.006089	0.000516	0.001766

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	12.7739	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Unmitigated	12.7739	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.7710					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.9100e-003	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Total	**12.7739**	**2.9000e-004**	**0.0305**	**0.0000**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.6000e-004**	**0.0000**	**0.0618**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.7710					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.9100e-003	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Total	**12.7739**	**2.9000e-004**	**0.0305**	**0.0000**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.6000e-004**	**0.0000**	**0.0618**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000

Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Peak with project info, 2023

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	3,270.00	1000sqft	18.30	3,270,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2023
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Designated Construction Size for Peak Scenario

Construction Phase - Project specific phasing

Off-road Equipment - Project specific

Off-road Equipment - Stanford Escondido Village

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Trips and VMT - Project-specific vendor and haul trips. Default worker trips. Site Prep and Grading 15 mi avg haul trip length

Demolition - Project specific

Grading - Project specific

Architectural Coating -

Vehicle Trips - not modeling operation here

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws.

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	12.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	7.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	20.00	131.00
tblConstructionPhase	NumDays	300.00	129.00

tblConstructionPhase	NumDays	300.00	261.00
tblConstructionPhase	NumDays	300.00	175.00
tblConstructionPhase	NumDays	20.00	44.00
tblConstructionPhase	NumDays	30.00	152.00
tblConstructionPhase	NumDays	20.00	86.00
tblConstructionPhase	NumDays	10.00	87.00
tblConstructionPhase	PhaseEndDate	3/4/2026	7/2/2025
tblConstructionPhase	PhaseEndDate	3/28/2024	12/31/2023
tblConstructionPhase	PhaseEndDate	9/1/2025	9/2/2025
tblConstructionPhase	PhaseEndDate	1/30/2024	10/1/2023
tblConstructionPhase	PhaseEndDate	10/30/2025	12/31/2025
tblConstructionPhase	PhaseEndDate	7/3/2023	7/2/2023
tblConstructionPhase	PhaseStartDate	9/3/2025	1/1/2025
tblConstructionPhase	PhaseStartDate	10/2/2023	7/4/2023
tblConstructionPhase	PhaseStartDate	12/31/2024	1/1/2025
tblConstructionPhase	PhaseStartDate	7/3/2023	3/2/2023
tblConstructionPhase	PhaseStartDate	7/3/2025	9/3/2025
tblConstructionPhase	PhaseStartDate	3/3/2023	3/2/2023
tblEnergyUse	LightingElect	4.41	0.00
tblEnergyUse	NT24E	7.84	0.00
tblEnergyUse	NT24NG	0.06	0.00
tblEnergyUse	T24E	7.46	0.00
tblEnergyUse	T24NG	17.16	0.00
tblGrading	MaterialExported	0.00	900,000.00
tblLandUse	LotAcreage	75.07	18.30
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	UsageHours	6.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00

tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2023
tblSolidWaste	SolidWasteGenerationRate	3,041.10	0.00
tblTripsAndVMT	HaulingTripLength	20.00	15.00
tblTripsAndVMT	HaulingTripLength	20.00	15.00
tblTripsAndVMT	HaulingTripNumber	781.00	1,408.00
tblTripsAndVMT	HaulingTripNumber	0.00	69,600.00
tblTripsAndVMT	HaulingTripNumber	112,500.00	121,600.00
tblTripsAndVMT	HaulingTripNumber	0.00	10,320.00
tblTripsAndVMT	HaulingTripNumber	0.00	20,880.00
tblTripsAndVMT	HaulingTripNumber	0.00	14,000.00
tblTripsAndVMT	HaulingTripNumber	0.00	1,310.00
tblTripsAndVMT	HaulingTripNumber	0.00	8,600.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	581,189,355.94	0.00
tblWater	OutdoorWaterUseRate	356,212,831.06	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2023	1.7997	11.7924	23.5589	0.0733	2.1894	0.3538	2.5432	0.5807	0.3269	0.9076	0.0000	6,079.2749	6,079.2749	0.1509	0.0000	6,082.4435
2024	0.8833	4.9106	10.8381	0.0343	1.6596	0.1646	1.8242	0.4479	0.1515	0.5994	0.0000	2,586.1062	2,586.1062	0.1437	0.0000	2,589.1241
2025	17.6700	3.1649	8.2079	0.0272	1.3251	0.0979	1.4230	0.3575	0.0901	0.4477	0.0000	2,047.5664	2,047.5664	0.0746	0.0000	2,049.1334
Total	**20.3529**	**19.8679**	**42.6049**	**0.1348**	**5.1741**	**0.6163**	**5.7904**	**1.3862**	**0.5686**	**1.9547**	**0.0000**	**10,712.9476**	**10,712.9476**	**0.3692**	**0.0000**	**10,720.7010**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2023	1.6295	10.3541	23.8101	0.0733	2.1894	0.2735	2.4629	0.5807	0.2523	0.8331	0.0000	6,079.2745	6,079.2745	0.1509	0.0000	6,082.4431
2024	0.7323	3.1273	11.1504	0.0343	1.6596	0.0796	1.7392	0.4479	0.0737	0.5217	0.0000	2,586.1059	2,586.1059	0.1437	0.0000	2,589.1237
2025	17.6390	2.8174	8.2263	0.0272	1.3251	0.0797	1.4048	0.3575	0.0735	0.4310	0.0000	2,047.5663	2,047.5663	0.0746	0.0000	2,049.1333
Total	**20.0008**	**16.2988**	**43.1867**	**0.1348**	**5.1741**	**0.4328**	**5.6069**	**1.3862**	**0.3995**	**1.7857**	**0.0000**	**10,712.9467**	**10,712.9467**	**0.3692**	**0.0000**	**10,720.7001**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**1.73**	**17.96**	**-1.37**	**0.00**	**0.00**	**29.78**	**3.17**	**0.00**	**29.73**	**8.65**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	12.7738	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**12.7738**	**2.7000e-004**	**0.0300**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.5000e-004**	**0.0000**	**0.0617**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	12.7738	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**12.7738**	**2.7000e-004**	**0.0300**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.5000e-004**	**0.0000**	**0.0617**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2023	3/2/2023	5	44	
2	Site Preparation	Site Preparation	3/2/2023	7/2/2023	5	87	
3	Grading	Grading	3/2/2023	10/1/2023	5	152	
4	Building Construction 1	Building Construction	7/4/2023	12/31/2023	5	129	
5	Building Construction 2	Building Construction	1/1/2024	12/30/2024	5	261	
6	Building Construction 3	Building Construction	1/1/2025	9/2/2025	5	175	
7	Architectural Coating	Architectural Coating	1/1/2025	7/2/2025	5	131	No AC equipment
8	Paving	Paving	9/3/2025	12/31/2025	5	86	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 4,905,000; Non-Residential Outdoor: 1,635,000 (Architectural

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	0	0.00	255	0.40
Site Preparation	Rubber Tired Dozers	0	0.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Grading	Excavators	2	8.00	162	0.38
Grading	Graders	0	0.00	174	0.41
Grading	Rubber Tired Dozers	0	0.00	255	0.40
Grading	Scrapers	0	0.00	361	0.48
Grading	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction 1	Cranes	3	7.00	226	0.29
Building Construction 1	Forklifts	4	8.00	89	0.20
Building Construction 1	Generator Sets	0	0.00	84	0.74
Building Construction 1	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction 1	Welders	4	8.00	46	0.45
Building Construction 2	Cranes	3	7.00	226	0.29
Building Construction 2	Forklifts	4	8.00	89	0.20
Building Construction 2	Generator Sets	0	0.00	84	0.74
Building Construction 2	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Building Construction 2	Welders	0	0.00	46	0.45
Building Construction 3	Cranes	0	0.00	226	0.29
Building Construction 3	Forklifts	4	8.00	89	0.20
Building Construction 3	Generator Sets	0	0.00	84	0.74
Building Construction 3	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Building Construction 3	Welders	0	0.00	46	0.45
Architectural Coating	Air Compressors	0	0.00	78	0.48
Paving	Pavers	1	8.00	125	0.42
Paving	Paving Equipment	1	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	1,408.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	4	10.00	0.00	69,600.00	12.40	7.30	15.00	LD_Mix	HDT_Mix	HHDT

Grading	2	5.00	0.00	121,600.00	12.40	7.30	15.00	LD_Mix	HDT_Mix	HHDT
Building Construction 1	11	1,046.00	285.00	10,320.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2	9	1,046.00	285.00	20,880.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 3	5	1,046.00	285.00	14,000.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	0	209.00	0.00	1,310.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	4	10.00	0.00	8,600.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Clean Paved Roads

3.2 Demolition - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0845	0.0000	0.0845	0.0128	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0201	0.1617	0.3009	4.9000e-004		7.9500e-003	7.9500e-003		7.5400e-003	7.5400e-003	0.0000	42.5299	42.5299	0.0105	0.0000	42.7507
Total	**0.0201**	**0.1617**	**0.3009**	**4.9000e-004**	**0.0845**	**7.9500e-003**	**0.0925**	**0.0128**	**7.5400e-003**	**0.0203**	**0.0000**	**42.5299**	**42.5299**	**0.0105**	**0.0000**	**42.7507**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0106	0.0780	0.1316	5.2000e-004	0.0119	2.2100e-003	0.0141	3.2700e-003	2.0400e-003	5.3000e-003	0.0000	44.4845	44.4845	3.2000e-004	0.0000	44.4913
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.7000e-004	6.4000e-004	6.1700e-003	2.0000e-005	2.0000e-003	1.0000e-005	2.0200e-003	5.3000e-004	1.0000e-005	5.5000e-004	0.0000	1.4397	1.4397	6.0000e-005	0.0000	1.4409
Total	**0.0111**	**0.0787**	**0.1378**	**5.4000e-004**	**0.0139**	**2.2200e-003**	**0.0161**	**3.8000e-003**	**2.0500e-003**	**5.8500e-003**	**0.0000**	**45.9241**	**45.9241**	**3.8000e-004**	**0.0000**	**45.9322**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0845	0.0000	0.0845	0.0128	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0116	0.0755	0.3456	4.9000e-004		3.4000e-003	3.4000e-003		3.4000e-003	3.4000e-003	0.0000	42.5299	42.5299	0.0105	0.0000	42.7507
Total	**0.0116**	**0.0755**	**0.3456**	**4.9000e-004**	**0.0845**	**3.4000e-003**	**0.0879**	**0.0128**	**3.4000e-003**	**0.0162**	**0.0000**	**42.5299**	**42.5299**	**0.0105**	**0.0000**	**42.7507**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0106	0.0780	0.1316	5.2000e-004	0.0119	2.2100e-003	0.0141	3.2700e-003	2.0400e-003	5.3000e-003	0.0000	44.4845	44.4845	3.2000e-004	0.0000	44.4913
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.7000e-004	6.4000e-004	6.1700e-003	2.0000e-005	2.0000e-003	1.0000e-005	2.0200e-003	5.3000e-004	1.0000e-005	5.5000e-004	0.0000	1.4397	1.4397	6.0000e-005	0.0000	1.4409

Total	**0.0111**	**0.0787**	**0.1378**	**5.4000e-004**	**0.0139**	**2.2200e-003**	**0.0161**	**3.8000e-003**	**2.0500e-003**	**5.8500e-003**	**0.0000**	**45.9241**	**45.9241**	**3.8000e-004**	**0.0000**	**45.9322**

3.3 Site Preparation - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0263	0.2672	0.3883	5.4000e-004		0.0132	0.0132		0.0121	0.0121	0.0000	47.6039	47.6039	0.0154	0.0000	47.9272
Total	**0.0263**	**0.2672**	**0.3883**	**5.4000e-004**	**0.0000**	**0.0132**	**0.0132**	**0.0000**	**0.0121**	**0.0121**	**0.0000**	**47.6039**	**47.6039**	**0.0154**	**0.0000**	**47.9272**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.4403	3.0289	6.0110	0.0195	0.4413	0.0824	0.5237	0.1213	0.0758	0.1970	0.0000	1,661.9355	1,661.9355	0.0126	0.0000	1,662.1989
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.3000e-004	1.2600e-003	0.0122	5.0000e-005	3.9600e-003	3.0000e-005	3.9900e-003	1.0500e-003	3.0000e-005	1.0800e-003	0.0000	2.8466	2.8466	1.2000e-004	0.0000	2.8491
Total	**0.4412**	**3.0301**	**6.0232**	**0.0196**	**0.4453**	**0.0824**	**0.5277**	**0.1223**	**0.0758**	**0.1981**	**0.0000**	**1,664.7821**	**1,664.7821**	**0.0127**	**0.0000**	**1,665.0480**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.6100e-003	0.0286	0.4075	5.4000e-004		8.8000e-004	8.8000e-004		8.8000e-004	8.8000e-004	0.0000	47.6038	47.6038	0.0154	0.0000	47.9272
Total	**6.6100e-003**	**0.0286**	**0.4075**	**5.4000e-004**	**0.0000**	**8.8000e-004**	**8.8000e-004**	**0.0000**	**8.8000e-004**	**8.8000e-004**	**0.0000**	**47.6038**	**47.6038**	**0.0154**	**0.0000**	**47.9272**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.4403	3.0289	6.0110	0.0195	0.4413	0.0824	0.5237	0.1213	0.0758	0.1970	0.0000	1,661.9355	1,661.9355	0.0126	0.0000	1,662.1989
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.3000e-004	1.2600e-003	0.0122	5.0000e-005	3.9600e-003	3.0000e-005	3.9900e-003	1.0500e-003	3.0000e-005	1.0800e-003	0.0000	2.8466	2.8466	1.2000e-004	0.0000	2.8491
Total	**0.4412**	**3.0301**	**6.0232**	**0.0196**	**0.4453**	**0.0824**	**0.5277**	**0.1223**	**0.0758**	**0.1981**	**0.0000**	**1,664.7821**	**1,664.7821**	**0.0127**	**0.0000**	**1,665.0480**

3.4 Grading - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0509	0.0000	0.0509	7.7100e-003	0.0000	7.7100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0294	0.2414	0.5077	8.1000e-004		0.0118	0.0118		0.0109	0.0109	0.0000	70.7064	70.7064	0.0229	0.0000	71.1867
Total	**0.0294**	**0.2414**	**0.5077**	**8.1000e-004**	**0.0509**	**0.0118**	**0.0627**	**7.7100e-003**	**0.0109**	**0.0186**	**0.0000**	**70.7064**	**70.7064**	**0.0229**	**0.0000**	**71.1867**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.2000e-004	1.1000e-003	0.0107	4.0000e-005	3.4600e-003	2.0000e-005	3.4800e-003	9.2000e-004	2.0000e-005	9.4000e-004	0.0000	2.4867	2.4867	1.0000e-004	0.0000	2.4889
Hauling	0.7692	5.2918	10.5019	0.0341	0.7711	0.1439	0.9150	0.2118	0.1324	0.3442	0.0000	2,903.6114	2,903.6114	0.0219	0.0000	2,904.0716
Total	**0.7701**	**5.2929**	**10.5126**	**0.0341**	**0.7745**	**0.1439**	**0.9185**	**0.2128**	**0.1324**	**0.3452**	**0.0000**	**2,906.0981**	**2,906.0981**	**0.0220**	**0.0000**	**2,906.5605**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0509	0.0000	0.0509	7.7100e-003	0.0000	7.7100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.9000e-003	0.0429	0.6106	8.1000e-004		1.3200e-003	1.3200e-003		1.3200e-003	1.3200e-003	0.0000	70.7064	70.7064	0.0229	0.0000	71.1866
Total	**9.9000e-003**	**0.0429**	**0.6106**	**8.1000e-004**	**0.0509**	**1.3200e-003**	**0.0522**	**7.7100e-003**	**1.3200e-003**	**9.0300e-003**	**0.0000**	**70.7064**	**70.7064**	**0.0229**	**0.0000**	**71.1866**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.2000e-004	1.1000e-003	0.0107	4.0000e-005	3.4600e-003	2.0000e-005	3.4800e-003	9.2000e-004	2.0000e-005	9.4000e-004	0.0000	2.4867	2.4867	1.0000e-004	0.0000	2.4889
Hauling	0.7692	5.2918	10.5019	0.0341	0.7711	0.1439	0.9150	0.2118	0.1324	0.3442	0.0000	2,903.6114	2,903.6114	0.0219	0.0000	2,904.0716
Total	**0.7701**	**5.2929**	**10.5126**	**0.0341**	**0.7745**	**0.1439**	**0.9185**	**0.2128**	**0.1324**	**0.3452**	**0.0000**	**2,906.0981**	**2,906.0981**	**0.0220**	**0.0000**	**2,906.5605**

3.5 Building Construction 1 - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1503	1.2461	1.0321	2.0100e-003		0.0559	0.0559		0.0526	0.0526	0.0000	167.1836	167.1836	0.0437	0.0000	168.1005
Total	**0.1503**	**1.2461**	**1.0321**	**2.0100e-003**		**0.0559**	**0.0559**		**0.0526**	**0.0526**	**0.0000**	**167.1836**	**167.1836**	**0.0437**	**0.0000**	**168.1005**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0779	0.5718	0.9646	3.8200e-003	0.0872	0.0162	0.1034	0.0240	0.0149	0.0389	0.0000	326.0510	326.0510	2.3800e-003	0.0000	326.1010
Vendor	0.1283	0.7078	1.7987	4.3200e-003	0.1187	0.0158	0.1345	0.0341	0.0145	0.0486	0.0000	366.8964	366.8964	2.6600e-003	0.0000	366.9522
Worker	0.1449	0.1948	1.8931	7.1000e-003	0.6143	4.3700e-003	0.6186	0.1634	4.0500e-003	0.1674	0.0000	441.4994	441.4994	0.0183	0.0000	441.8845
Total	**0.3511**	**1.4744**	**4.6563**	**0.0152**	**0.8202**	**0.0364**	**0.8566**	**0.2214**	**0.0335**	**0.2549**	**0.0000**	**1,134.4468**	**1,134.4468**	**0.0234**	**0.0000**	**1,134.9377**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0279	0.3310	1.1164	2.0100e-003		2.9700e-003	2.9700e-003		2.9700e-003	2.9700e-003	0.0000	167.1834	167.1834	0.0437	0.0000	168.1003
Total	**0.0279**	**0.3310**	**1.1164**	**2.0100e-003**		**2.9700e-003**	**2.9700e-003**		**2.9700e-003**	**2.9700e-003**	**0.0000**	**167.1834**	**167.1834**	**0.0437**	**0.0000**	**168.1003**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0779	0.5718	0.9646	3.8200e-003	0.0872	0.0162	0.1034	0.0240	0.0149	0.0389	0.0000	326.0510	326.0510	2.3800e-003	0.0000	326.1010

Vendor	0.1283	0.7078	1.7987	4.3200e-003	0.1187	0.0158	0.1345	0.0341	0.0145	0.0486	0.0000	366.8964	366.8964	2.6600e-003	0.0000	366.9522
Worker	0.1449	0.1948	1.8931	7.1000e-003	0.6143	4.3700e-003	0.6186	0.1634	4.0500e-003	0.1674	0.0000	441.4994	441.4994	0.0183	0.0000	441.8845
Total	**0.3511**	**1.4744**	**4.6563**	**0.0152**	**0.8202**	**0.0364**	**0.8566**	**0.2214**	**0.0335**	**0.2549**	**0.0000**	**1,134.4468**	**1,134.4468**	**0.0234**	**0.0000**	**1,134.9377**

3.6 Building Construction 2 - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1932	1.9664	1.7001	3.4400e-003		0.0907	0.0907		0.0834	0.0834	0.0000	302.5199	302.5199	0.0978	0.0000	304.5745
Total	**0.1932**	**1.9664**	**1.7001**	**3.4400e-003**		**0.0907**	**0.0907**		**0.0834**	**0.0834**	**0.0000**	**302.5199**	**302.5199**	**0.0978**	**0.0000**	**304.5745**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1570	1.1519	1.9426	7.7400e-003	0.1765	0.0330	0.2095	0.0485	0.0304	0.0788	0.0000	659.8892	659.8892	4.8300e-003	0.0000	659.9906
Vendor	0.2548	1.4205	3.5747	8.7400e-003	0.2403	0.0321	0.2724	0.0689	0.0296	0.0985	0.0000	742.6052	742.6052	5.4000e-003	0.0000	742.7187
Worker	0.2782	0.3718	3.6208	0.0144	1.2428	8.8300e-003	1.2517	0.3305	8.1900e-003	0.3387	0.0000	881.0920	881.0920	0.0356	0.0000	881.8402
Total	**0.6900**	**2.9442**	**9.1380**	**0.0309**	**1.6596**	**0.0740**	**1.7336**	**0.4479**	**0.0681**	**0.5160**	**0.0000**	**2,283.5864**	**2,283.5864**	**0.0459**	**0.0000**	**2,284.5496**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0423	0.1832	2.0124	3.4400e-003		5.6400e-003	5.6400e-003		5.6400e-003	5.6400e-003	0.0000	302.5195	302.5195	0.0978	0.0000	304.5742
Total	**0.0423**	**0.1832**	**2.0124**	**3.4400e-003**		**5.6400e-003**	**5.6400e-003**		**5.6400e-003**	**5.6400e-003**	**0.0000**	**302.5195**	**302.5195**	**0.0978**	**0.0000**	**304.5742**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1570	1.1519	1.9426	7.7400e-003	0.1765	0.0330	0.2095	0.0485	0.0304	0.0788	0.0000	659.8892	659.8892	4.8300e-003	0.0000	659.9906
Vendor	0.2548	1.4205	3.5747	8.7400e-003	0.2403	0.0321	0.2724	0.0689	0.0296	0.0985	0.0000	742.6052	742.6052	5.4000e-003	0.0000	742.7187
Worker	0.2782	0.3718	3.6208	0.0144	1.2428	8.8300e-003	1.2517	0.3305	8.1900e-003	0.3387	0.0000	881.0920	881.0920	0.0356	0.0000	881.8402
Total	**0.6900**	**2.9442**	**9.1380**	**0.0309**	**1.6596**	**0.0740**	**1.7336**	**0.4479**	**0.0681**	**0.5160**	**0.0000**	**2,283.5864**	**2,283.5864**	**0.0459**	**0.0000**	**2,284.5496**

3.7 Building Construction 3 - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0405	0.3887	0.5675	7.7000e-004		0.0195	0.0195		0.0179	0.0179	0.0000	67.9817	67.9817	0.0220	0.0000	68.4434
Total	**0.0405**	**0.3887**	**0.5675**	**7.7000e-004**		**0.0195**	**0.0195**		**0.0179**	**0.0179**	**0.0000**	**67.9817**	**67.9817**	**0.0220**	**0.0000**	**68.4434**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1050	0.7694	1.2992	5.1900e-003	0.1183	0.0222	0.1406	0.0325	0.0204	0.0530	0.0000	442.5620	442.5620	3.2500e-003	0.0000	442.6303
Vendor	0.1686	0.9459	2.3681	5.8600e-003	0.1612	0.0217	0.1828	0.0462	0.0199	0.0662	0.0000	498.1131	498.1131	3.6400e-003	0.0000	498.1895
Worker	0.1780	0.2366	2.3105	9.6400e-003	0.8333	5.9400e-003	0.8392	0.2216	5.5100e-003	0.2271	0.0000	583.5749	583.5749	0.0231	0.0000	584.0591
Total	**0.4515**	**1.9519**	**5.9779**	**0.0207**	**1.1128**	**0.0498**	**1.1626**	**0.3003**	**0.0459**	**0.3462**	**0.0000**	**1,524.2500**	**1,524.2500**	**0.0300**	**0.0000**	**1,524.8789**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.5000e-003	0.0412	0.5859	7.7000e-004		1.2700e-003	1.2700e-003		1.2700e-003	1.2700e-003	0.0000	67.9816	67.9816	0.0220	0.0000	68.4433

Total	**9.5000e-003**	**0.0412**	**0.5859**	**7.7000e-004**		**1.2700e-003**	**1.2700e-003**		**1.2700e-003**	**1.2700e-003**	**0.0000**	**67.9816**	**67.9816**	**0.0220**	**0.0000**	**68.4433**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1050	0.7694	1.2992	5.1900e-003	0.1183	0.0222	0.1406	0.0325	0.0204	0.0530	0.0000	442.5620	442.5620	3.2500e-003	0.0000	442.6303
Vendor	0.1686	0.9459	2.3681	5.8600e-003	0.1612	0.0217	0.1828	0.0462	0.0199	0.0662	0.0000	498.1131	498.1131	3.6400e-003	0.0000	498.1895
Worker	0.1780	0.2366	2.3105	9.6400e-003	0.8333	5.9400e-003	0.8392	0.2216	5.5100e-003	0.2271	0.0000	583.5749	583.5749	0.0231	0.0000	584.0591
Total	**0.4515**	**1.9519**	**5.9779**	**0.0207**	**1.1128**	**0.0498**	**1.1626**	**0.3003**	**0.0459**	**0.3462**	**0.0000**	**1,524.2500**	**1,524.2500**	**0.0300**	**0.0000**	**1,524.8789**

3.8 Architectural Coating - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	17.0510					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**17.0510**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	9.8200e-003	0.0720	0.1216	4.9000e-004	0.0111	2.0800e-003	0.0132	3.0400e-003	1.9100e-003	4.9600e-003	0.0000	41.4112	41.4112	3.0000e-004	0.0000	41.4176
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0266	0.0354	0.3456	1.4400e-003	0.1246	8.9000e-004	0.1255	0.0332	8.2000e-004	0.0340	0.0000	87.2860	87.2860	3.4500e-003	0.0000	87.3584
Total	**0.0364**	**0.1074**	**0.4672**	**1.9300e-003**	**0.1357**	**2.9700e-003**	**0.1387**	**0.0362**	**2.7300e-003**	**0.0389**	**0.0000**	**128.6971**	**128.6971**	**3.7500e-003**	**0.0000**	**128.7759**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	17.0510					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**17.0510**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	9.8200e-003	0.0720	0.1216	4.9000e-004	0.0111	2.0800e-003	0.0132	3.0400e-003	1.9100e-003	4.9600e-003	0.0000	41.4112	41.4112	3.0000e-004	0.0000	41.4176
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0266	0.0354	0.3456	1.4400e-003	0.1246	8.9000e-004	0.1255	0.0332	8.2000e-004	0.0340	0.0000	87.2860	87.2860	3.4500e-003	0.0000	87.3584
Total	**0.0364**	**0.1074**	**0.4672**	**1.9300e-003**	**0.1357**	**2.9700e-003**	**0.1387**	**0.0362**	**2.7300e-003**	**0.0389**	**0.0000**	**128.6971**	**128.6971**	**3.7500e-003**	**0.0000**	**128.7759**

3.9 Paving - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0252	0.2431	0.3864	5.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	52.0364	52.0364	0.0168	0.0000	52.3898
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0252**	**0.2431**	**0.3864**	**5.9000e-004**		**0.0120**	**0.0120**		**0.0110**	**0.0110**	**0.0000**	**52.0364**	**52.0364**	**0.0168**	**0.0000**	**52.3898**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0645	0.4727	0.7981	3.1900e-003	0.0727	0.0137	0.0864	0.0200	0.0126	0.0325	0.0000	271.8595	271.8595	2.0000e-003	0.0000	271.9015
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	8.4000e-004	1.1100e-003	0.0109	5.0000e-005	3.9200e-003	3.0000e-005	3.9400e-003	1.0400e-003	3.0000e-005	1.0700e-003	0.0000	2.7417	2.7417	1.1000e-004	0.0000	2.7440
Total	**0.0653**	**0.4738**	**0.8090**	**3.2400e-003**	**0.0766**	**0.0137**	**0.0903**	**0.0210**	**0.0126**	**0.0336**	**0.0000**	**274.6012**	**274.6012**	**2.1100e-003**	**0.0000**	**274.6455**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0252	0.2431	0.3864	5.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	52.0363	52.0363	0.0168	0.0000	52.3897
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0252**	**0.2431**	**0.3864**	**5.9000e-004**		**0.0120**	**0.0120**		**0.0110**	**0.0110**	**0.0000**	**52.0363**	**52.0363**	**0.0168**	**0.0000**	**52.3897**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0645	0.4727	0.7981	3.1900e-003	0.0727	0.0137	0.0864	0.0200	0.0126	0.0325	0.0000	271.8595	271.8595	2.0000e-003	0.0000	271.9015
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.4000e-004	1.1100e-003	0.0109	5.0000e-005	3.9200e-003	3.0000e-005	3.9400e-003	1.0400e-003	3.0000e-005	1.0700e-003	0.0000	2.7417	2.7417	1.1000e-004	0.0000	2.7440
Total	**0.0653**	**0.4738**	**0.8090**	**3.2400e-003**	**0.0766**	**0.0137**	**0.0903**	**0.0210**	**0.0126**	**0.0336**	**0.0000**	**274.6012**	**274.6012**	**2.1100e-003**	**0.0000**	**274.6455**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551461	0.058468	0.185554	0.123211	0.029507	0.004440	0.012712	0.023230	0.001775	0.001270	0.006089	0.000516	0.001766

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	12.7738	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Unmitigated	12.7738	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.7710					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.7800e-003	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Total	**12.7738**	**2.7000e-004**	**0.0300**	**0.0000**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.5000e-004**	**0.0000**	**0.0617**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.7710					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.7800e-003	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Total	**12.7738**	**2.7000e-004**	**0.0300**	**0.0000**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.5000e-004**	**0.0000**	**0.0617**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

APPENDIX C
RAMBOLL ENVIRON MOBILE EMISSIONS CALCULATIONS
(provided electronically)

APPENDIX D
CONSTRUCTION HEALTH RISK ASSESSMENT SCREENING TOOL

Prepared for
Ramboll Environ US Corporation
San Francisco, California

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APPENDIX D
STANFORD 2018 GENERAL USE PERMIT: CONSTRUCTION HRA SCREENING TOOL
STANFORD UNIVERSITY
STANFORD, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Air Dispersion Model
AQ	Air Quality
ASFs	Age Sensitivity Factors
BAAQMD	Bay Area Air Quality Management District
CalEEMod®	California Emissions Estimator Model
CEQA	California Environmental Quality Act
DPM	Diesel Particulate Matter
EVGR	Escondido Village Graduate Residences
GHG	Greenhouse Gas
GUP	General Use Permit
HRA	Health Risk Assessment
IFinh	intake factor for inhalation
OEHHA	Office of Environmental Health Hazard Assessment
$PM_{2.5}$	Particulate Matter, 2.5 micrometers or less
REL	Reference Exposure Level
SCAQMD	South Coast Air Quality Management District
SRDT	Solar Radiation/Delta-T
TOG	Total Organic Gas
USEPA	United States Environmental Protection Agency
$\mu g/m^3$	Micrograms Per Cubic Meter

1. INTRODUCTION

This section describes the methodology used to develop the construction HRA screening tool developed for use with future construction projects on the Stanford University land covered by the General Use Permit (GUP). Ramboll Environ has developed a set of criteria that future construction projects must meet in order to “screen out” of conducting a full Health Risk Assessment (HRA), meaning the project would be below health risk thresholds if all criteria are met. Criteria were developed using conservative assumptions of emissions and exposure parameters for theoretical project sites. By assuring the same standards of construction as our model, smaller future projects can be screened out of a full health risk assessment because they will comply with Bay Area Air Quality Management District (BAAQMD) risk thresholds. Without knowing the shape and size of future projects, Ramboll Environ modelled various generic, theoretical construction sites. Two approaches were taken: (1) one model mimicking a very large construction project to set an upper bound on a large project size and (2) three much smaller, scaled down versions of the large model to allow very small projects to be constructed nearer to sensitive receptors than a larger project. The four theoretical construction site models represented 3,270,000; 540,000; 180,000; and 45,000 square feet of building construction. The methods and assumptions used for completing the air dispersion modeling and health risk assessment for these generic, theoretical construction sites informing the construction HRA screening criteria are described in the following sections.

2. REGULATORY BACKGROUND

The BAAQMD California Environmental Quality Act (CEQA) Guidelines ("Guidelines") provide recommended procedures for evaluating potential air quality (AQ) and greenhouse gas (GHG) impacts, which include, among other requirements:

1. Evaluation of cancer risk/non-cancer impacts and Particulate Matter, 2.5 micrometers or less ($PM_{2.5}$) concentrations for construction emissions on sensitive populations.

Ramboll Environ compared the results of health risk analyses to the BAAQMD 2011 CEQA significance threshold for excess lifetime cancer risk. The BAAQMD 2011 CEQA single source thresholds are:

- An excess lifetime cancer risk level of more than 10 in one million;
- A noncancer chronic HI greater than 1.0;
- A noncancer acute HI greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.3 micrograms per cubic meter ($\mu g/m^3$).

In this analysis, given that source of emissions is diesel construction equipment engines, if cancer risk from diesel particulate matter (DPM) and diesel total organic gas (TOG) is below the threshold, then noncancer acute and chronic HI and $PM_{2.5}$ incremental increase will also be below the threshold[1]. For this reason, we only evaluated excess lifetime cancer risk.

[1] Ramboll Environ conducted a conservative quantitative analysis of $PM_{2.5}$ concentrations for the largest project size confirming that $PM_{2.5}$ concentrations are below thresholds in all locations, including locations close to the theoretical project where cancer risk was above thresholds.

3. DISPERSION MODELING METHODOLOGY

This section describes the estimation of DPM and diesel TOG air concentrations at the locations of sensitive receptors surrounding the generic theoretical construction sites. Ramboll Environ performed refined air dispersion modeling using the United States Environmental Protection Agency's (USEPA's) American Meteorological Society/Environmental Protection Agency regulatory air dispersion model (AERMOD) (version 15181), with local meteorological data to determine DPM and diesel TOG concentrations for potentially exposed individuals. These concentrations are used to assess the potential human health risk as described in the risk assessment methodology section below.

3.1 Meteorological Data

Ramboll Environ used meteorological data collected on-site at Stanford and processed by the BAAQMD. The most recent one-year period available in model ready format was used (March, 2009 through February, 2010).[2] The meteorological dataset utilizing the solar radiation/delta-T (SRDT) method to estimate the stable boundary layer was used as it incorporates local temperature data in lieu of offsite cloud cover data and ceiling observations. When processing the meteorological data for use in AERMOD, the BAAQMD used the most recent version of AERMET (v15181).

3.2 Terrain

Ramboll Environ assumed flat terrain surrounding the sites since the topography depends on the specific location of the project, which is unknown. In test runs, the addition of terrain reduced the maximum dispersion factor so the no-elevation assumption is considered a conservative one, and will lead to an overestimate of risks from the theoretical project.

3.3 Generic Theoretical Project Shapes

Large Project Methodology

Without knowing the specific shape and location of future construction projects, Ramboll Environ modeled emissions dispersion for five generic project shapes, all with identical project area, referred to as Shapes 1-5. Two of the five project shapes were modeled with a "notch" missing in order to mimic a project wrapping around an existing building. Projects that wrap around existing buildings have the potential for high health impacts within the notch (depending on the wind speed and direction in relation to the notch).

The dispersion factors were compared across all shapes to determine which orientation and shapes result in the highest impacts near the shape boundaries. The two most conservative project shapes with regards to emissions dispersion (Shapes 2 and 4) were then further refined in the model. Shapes 2 and 4 were scaled up in size to match the approximate area (18.3 acres) of one of the largest construction projects to recently occur at Stanford, the Escondido Village Graduate Residences (EVGR). The large project model therefore reflects a density of about 180,000 square feet of development per acre of construction site.

Smaller Projects Methodology

[2] The 2015 OEHHA Guidelines (OEHHA, 2015) cite USEPA Guidance which allows the use of one year of on-site meteorological data, versus five years of off-site meteorological data.

In addition to modeling generic large project shapes, Ramboll Environ modeled three squares with areas of 3, 1, and 0.25 acres to represent smaller-sized projects of 540,000; 180,000; and 45,000 square feet of building construction. Similar to the large project, these small project models maintain the conservative density assumption of 180,000 square feet of development per acre of construction site.

3.4 Emission Rates

Large Project Methodology

Total off-road and on-road emissions from construction equipment were estimated using methodologies consistent with CalEEMod® 2013.2.2 (California Emissions Estimator Model). The equipment usage was based on a real construction equipment fleet estimated for the EVGR project. CalEEMod® 2013.2.2 was developed by Ramboll Environ in collaboration with the South Coast Air Quality Management District (SCAQMD) for use in developing emission inventories suitable for CEQA analysis. The model is publically available and employs widely accepted calculation methodologies for emission estimates combined with appropriate default data if site-specific information is not available. As a standard condition of approval, Stanford would be required to use Final Tier 4 standard construction equipment (except for chainsaws and paving phase equipment) so emissions were estimated using those Tier-specific assumptions (or fleet-average engines for chainsaws and paving phase equipment). Off-road equipment is listed in **Table D-1** and on-road equipment is listed in **Table D-2**. Equipment and construction phasing are based on a real Stanford proposed construction project, as noted above. DPM emissions for off-road and on-road equipment are listed in **Tables D-3a and D-4a**, respectively, and Diesel TOG emissions for off-road and on-road equipment are listed in **Tables D-3b and D-4b**, respectively. Since it would be speculative to assume the breakdown of off-site hauling traffic on various haul routes with different campus entrances for future construction projects, 0.5 miles of each off-site haul trip was conservatively added to on-site emissions. While sensitive receptors may be located near hauling routes, they would not be impacted more than sensitive receptors located near both construction haul routes near the site and off-road construction activity (onsite emissions).

Generic models (using Shapes 2 and 4) conservatively assume a project length of two years instead of the nearly three-year length that is typical for a project of the same size. This approach will result in higher estimated risks, because the sensitive receptors for the shorter period would be assumed to have higher breathing rates because the project falls completely within the age category with the highest breathing rates used in a health risk assessment (see Section 4.1 below). The amount of material exported and square footage of land use were set as upper limits in the screening criteria to restrict emissions from exceeding quantities emitted in our model with unusually high levels of excavation or a project where very tall buildings are constructed.

Smaller Projects Methodology

The smaller models estimated emissions by scaling down the large project emissions by size. Equipment was scaled in terms of number of equipment hours, not by number of whole equipment units. For example, since the large project represented 3,270,000 square feet of building construction, total emissions (i.e. equipment hours) for the 180,000 square foot project were scaled down by 180,000/3,270,000. Alternatively, total emissions for the 540,000 square foot project were scaled down by 540,000/3,270,000. As described above,

emissions were still conservatively estimated to occur within a two year duration. Limits on material exported were also scaled down by size to be included in the screening criteria.

3.5 Dispersion Model Setup

DPM and diesel TOG annual average air concentrations were estimated using the annual average dispersion factors calculated from the model and multiplying them by the respective annual average emissions from the construction equipment (off-road and on-road). Model source parameters are listed in **Table D-5**. The simulated dispersion of the construction operations were given a unit emissions rate (1 gram per second [g/s]) to calculate dispersion factors for each source-receptor combination.

The following equation was used to estimate the annual concentrations:

$$\text{Average Concentration} = \left(Q_{annual} \times \left(\frac{\chi}{Q} \right)_{annual} \right)_i$$

Where:

Q	=	emission rate of DPM or diesel TOG (g/s)
$\left(\frac{\chi}{Q} \right)$	=	dispersion factor ($\mu g/m^3$)/(g/s)
i	=	construction volume source

The modeled air concentrations were then used to evaluate risks as described in the following risk assessment methodology section.

4. RISK ASSESSMENT METHODOLOGY

4.1 Exposure Assumptions

The exposure parameters used in this HRA were developed for each sensitive receptor type based on parameters recommended by BAAQMD (BAAQMD, 2016) and the new Office of Environmental Health Hazard Assessment (OEHHA) Guidance, released in March, 2015 ("2015 OEHHA Guidance") (OEHHA, 2015).

The following types of sensitive populations were evaluated in this assessment (for both large and small project sizes): child residents, adult residents, and children in childcare. The population-specific exposure parameters used in this analysis are presented in **Table D-6**. All populations were assumed to be possible at all locations.

California Environmental Protection Agency (Cal/EPA) and the 2015 OEHHA Guidance recommend applying an adjustment factor to the annual average concentration modeled assuming continuous emissions (i.e., 24 hours per day, 7 days per week, and 365 days per year), when the actual emissions are less than 24 hours per day and exposures are concurrent with emissions activities occurring at the project site. (Cal/EPA, 2003, OEHHA, 2015) Residents (including both adult and child residents) living on campus are assumed to be present 24 hours per day, 7 days per week. This assumption is consistent with the modeled annual average air concentration, thus the annual average concentration need not be adjusted.

Childcare locations are assumed to be present during construction activities which occur 9 hours per day, during weekdays only. As this assumption is not consistent with the modeled annual average air concentration (24 hours per day, 365 days per year), a modeling adjustment factor[3] (MAF) of 3.7 (equal to [24 hours/9 hours] x [7 days/5 days]) was applied to the annual average concentration to align with the source operating schedule.

HRAs conducted using 2015 OEHHA Guidance utilize a number of standard "default" exposure assumptions when calculating cancer risk and non-cancer hazard. These exposure assumptions are conservative, in that they lead to calculated potential health effects that likely overestimate the impacts of a project's emissions. This has been acknowledged by OEHHA when they noted that the use of conservative assumptions in risk assessment is intended to produce a hypothetical estimate of risk that does not underestimate risks and that can be viewed as an upper-bound estimate. Examples of these conservative exposure assumptions include the following:

- Residential occupancy: Residents (including both adult and child residents) living on campus are assumed to be present 24 hours per day, 7 days per week instead of the average time spent at home of 85% for ages less than 2 years, 72% for ages 2 to <16 years, and 73% for ages 16 and above.
- Child receptor: For locations where a child may live, exposure is assumed to begin at age 0 (newborn) as this is the most conservative scenario for a 2-year construction project. Children are assumed to be ten times more susceptible to carcinogens than adults from age 0 to age 2 and three times more susceptible from age 2 to 16. Therefore, should

[3] Referred to as "worker adjustment factor (WAF)" in the 2015 OEHHA Guidance.

adults be present at these locations or should children begin exposure at a later age, potential risks would be lower than those presented in this assessment.

- Outdoor exposure: Modeling and health risk calculations are performed assuming that all potential receptors are breathing outdoor air for the entire exposure period. In many cases, receptors will be located indoors where there could be reductions in potential pollutant levels.

4.2 Toxicity Assumptions

The cancer toxicity data for DPM, chronic reference exposure level (REL) for DPM, and acute RELs for diesel TOG components are summarized in **Table D-7**.

The estimated excess lifetime cancer risks for each evaluated sensitive receptor type were adjusted by Age Sensitivity Factors (ASFs), when appropriate, as recommended by BAAQMD (BAAQMD, 2016) and as discussed in the 2015 OEHHA Guidance. This approach accounts for an "anticipated special sensitivity to carcinogens" of infants and children. The applicable ASFs used in this analysis are summarized in **Table D-6**, and are incorporated within the intake factor for inhalation ("IFinh") discussed in Section 4.3.1 below.

4.3 Risk Characterization

4.3.1 Estimation of Cancer Risks

Carcinogenic risks are estimated as the incremental probability that an individual will develop cancer over a lifetime as a result of exposure to potential carcinogens.

The following equation was used to calculate excess lifetime cancer risk:

$$\text{Cancer Risk}_i = C_i \times CF \times IFinh \times CPF_i$$

Where:

$Risk_i$	=	Lifetime Excess Cancer Risk from exposure to $chemical_i$
C_i	=	Annual Average Air Concentration for $chemical_i$ ($\mu g/m^3$)
CF	=	Conversion Factor (mg/1000 µg)
IFinh	=	Intake Factor for Inhalation (m^3/kg-day)
CPF_i	=	Cancer Potency Factor for $chemical_i$ ($[mg/kg\text{-}day]^{-1}$)

The estimated risk is expressed as a unitless probability.

4.3.2 Risk Assessment Results

The results of this HRA for sensitive populations potentially exposed to DPM and diesel TOG emissions from construction equipment were compared to the BAAQMD's thresholds of 10-in-one-million for cancer risk (BAAQMD, 2011).

The maximum cancer risk was evaluated as a function of distance for the two most conservative generic large project shapes, the three smaller project shapes, and for all receptor types for all four project sizes. This allows for a screening distance for specific receptor types for future construction projects. **Table D-8** shows the maximum cancer risk as a function of distance using the large project methodology outlined in previous sections of this appendix. **Tables D-9 through D-11** show the maximum cancer risk as a function of distance for the medium, small, and very small square models, respectively, for various receptor types. Results presented in **Tables D-8 through D-11** were used to determine the

following criteria for the construction screening tool for future large and small construction projects.

5. SCREENING CRITERIA

Generalized HRA models were used to develop four lists of criteria, for large- and small-sized projects, that would allow Stanford to screen out of future construction HRA analyses since the project would not exceed BAAQMD thresholds if all of the following criteria are met within the appropriate project size category:

For Large-Sized Projects:

1. The project must be less than 3,270,000 square feet of building and/or parking structure area
2. The project must have less than 900,000 cubic yards of debris/soil exported
3. The project must commit to using all available Tier 4 Final construction equipment[4]
4. The nearest receptors must meet the following criteria:
    a. The nearest childcare facility is farther than 140 meters from the project boundary
    b. The nearest residence housing children is farther than 50 meters from the project boundary
    c. The nearest adult resident is farther than 10 meters from the project boundary[5]

For Medium-Sized Projects:

1. The project must be less than 540,000 square feet of building and/or parking structure area
2. The project must have less than 150,000 cubic yards of debris/soil exported
3. The project must commit to using all available Tier 4 Final construction equipment
4. The nearest receptors must meet the following criteria:
    a. The nearest childcare facility is farther than 50 meters from the project boundary
    b. The nearest resident is farther than 10 meters from the project boundary

For Small-Sized Projects:

1. The project must be less than 180,000 square feet of building and/or parking structure area
2. The project must have less than 50,000 cubic yards of debris/soil exported
3. The project must commit to using all available Tier 4 Final construction equipment
    a. The nearest childcare facility is farther than 30 meters from the project boundary
    b. The nearest resident is farther than 10 meters from the project boundary

[4] Ramboll Environ understands that not all construction equipment are available with Tier 4 Final engines. In this model, using default-tier chainsaws and paving phase equipment (and Tier 4 Final for everything else) yielded 94% of total equipment horsepower hours (hp-hrs) with Tier 4 engines. Therefore, the project must have greater than 94% of total equipment hp-hrs with Tier 4 engines to meet this condition. This applies to large, medium, small, and very small sized projects.

[5] This criteria applies to all project size categories. Due to the 10 meter by 10 meter resolution of the model, all models assume that construction projects will allow a 10 meter buffer from the project fence line where no person resides.

For Very Small-Sized Projects:

1. The project must be less than 45,000 square feet of building and/or parking structure area
2. The project must have less than 12,500 cubic yards of debris/soil exported
3. The project must commit to using all available Tier 4 Final construction equipment
4. The nearest receptors must meet the following criteria:
   a. The nearest resident or childcare is farther than 10 meters from the project boundary[6,7]

[6] No receptor was found to exceed the 10 in a million cancer risk but the model assumes a 10-meter buffer separating the project fence line and the nearest receptor.

[7] If Stanford wishes to construct within the 10 meter buffer under this set of criteria and still screen out of a health risk analysis, construction activities using diesel equipment cannot occur when children are present (meaning work must occur during off-hours and/or weekends).

REFERENCES

Bay Area Air Quality Management District (BAAQMD). 2016. BAAQMD Air Toxics NSR Program Health Risk Screening Analysis (HRSA) Guidelines. January.

BAAQMD. 2011. California Environmental Quality Act Air Quality Guidelines. May.

Cal/EPA. 2003. Air Toxics Hot Spots Program Risk Assessment Guidelines. August.

OEHHA. 2015. Guidance Manual for Preparation of Health Risk Assessments. February. South Coast Air Quality Management District (SCAQMD). 2008. Final Localized Significance Threshold Methodology. July.

Table D-1
Construction, Off-road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Construction Year	Construction Start	Construction End	Equipment	Quantity	Tier	Usage Hours per Day	Horsepower	Load Factor	Construction Days per Year
Demolition	2016	10/1/2016	12/1/2016	Concrete/Industrial Saws	1	Fleet average	8	81	0.73	44
				Excavators	3	Tier 4	8	162	0.38	44
Site Preparation	2016	12/1/2016	12/31/2016	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.37	22
	2016	1/1/2017	3/31/2017	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.37	65
Grading	2016	12/1/2016	12/31/2016	Excavators	2	Tier 4	8	162	0.38	22
	2017	1/1/2017	7/1/2017	Excavators	2	Tier 4	8	162	0.38	130
Building Constructio	2017	4/1/2017	12/31/2017	Cranes	3	Tier 4	7	226	0.29	195
				Forklifts	4	Tier 4	8	89	0.20	195
				Welders	4	Tier 4	8	46	0.45	195
	2018	1/1/2018	12/31/2018	Cranes	3	Tier 4	7	226	0.29	65
				Forklifts	4	Tier 4	8	89	0.20	261
				Tractors/Loaders/Backhoes	2	Tier 4	8	97	0.37	261
	2019	1/1/2019	6/1/2019	Forklifts	4	Tier 4	8	89	0.20	109
				Tractors/Loaders/Backhoes	1	Tier 4	8	97	0.37	109
Architectural Coating	2018	6/1/2018	12/1/2018	*no equipment*						
Paving	2019	6/1/2019	9/30/2019	Pavers	1	Fleet average	8	125	0.42	86
				Paving Equipment	1	Fleet average	8	130	0.36	86
				Rollers	2	Fleet average	8	80	0.38	86

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Table D-2
Construction, On-road Vehicles
Stanford Construction HRA Screening
Stanford, CA

Phase	Trip Type	Number of Round Trips per Day	Number of Vehicles	Total Construction Days
Demolition	Hauling	16	10	44
Site Preparation	Hauling	400	20	87
Grading	Hauling	400	50	152
Building Construction	Vendor	143	143	565
	Hauling	40	20	
Architectural Coating	Hauling	5	5	131
Paving	Hauling	50	20	86

Vendor trips use CalEEMod default activity assumptions.

Note: Worker trips are not considered in this analysis due to their minimal contribution to DPM emissions and since workers may park off-site.

Table D-3a
Diesel PM Emissions from Off-road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Construction Year[1]	Construction Start[1]	Construction End[1]	Equipment[1]	Quantity[1]	Tier[1]	Usage Hours per Day[2]	Horsepower[2]	PM_{10} Emission Factor (g/bhp-hr)[2]	Load Factor[2]	Construction Days per Period	PM_{10} Emissions (lbs/day)	PM_{10} Emissions (tons/year)
Demolition	2016	10/1/2016	12/1/2016	Concrete/Industrial Saws	1	Fleet Average	8	81	0.33	0.73	44	0.35	7.64E-03
				Excavators	3	Tier 4	8	162	0.01	0.38	44	0.03	5.73E-04
Site Preparation	2016	12/1/2016	12/31/2016	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.01	0.37	22	0.02	2.23E-04
	2017	1/1/2017	3/31/2017	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.01	0.37	65	0.02	6.58E-04
Grading	2016	12/1/2016	12/31/2016	Excavators	2	Tier 4	8	162	0.01	0.38	22	0.02	1.91E-04
	2017	1/1/2017	7/1/2017	Excavators	2	Tier 4	8	162	0.01	0.38	130	0.02	1.13E-03
Building Construction	2017	4/1/2017	12/31/2017	Cranes	3	Tier 4	7	226	0.01	0.29	195	0.02	2.37E-03
				Forklifts	4	Tier 4	8	89	0.01	0.20	195	0.01	9.79E-04
				Welders	4	Tier 4	8	46	0.01	0.45	195	0.01	1.14E-03
	2018	1/1/2018	12/31/2018	Cranes	3	Tier 4	7	226	0.01	0.29	65	0.02	7.89E-04
				Forklifts	4	Tier 4	8	89	0.01	0.20	261	0.01	1.31E-03
				Tractors/Loaders/Backhoes	2	Tier 4	8	97	0.01	0.37	261	0.01	1.32E-03
	2019	1/1/2019	6/1/2019	Forklifts	4	Tier 4	8	89	0.01	0.20	109	0.01	5.48E-04
				Tractors/Loaders/Backhoes	1	Tier 4	8	97	0.01	0.37	109	0.01	2.76E-04
Paving	2019	6/1/2019	9/30/2019	Pavers	1	Fleet Average	8	125	0.16	0.42	86	0.15	6.33E-03
				Paving Equipment	1	Fleet Average	8	130	0.13	0.36	86	0.11	4.74E-03
				Rollers	2	Fleet Average	8	80	0.27	0.38	86	0.29	1.27E-02
												Total	**0.04**

Notes:

1. The construction schedule, equipment, and Tier level were provided by Stanford.
2. Usage hours per day, horsepower, load factor, and emission factors are based on CalEEMod® 2013.2.2 defaults.

Abbreviations:

bhp-hr - brake-horsepower-hour
CalEEMod - California Emissions Estimator Model
g - gram
lbs - pounds
PM_{10} - Particulate Matter 10 microns or less

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Table D-3b
Diesel TOG Emissions from Off-road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Construction Year[1]	Construction Start[1]	Construction End[1]	Equipment[1]	Quantity[1]	Tier[1]	Usage Hours per Day[2]	Horsepower[2]	TOG Emission Factor (g/bhp-hr)[2]	Load Factor[2]	Construction Days per Period	TOG Emissions (lbs/day)	TOG Emissions (tons/year)
Demolition	2016	10/1/2016	12/1/2016	Concrete/Industrial Saws	1	Fleet Average	8	81	6.24	0.73	44	6.50	1.43E-01
				Excavators	3	Tier 4	8	162	0.06	0.38	44	0.20	4.30E-03
Site Preparation	2016	12/1/2016	12/31/2016	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.06	0.37	22	0.15	1.67E-03
	2017	1/1/2017	3/31/2017	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.06	0.37	65	0.15	4.94E-03
Grading	2016	12/1/2016	12/31/2016	Excavators	2	Tier 4	8	162	0.06	0.38	22	0.13	1.43E-03
	2017	1/1/2017	7/1/2017	Excavators	2	Tier 4	8	162	0.06	0.38	130	0.13	8.47E-03
Building Construction	2017	4/1/2017	12/31/2017	Cranes	3	Tier 4	7	226	0.06	0.29	195	0.18	1.78E-02
				Forklifts	4	Tier 4	8	89	0.06	0.20	195	0.08	7.35E-03
				Welders	4	Tier 4	8	46	0.12	0.45	195	0.18	1.71E-02
	2018	1/1/2018	12/31/2018	Cranes	3	Tier 4	7	226	0.06	0.29	65	0.18	5.92E-03
				Forklifts	4	Tier 4	8	89	0.06	0.20	261	0.08	9.83E-03
				Tractors/Loaders/Backhoes	2	Tier 4	8	97	0.06	0.37	261	0.08	9.91E-03
	2019	1/1/2019	6/1/2019	Forklifts	4	Tier 4	8	89	0.06	0.20	109	0.08	4.11E-03
				Tractors/Loaders/Backhoes	1	Tier 4	8	97	0.06	0.37	109	0.04	2.07E-03
Paving	2019	6/1/2019	9/30/2019	Pavers	1	Fleet Average	8	125	0.36	0.42	86	0.33	1.42E-02
				Paving Equipment	1	Fleet Average	8	130	0.30	0.36	86	0.25	1.07E-02
				Rollers	2	Fleet Average	8	80	0.50	0.38	86	0.54	2.32E-02
												Total	**0.29**

Notes:

1. The construction schedule, equipment, and Tier level were provided by Stanford.
2. Usage hours per day, horsepower, load factor, and emission factors are based on CalEEMod® 2013.2.2 defaults.

Abbreviations:

bhp-hr - brake-horsepower-hour
g - gram
lbs - pounds
TOG - total organic gas

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Table D-4a
Diesel PM Emissions from On-Road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Year	Trip Type	Number of One-Way Trips per Day[1]	Number of Vehicles[2]	On-Site Trip Length (miles)[3]	Construction Days per Year	PM_{10} Emission Factors[4]		PM_{10} Emissions	PM_{10} Emissions
							(g/mile)	(g/vehicle/day)	(lbs/day)	(tons/year)
Demolition	2016	Hauling	32	10	0.5	44	6.86E-02	2.05E-01	6.95E-03	1.53E-04
Site Preparation	2016	Hauling	800	20	0.5	22	6.86E-02	2.05E-01	6.96E-02	7.65E-04
	2017	Hauling	800	20	0.5	65	4.14E-02	1.39E-01	4.26E-02	1.39E-03
Grading	2016	Hauling	800	50	0.5	22	6.86E-02	2.05E-01	8.32E-02	9.15E-04
	2017	Hauling	800	50	0.5	130	4.14E-02	1.39E-01	5.18E-02	3.37E-03
Building Construction	2017	Vendor	285	143	0.5	195	4.14E-02	1.39E-01	5.65E-02	5.51E-03
		Hauling	80	20	0.5	195	4.14E-02	1.39E-01	9.76E-03	9.52E-04
	2018	Vendor	285	143	0.5	261	2.71E-02	1.01E-01	4.01E-02	5.24E-03
		Hauling	80	20	0.5	261	2.71E-02	1.01E-01	6.83E-03	8.91E-04
	2019	Vendor	285	143	0.5	109	2.48E-02	8.95E-02	3.59E-02	1.96E-03
		Hauling	80	20	0.5	109	2.48E-02	8.95E-02	6.13E-03	3.34E-04
Architectural Coating	2018	Hauling	10	5	0.5	131	2.71E-02	1.01E-01	1.41E-03	9.22E-05
Paving	2019	Hauling	100	20	0.5	86	2.48E-02	8.95E-02	6.68E-03	2.87E-04
									Total	**0.022**

Notes:

1. The number of hauling trips was provided by Stanford. Vendor trips use CalEEMod® 2013.2.2 default activity assumptions. Worker trips are not considered in this analysis due to their minimal contribution to DPM emissions and since workers may park off-site.
2. The number of haul trucks were provided by Stanford. For vendor trips, each round trip was conservatively assumed to be a new vehicle.
3. The Project site is approximately 0.3 miles long. Therefore, a one-way trip length of 0.5 miles was conservatively assumed for evaluating on-site emissions. Additionally, 0.5 miles of each off-site haul trip was conservatively added to on-site impacts.
4. Emission factors were derived from EMFAC2014 for Santa Clara County and calendar years 2016 - 2019. Consistent with CalEEMod® 2013.2.2 options, vendor and hauling trucks are all conservatively assumed to be HHD diesel trucks.

Abbreviations:

g - gram

lbs - pounds

PM_{10} - Particulate Matter 10 microns or less

HHD - heavy-heavy duty

CalEEMod - California Emissions Estimator Model

Table D-4b
Diesel TOG Emissions from On-Road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Year	Trip Type	Number of One-Way Trips per Day[1]	Number of Vehicles[2]	On-Site Trip Length (miles)[3]	Construction Days per Year	TOG Emission Factors[4]		TOG Emissions	TOG Emissions
							(g/mile)	(g/vehicle/day)	(lb/day)	(ton/year)
Demolition	2016	Hauling	32	10	0.5	44	3.13E-01	3.06E+00	7.85E-02	1.73E-03
Site Preparation	2016	Hauling	800	20	0.5	22	3.13E-01	3.06E+00	4.11E-01	4.52E-03
	2017	Hauling	800	20	0.5	65	2.54E-01	2.72E+00	3.44E-01	1.12E-02
Grading	2016	Hauling	800	50	0.5	22	3.13E-01	3.06E+00	6.13E-01	6.74E-03
	2017	Hauling	800	50	0.5	130	2.54E-01	2.72E+00	5.24E-01	3.41E-02
Building Construction	2017	Vendor	285	143	0.5	195	2.54E-01	2.72E+00	9.34E-01	9.11E-02
		Hauling	80	20	0.5	195	2.54E-01	2.72E+00	1.42E-01	1.39E-02
	2018	Vendor	285	143	0.5	261	2.24E-01	2.49E+00	8.51E-01	1.11E-01
		Hauling	80	20	0.5	261	2.24E-01	2.49E+00	1.29E-01	1.69E-02
	2019	Vendor	285	143	0.5	109	2.18E-01	2.37E+00	8.12E-01	4.43E-02
		Hauling	80	20	0.5	109	2.18E-01	2.37E+00	1.24E-01	6.74E-03
Architectural Coating	2018	Hauling	10	5	0.5	131	2.24E-01	2.49E+00	2.99E-02	1.96E-03
Paving	2019	Hauling	100	20	0.5	86	2.18E-01	2.37E+00	1.28E-01	5.52E-03
									Total	**0.35**

Notes:

1. The number of hauling trips was provided by Stanford. Vendor trips use CalEEMod® 2013.2.2 default activity assumptions. Worker trips are not considered in this analysis due to their minimal contribution to DPM emissions and since workers may park off-site.
2. The number of haul trucks were provided by Stanford. For vendor trips, each round trip was conservatively assumed to be a new vehicle.
3. The Project site is approximately 0.3 miles long. Therefore, a one-way trip length of 0.5 miles was conservatively assumed for evaluating on-site emissions. Additionally, 0.5 miles of each off-site haul trip was conservatively added to on-site impacts.
4. Emission factors were derived from EMFAC2014 for Santa Clara County and calendar years 2016 - 2019. Consistent with CalEEMod® 2013.2.2 options, vendor and hauling trucks are all conservatively assumed to be HHD diesel trucks.

Abbreviations:

CalEEMod - California Emissions Estimator Model
g - gram
HHD - heavy-heavy duty
lbs - pounds
TOG - total organic gas

Table D-5
Model Source Parameters
Stanford Construction HRA Screening
Stanford, CA

Pathway	Description	Selection	Notes
Control	Averaging Time	Period average	
	Urban Population	78,212	Based on 2010 census (Stanford and Palo Alto)
	Model Version	AERMOD v15181	
Source	Spacing	10 m x 10 m	LST Guidance for sites >5 acres
	Release Height[1]	0 m	0 m for all construction phases
	Initial Vertical Dimension (IVD)	1.4 m	LST Guidance
	Initial Lateral Dimension (ILD)	4.65 m	Length of side (10 m) divided by 2.15, per AERMOD User's Guide.
	Variable Emission Factor	8 am - 5 pm construction	
Receptors	Receptor Height[1]	0 m	
	Grid	10 m spacing within 1 km of boundary	
Meteorology	Surface Data	Stanford onsite data processed by BAAQMD using AERMET 15181, 3/2009-2/2010	
	Upper Air	Oakland	
	Station Elevation	37.5 m	

Notes:

1. Guidance for Preparation of Health Risk Assessments (OEHHA, 2015) recommends using a receptor height from 0 meters to 1.8 meters. 0 meters was chosen for this analysis to account for the lower breathing zone of a potential child receptor. Additionally, while the release height of emission sources is often above grade, a release height of 0 was conservatively used here to account for sources that may be below grade (such as excavation activity). This combination of receptor and release height results in the shortest distance between the release point and the receptor, therefore representing a conservative analysis.

Abbreviations:

AERMOD - American Meteorological Society/Environmental Protection Agency Regulatory Model

BAAQMD - Bay Area Air Quality Management District

m - meter

South Coast Air Quality Management District

USEPA - United States Environmental Protection Agency

Sources:

SCAQMD. 2008. Final Localized Significance Threshold Methodology. July. ["LST Guidance"]

USEPA. 2004. User's Guide for the AMS/EPA Regulatory Model - AERMOD. September. ["AERMOD User's Guide"]

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

Table D-6
Exposure Parameters (2015 OEHHA Guidance)
Stanford Construction HRA Screening
Stanford, CA

Exposure Parameters	Receptor Type				Details
	Child Resident	Childcare		Adult Resident	
Starting Age	0	6 weeks	2	16	The 0-2 age group was used in this analysis because, for the 2-year-long project evaluated, the 0-2 age group has the highest, most conservative daily breathing rate. The earliest age at the childcare is assumed to be 6 weeks, based on review of nearby Stanford childcare websites.
Construction Length	2 yrs or less	2 yrs or less		2 yrs or less	
8-hr Breathing Rate (L/kg-8-hr)	N/A	1,200	640	N/A	8-hr breathing rate is from the 2015 OEHHA Guidance, Table 5.8. These values represent the 95th percentile breathing rates for moderate intensity activities for children age 0-2 and 2-9, respectively. BAAQMD recommends a default exposure using the 8-hour breathing rate for children age 2-16 for school exposures, but allows the "use of breathing rates for other age ranges that are tailored to the ages of the children in the specific school under evaluation."
1-hr Breathing Rate (L/kg-hr)	N/A	150	80	N/A	1-hr Breathing Rate = 8-hr Breathing Rate / 8 hrs
Exposure Time ET (hrs/day)	N/A	10	10	N/A	ET is conservatively estimated as 10 hours, because the childcares are open longer than a standard work day. The extrapolation to 10 hours per day is a conservative approach to account for childcare facilities where children may be present for 10 instead of 8 hours (typical school/workplace).
Daily Breathing Rate DBR (L/kg-day) [L/kg-10hr for childcare]	1,090	1,500	800	261	**Resident:** Daily Breathing Rate is the 95th percentile breathing rate for ages 0-2 from the 2015 OEHHA Guidance. **Childcare:** Daily Breathing Rate = 1 hr Breathing Rate x Exposure Time **Student Resident:** Daily Breathing Rate is the 80th percentile breathing rate for ages 16-30 from the 2015 OEHHA Guidance.
Exposure Frequency EF (day/year)	350	245	245	350	**Resident and Student Resident:** Assumes 350 days per year, consistent with the January 2016 BAAQMD guidance. **Childcare:** Assumes attendance 5 days per week, 49 weeks per year (245 days). In comparison, the January 2016 BAAQMD HRA guidelines recommend 250 days per year for workers (5 days per week, 50 weeks per year). This difference of 5 days on the inhalation factor is insignificant (2%).
Exposure Duration ED (year)	2.00	1.88	0.12	2.00	This analysis is based on a worst-case 2 year construction period. Since the starting age at childcare is 6 weeks, the time up until age 2 is in the 0-2 age bin, while the final 6 weeks of the 2 years exposure is in the age bin 2-9.
Conversion Factor CF (m^3/L)	0.001	0.001	0.001	0.001	
Averaging Time AT (days)	25,550	25,550	25,550	25,550	Averaging time is the assumed lifetime of the person over which this risk is distributed (70 years).
Fraction of Time at Home FAH (unitless)	1	N/A	N/A	1	FAH reflects default values from OEHHA 2015. Since residents may work at Stanford (e.g., within 1 km of the Project site), fraction of time spent at home was set to 1 for all receptor types.
Age Sensitivity Factor ASF (unitless)	10	10	3	1	ASF is 10 for ages 0-2, 3 for ages 2-16, and 1 for ages 16+, consistent with January 2016 BAAQMD guidance.
Model Adjustment Factor MAF (unitless)	1	3.7	3.7	1	MAF is used to reconcile the AERMOD modeled annual average dispersion factor with the actual construction hours to account for accurate exposure for people who are not present all day year-round. Construction will occur 5 days per week, 9 hours per day, so the MAF is 7/5 x 24/9 for the childcare.
Discount Factor DF (unitless)	1	0.9	0.9	1	DF adjusts the exposure to account for the period of construction emissions compared to the period of time the receptor is present so as not to count exposure for hours when construction does not occur. Construction occurs 9 hours per day, while the childcare child is assumed to be present 10 hours per day, therefore the DF for childcare = 9/10.
Inhalation Factor IF_inh	0.2986	0.9108	0.0089	0.0072	**Resident and Student Resident:** IF_inh = DBR x EF x ED x CF x FAH x ASF x MAF x DF / AT **Childcare:** IF_inh = DBR [L/kg-10hr] x ET [10hr/day] x EF x ED x CF x FAH x ASF x MAF x DF / AT Total IF_inh for childcare risk calculations is the sum of the IF_inh for the two age bins.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
HRA - health risk assessment
OEHHA - Office of Environmental Health Hazard Assessment
hr - hour
kg - kilogram
m^3 - cubic meter
L - liter

Sources:

BAAQMD. 2016. Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines. January. http://www.baaqmd.gov/~/media/files/planning-and-research/rules-and-regs/workshops/2016/reg-2-5/hra-guidelines_clean_jan_2016-pdf.pdf?la=en

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

Table D-7
Speciation and Cancer Potency Factor
Stanford Construction HRA Screening
Stanford, CA

Source	Chemical[1]		CAS Number	Speciation	Cancer Potency Factor (CPF)
				[unitless]	[mg/kg-day]$^{-1}$
Off-Road and On-Road Construction Emissions (Diesel equipment and vehicles)	Diesel PM	Diesel PM	9901	1	1.1

Notes:

1. DPM is used as a surrogate measure of carcinogen exposure for the mixture of chemicals that make up diesel exhaust as a whole, including diesel TOG.

Abbreviations:

Cal/EPA - California Environmental Protection Agency
CAS - Chemical Abstract Number
CPF - cancer potency factor
DPM - diesel particulate matter
kg - kilogram
mg - milligram
OEHHA - Office of Environmental Health Hazard Assessment
PM - particulate matter
TOG - total organic gas

Sources:

Cal/EPA. 2015. OEHHA/ARB Consolidated Table of Approved Risk Assessment Health Values. May.

Table D-8
Maximum Cancer Risk by Receptor Population and Large Project Model Type (3,270,000 sq ft) as a Function of Distance from Project Fenceline
Stanford Construction HRA Screening
Stanford, CA

	Childcare				Child Resident				Adult Resident			
Distance from Construction Project Boundary (m)	Square Polygon[1]	Notched Polygon[2]	EVGR - No Elevation[3]	EVGR - Original[4]	Square Polygon[1]	Notched Polygon[2]	EVGR - No Elevation[3]	EVGR - Original[4]	Square Polygon[1]	Notched Polygon[2]	EVGR - No Elevation[3]	EVGR - Original[4]
10	46.3	60.9	50.8	28.8	15.0	19.8	16.5	8.5	0.4	0.5	0.4	0.4
20	33.4	46.5	45.1	25.7	10.8	15.1	14.6	7.6	0.3	0.4	0.4	0.3
30	26.9	37.2	34.2	20.0	8.7	12.1	11.1	5.9	0.2	0.3	0.3	0.3
40	22.8	31.7	29.8	17.5	7.4	10.3	9.7	5.1	0.2	0.2	0.2	0.2
50	19.8	28.4	24.2	14.3	6.4	9.2	7.9	4.2	0.2	0.2	0.2	0.2
60	17.5	16.3	15.8	9.3	5.7	5.3	5.1	2.7	0.1	0.1	0.1	0.1
70	15.6	13.8	15.5	9.1	5.1	4.5	5.0	2.7	0.1	0.1	0.1	0.1
80	14.0	11.7	12.7	7.5	4.6	3.8	4.1	2.2	0.1	0.1	0.1	0.1
90	12.7	10.8	10.8	6.4	4.1	3.5	3.5	1.9	0.1	0.1	0.1	0.1
100	11.6	10.0	9.3	5.4	3.8	3.2	3.0	1.6	0.1	0.1	0.1	0.1
120	10.6	8.7	9.3	5.5	3.4	2.8	3.0	1.6	0.1	0.1	0.1	0.1
140	9.0	7.5	7.8	4.6	2.9	2.4	2.5	1.3	0.1	0.1	0.1	0.1
160	7.7	6.6	6.1	3.6	2.5	2.1	2.0	1.0	0.1	0.1	0.0	0.0
180	6.7	5.8	5.2	3.1	2.2	1.9	1.7	0.9	0.1	0.0	0.0	0.0
200	5.9	5.2	4.5	2.6	1.9	1.7	1.5	0.8	0.0	0.0	0.0	0.0
250	5.2	4.6	4.1	2.4	1.7	1.5	1.3	0.7	0.0	0.0	0.0	0.0
300	3.9	3.6	3.0	1.7	1.3	1.2	1.0	0.5	0.0	0.0	0.0	0.0

Notes:

1. This is a square polygon with the same project area and square footage (3,270,000 square feet) as the original EVGR project area. Total emissions from the entire EVGR project were compressed into a two-year time period when estimating the emission rates. Dispersion factors were modeled assuming zero elevation (since elevation and location of future projects are unknown).
2. This is a square polygon with a notch removed on the south side of the project. The notch is 1/9th the size of the square but the project area still matches the orginal EVGR project area. Total emissions from the entire EVGR project were compressed into a two-year time period when estimating the emission rates. Dispersion factors were modeled assuming zero elevation (since we don't know the location of projects to come).
3. This is the exact EVGR model but with zero elevation for dispersion modeling to match the other hypothetical project shapes (and since we don't know the location of future projects). Total emissions from the entire EVGR project were compressed into a two-year time period to match the conservative hypothetical project models listed above.
4. This is the exact same EVGR cancer risk (same project length and emission rates, dispersion factors with elevation, same inhalation factors) except that all receptors were assumed to be a specific receptor population (either childcare, resident, or student resident).
5. Inhalation factors for the Square Polygon, Notched Polygon, and EVGR – No Elevation scenarios are based on the 2015 OEHHA guidance for 2 years of exposure. The inhalation factors for the EVGR – Original use 3 years of exposure.

Abbreviations:

EVGR - Escondido Village Graduate Residences

HRA - health risk assessment

m - meter

OEHHA - Office of Environmental Health Hazard Assessment

sqft - square feet

Table D-9

Maximum Cancer Risk by Receptor Population for a 540,000 Square Foot Construction Project as a Function of Distance from Project Fenceline

Stanford Construction HRA Screening

Stanford, CA

	3-Acre Square Polygon[1]		
Distance from Construction Project Boundary (m)	Childcare	Child Resident	Adult Resident
10	27	8.6	0.21
20	19	6.2	0.15
30	14	4.5	0.11
40	11	3.5	0.084
50	8.8	2.9	0.069
60	7.4	2.4	0.057
70	6.3	2.0	0.049
80	5.6	1.8	0.044
90	5.1	1.7	0.040
100	4.3	1.4	0.033
120	3.6	1.2	0.028
140	2.9	0.95	0.023
160	2.5	0.83	0.020
180	2.0	0.64	0.015
200	1.7	0.54	0.013
250	1.5	0.49	0.012
300	1.1	0.34	0.0082

Notes:

1. This is a square polygon with an area of 3 acres that represents emissions from 540,000 square feet of construction. Total emissions from the entire EVGR project were compressed into a two-year time period and then scaled down by project size (approximately 3/18th of the total emissions) when estimating the emission rates. Dispersion factors were modeled assuming flat terrain.

Abbreviations:

EVGR - Escondido Village Graduate Residences
HRA - health risk assessment
m - meter

Table D-10

Maximum Cancer Risk by Receptor Population for a 180,000 Square Foot Construction Project as a Function of Distance from Project Fenceline

Stanford Construction HRA Screening

Stanford, CA

	1-Acre Square Polygon[1]		
Distance from Construction Project Boundary (m)	Childcare	Child Resident	Adult Resident
10	18	5.8	0.14
20	13	4.3	0.10
30	8.7	2.8	0.068
40	6.3	2.1	0.049
50	4.9	1.6	0.038
60	3.9	1.3	0.031
70	3.2	1.1	0.025
80	2.7	0.88	0.021
90	2.3	0.75	0.018
100	2.0	0.64	0.015
120	1.7	0.56	0.013
140	1.3	0.43	0.010
160	1.1	0.34	0.0082
180	0.86	0.28	0.0067
200	0.71	0.23	0.0055
250	0.60	0.19	0.0046
300	0.41	0.13	0.0032

Notes:

1. This is a square polygon with an area of 1 acre that represents emissions from 180,000 square feet of construction. Total emissions from the entire EVGR project were compressed into a two-year time period and then scaled down by project size (approximately 1/18th of the total emissions) when estimating the emission rates. Dispersion factors were modeled assuming flat terrain.

Abbreviations:

EVGR - Escondido Village Graduate Residences
HRA - health risk assessment
m - meter

Table D-11

Maximum Cancer Risk by Receptor Population for a 45,000 Square Foot Construction Project as a Function of Distance from Project Fenceline

Stanford Construction HRA Screening

Stanford, CA

	0.25-Acre Square Polygon[1]		
Distance from Construction Project Boundary (m)	Childcare	Child Resident	Adult Resident
10	9.2	3.0	0.072
20	6.9	2.2	0.053
30	3.3	1.1	0.026
40	2.2	0.72	0.017
50	1.6	0.53	0.013
60	1.3	0.42	0.010
70	1.1	0.34	0.0082
80	0.88	0.28	0.0068
90	0.73	0.24	0.0057
100	0.62	0.20	0.0048
120	0.53	0.17	0.0042
140	0.41	0.13	0.0032
160	0.30	0.10	0.0023
180	0.24	0.079	0.0019
200	0.20	0.065	0.0016
250	0.17	0.054	0.0013
300	0.11	0.037	8.8E-04

Notes:

1. This is a square polygon with an area of 0.25 acre that represents emissions from 45,000 square feet of construction. Total emissions from the entire EVGR project were compressed into a two-year time period and then scaled down by project size (approximately 1/72th of the total emissions) when estimating the emission rates. Dispersion factors were modeled assuming flat terrain.

Abbreviations:

EVGR - Escondido Village Graduate Residences
HRA - health risk assessment
m - meter

APPENDIX E
LABORATORY HEALTH RISK ESTIMATION

LABORATORY RISK ESTIMATION

This section describes the methodology and results of the laboratory health risk estimation conducted by Ramboll Environ for use with future laboratory operations on the Stanford University land covered by the General Use Permit (GUP). Without knowing the exact chemicals that will be used in the future laboratory operations or the locations of the laboratories where each chemical would be used, Ramboll Environ conservatively estimated the impacts resulting from the release of all chemicals used in Stanford labs from one fume hood on campus located in the ChemBio building. Based on this conservative analysis, even if different chemicals are used in the future or quantities increase beyond those accounted for, associated cancer risk, and acute and chronic hazards would still be expected to be below what is estimated here. The methods and assumptions used for completing the analysis for this conservative case are described in the following sections.

The BAAQMD California Environmental Quality Act (CEQA) Guidelines ("Guidelines") provide recommended procedures for evaluating potential toxic air contaminant (TAC) impacts, which include, among other requirements:

1. Evaluation of cancer risk/non-cancer impacts and $PM_{2.5}$ concentrations for construction emissions on sensitive offsite populations.

Ramboll Environ compared the results of health risk analyses to the BAAQMD 2011 CEQA significance threshold for excess lifetime cancer risk. The BAAQMD 2011 CEQA single source thresholds are:

- Non-compliance with a qualified Community Risk Reduction Plan (CRRP)
- An excess lifetime cancer risk level of more than 10 in one million;
- A noncancer chronic HI greater than 1.0;
- A noncancer acute HI greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.3 micrograms per cubic meter ($\mu g/m^3$).

Laboratory chemical inventories did not include any sources emitting $PM_{2.5}$ so the incremental increase in the annual average $PM_{2.5}$ was not evaluated. In addition, there is no CRRP with jurisdiction over the Stanford campus, so compliance with a CRRP was not evaluated.

1. ESTIMATION OF AIR CONCENTRATIONS

This section describes the estimation of air concentrations of toxic air contaminants (TACs) at locations surrounding the ChemBio building on campus. The ChemBio building was selected as a representative laboratory for air dispersion modelling because of its typically high chemical usage. Ramboll Environ estimated concentrations using the United States Environmental Protection Agency's (USEPA's) American Meteorological Society/Environmental Protection Agency regulatory air dispersion model (AERMOD) (version 15181), with representative meteorological data. These concentrations are used to assess the potential human health impacts as described in the risk assessment methodology section below.

1.1 Meteorological Data

Ramboll Environ used meteorological data collected on-site at Stanford and processed by the BAAQMD. The most recent one-year period available in model ready format was used (March 2009 through February 2010). The meteorological dataset utilizing the solar radiation/delta-T (SRDT) method to estimate the stable boundary layer was used as it incorporates local temperature data in lieu of offsite cloud cover data and ceiling observations. When processing the meteorological data for use in AERMOD, the BAAQMD used the most recent version of AERMET (v15181).

1.2 Terrain

Ramboll Environ assumed flat terrain surrounding the sites since the topography depends on the specific location of the project, which is unknown. The removal of terrain features in the dispersion model increased the maximum dispersion factor so the no-elevation assumption is considered a conservative one.

1.3 Emission Rates

The methods used to estimate the total laboratory emissions from Stanford are discussed in Section 1.3.4 in the Air Quality Technical Appendix. The total TAC emissions for each chemical are multiplied the anticipated increase in academic building square footage during the length of the Project (approximately 22%), which is used as a proxy for estimating projected increase in chemical use. It was assumed that the incremental increase of the laboratory chemicals were all used in the ChemBio building and would therefore be emitted from the ChemBio fume hoods. This is a very conservative assumption, since in reality, these chemicals would be used over a many buildings and their emissions would therefore not be as concentrated in one area.

Emissions in pounds per year are shown in **Table E-1**. Emissions were then converted to grams per second emission rates assuming emissions are evenly distributed throughout the year; these are also shown in **Table E-1**.

Emissions were modeled using the unit emissions rate method, such that each source had a unit emission rate (i.e., 1 gram per second [g/s] for point sources), and the model estimated dispersion factors (with units of microgram per cubic meter [$\mu g/m^3$]/[g/s]).

1.4 Sources Evaluated

Without knowing the exact chemicals that will be used in the future laboratory operations or the locations of the laboratories where each chemical would be used, Ramboll Environ modeled one point source to represent fume hoods in the ChemBio building. Building specific information, such as dimensions of length and width, were provided by Stanford. A single stack was modelled in the center of a building with the same length and width dimensions as the ChemBio building. Information on source parameters used in the model can be found in **Table E-2.**

1.5 Dispersion Model Setup

TAC annual average air concentrations were estimated using the annual average dispersion factors calculated from the model and multiplying them by the respective annual average emissions from the laboratory chemical use. Model source parameters are listed in **Table E-2**.

The following equation was used to estimate the annual concentrations:

$$\text{Average Concentration} = \left(Q_{annual\ or\ \max\ 1\text{–}hr} \times \left(\frac{\chi}{Q} \right)_{annual\ or\ \max\ 1\text{–}hr} \right)_i$$

Where:

Q	=	emission rate of chemical (g/s)
$\left(\frac{\chi}{Q}\right)$	=	unit dispersion factor (µg/m^3)/(g/s)
i	=	point source

The modeled air concentrations were then used to evaluate risks as described in the following risk assessment methodology section.

2. RISK ASSESSMENT METHODOLOGY

2.1 Exposure Assumptions

The exposure parameters used in this HRA screening assume a residential receptor type based on parameters recommended by BAAQMD (BAAQMD, 2016) and the new OEHHA Guidance, released in March, 2015 ("2015 OEHHA Guidance") (OEHHA, 2015). While BAAQMD is not yet requiring the use of the 2015 OEHHA Guidance, this HRA relies on such Guidance as it includes refinements of the assumptions and methodologies relating to children.

The exposure parameters used in this analysis are presented in **Table E-3**.

HRAs conducted using 2015 OEHHA Guidance utilize a number of standard "default" exposure assumptions when calculating cancer risk and non-cancer hazard. These exposure assumptions are conservative, in that they lead to calculated potential health effects that likely overestimate the impacts of a project's emissions (laboratory emissions in this case). This has been acknowledged by OEHHA when they noted that the use of conservative assumptions in risk assessment is intended to produce a hypothetical estimate of risk that does not underestimate risks and that can be viewed as an upper-bound estimate of impacts. Examples of these conservative exposure assumptions include the following:

- Residential occupancy: Residents (including both adult and child residents) living on campus are assumed to be present 24 hours per day, 7 days per week instead of the average time spent at home of 85% for ages less than 2 years, 72% for ages 2 to <16 years, and 73% for ages 16 and above.
- Child receptor: For locations where a child may live, exposure is assumed to begin at the third trimester as this is the most conservative scenario. Children are assumed to be ten times more susceptible to carcinogens than adults from the third trimester in utero to age 2 and three times more susceptible from age 2 to 16. Therefore, should adults be present at these locations or should children begin exposure at a later age, potential risks would be even lower than those presented in this assessment.
- Outdoor exposure: Modeling and health risk calculations are performed assuming that all potential receptors are breathing outdoor air for the entire exposure period. In many cases, receptors will be located indoors where there could be reductions in potential pollutant levels.

2.1.1 Toxicity Assumptions

The cancer potency factors, chronic reference exposure levels (RELs) and acute RELs for TACs emitted in laboratories are summarized in **Table E-1.**

The estimated excess lifetime cancer risks for each evaluated sensitive receptor type were adjusted by Age Sensitivity Factors (ASFs), when appropriate, as recommended by BAAQMD (BAAQMD, 2016) and as discussed in the 2015 OEHHA Guidance. This approach accounts for an "anticipated special sensitivity to carcinogens" of infants and children. The applicable ASFs used in this analysis are summarized in **Table E-4**, and are incorporated within the intake factor for inhalation ("IFinh") discussed in Section 2.2.1 below.

2.2 Risk Characterization

2.2.1 Estimation of Cancer Risks

Carcinogenic risks are estimated as the incremental probability that an individual will develop cancer over a lifetime as a result of exposure to potential carcinogens.

The following equation was used to calculate excess lifetime cancer risk:

$$\text{Cancer Risk}_i = C_i \times CF \times IFinh \times CPF_i \times ASF$$

Where:

$Risk_i$	=	Lifetime Excess Cancer Risk from exposure to $chemical_i$
C_i	=	Annual Average Air Concentration for $chemical_i$ ($\mu g/m^3$)
CF	=	Conversion Factor (mg/µg)
IFinh	=	Intake Factor for Inhalation (m^3/kg-day)
CPF_i	=	Cancer Potency Factor for $chemical_i$ ($[mg/kg\text{-}day]^{-1}$)
ASF	=	Age Sensitivity Factor (unitless)

The estimated risk is expressed as a unitless probability.

2.2.2 Estimation of Chronic HI

When evaluating chronic non-cancer effects due to chemical exposures, a hazard quotient (HQ) is established for each constituent. The following equation was used to calculate an inhalation HQ:

$$\text{Chronic HQ}_i = C_i / REL_i$$

Where:

Chronic HQ_i	=	Chronic Hazard Quotient from exposure to $chemical_i$
C_i	=	Annual Average air concentration for $chemical_i$ ($\mu g/m^3$)
REL_i	=	Chronic non-cancer Reference Exposure Level for $chemical_i$ ($\mu g/m^3$)

To evaluate the potential for adverse non-cancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals that affect the same target organ are summed yielding a HI. The HI is thus estimated as follows:

$$HI_{(eyes)} = \sum HQ_{substance1\ (eyes)} + HQ_{substance2\ (eyes)}$$

As a conservative assessment, all HQs were summed for comparison to the threshold, regardless of target organ.

Chronic RELs are developed so as to represent the level "at or below which no adverse health impacts are anticipated following long-term exposure. Long-term exposure for these purposes has been defined as 12% of a lifetime, or about eight years for humans." (OEHHA, 2015) The estimated HI is expressed as a unitless metric.

2.2.3 Estimation of Acute HI

The potential for acute effects was evaluated by comparing the one-hour maximum concentrations with the corresponding acute RELs. The following equation was used to calculate acute HQ:

$$\text{Acute } HQ_i = C_i / REL_i$$

Where:

Acute HQ_i	=	Acute Hazard Quotient from exposure to $chemical_i$
C_i	=	One-hour Maximum air concentration for $chemical_i$ ($\mu g/m^3$)
REL_i	=	Acute non-cancer Reference Exposure Level for $chemical_i$ ($\mu g/m^3$)

HQs were then summed to obtain a target organ-specific HI as follows:

$$HI_{(eyes)} = \sum HQ_{substance\,1\,(eyes)} + HQ_{substance2\ \ (eyes)}$$

As a conservative assessment, all HQs were summed for comparison to the threshold, regardless of target organ.

Acute RELs, are developed so as to represent "an exposure that is not likely to cause adverse health effects in a human population, including sensitive subgroups, exposed to that concentration … for the specified exposure duration on an intermittent basis" (OEHHA, 2015) The estimated HI is expressed as a unitless metric.

2.3 Risk Assessment Results

The results of this HRA for sensitive populations potentially exposed to TAC emissions from laboratory fume hoods were compared to the BAAQMD's thresholds of 10-in-one-million for cancer risk and 1 for chronic HI and acute HI (BAAQMD, 2011).

Incremental increase in cancer risk for a maximally exposed resident is 4.5 in one million (with a threshold of 10 in one million). Acute and chronic hazard indices (HIs) were increased by 0.03 and 0.01, respectively, below the BAAQMD significance threshold of 1. Project incremental increase in cancer risks and non-cancer chronic and acute HIs are all well below BAAQMD thresholds, even with conservative assumptions of all emissions occurring from one stack with sensitive resident receptors surrounding the source. Therefore, impacts are less than significant from laboratory TAC emissions.

REFERENCES

Bay Area Air Quality Management District (BAAQMD). 2016. BAAQMD Air Toxics NSR Program Health Risk Screening Analysis (HRSA) Guidelines. January.

BAAQMD. 2011. California Environmental Quality Act Air Quality Guidelines. May.

OEHHA. 2015. Guidance Manual for Preparation of Health Risk Assessments. February. South Coast Air Quality Management District (SCAQMD). 2008. Final Localized Significance Threshold Methodology. July.

ACRONYMS AND ABBREVIATIONS

AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Air Dispersion Model
ASFs	Age Sensitivity Factors
BAAQMD	Bay Area Air Quality Management District
CARE	Community Air Risk Evaluation
CEQA	California Environmental Quality Act
g/s	Gram Per Second
GUP	General Use Permit
HHRA:	Human Health Risk Assessment
HI:	Hazard Indices
HQ	Hazard Quotient
IFinh	Intake Factor for Inhalation
OEHHA	Office of Environmental Health Hazard Assessment
REL	Reference Exposure Levels
$PM_{2.5}$	Particulate Matter, 2.5 Micrometers Or Less
SRDT	Solar Radiation/Delta-T
TAC	Potential Toxic Air Contaminant
USEPA	United States Environmental Protection Agency
$\mu g/m^3$	Micrograms Per Cubic Meter

Table E-1
Fall 2035 TAC Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Scaling for Fall 2035[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	TAC Emission Rate [g/s]	Cancer Potency Factor (CPF)[6] [mg/kg-day]$^{-1}$	Chronic Reference Exposure Level (REL)[6] [µg/m^3]	Acute Reference Exposure Level (REL)[6] [µg/m^3]
1,1,1-Trichloroethane	71-55-6	195	22%	5%	45	6.5E-04			
1,1,2-Trichloroethane	79-00-5	30	22%	5%	3.3	4.7E-05	0.057		
1,2-Dichloroethane	107-06-2	245	22%	5%			0.072		
1,3-Butadiene	106-99-0	101	22%	100%	234	0.0034	0.60	7.0E-05	1.2E-04
1,4-Dichlorobenzene	106-46-7	15	22%	1%	0.65	9.4E-06	0.040	4.9E-09	
1,4-Dioxane	123-91-1	166	22%	5%	65	9.3E-04	0.027	1.3E-07	7.5E-06
2,4,6-Trichlorophenol	88-06-2	2.9	22%	1%	0.098	1.4E-06	0.070		
2-Chlorophenol	95-57-8	6.0	22%	5%	0.78	1.1E-05			
2-Nitropropane	79-46-9	25	22%	5%	0.42	6.1E-06			
Acetaldehyde	75-07-0	35	22%	5%			0.010		
Acetone	67-64-1	5,583	22%	100%	128,476	1.8			
Acetonitrile	75-05-8	0,930	22%	5%	0,411	0.0059			
Acrylamide	79-06-1	42	22%	1%	3.7	5.4E-05	4.5		
Acrylonitrile	107-13-1	78	22%	5%			1.0		
Ammonia	7664-41-7	156	22%	100%	635	0.0091			
Arsenic and inorganic compounds	7440-38-2	35	22%	1%	0.87	1.2E-05	12	3.5E-04	0.0015
Benzene	71-43-2	1,307	22%	5%	538	0.0077	0.10	0.0011	0.0069
Beryllium	7440-41-7	0.15	22%	1%	0.0027	3.9E-08	8.4	2.3E-06	
Bromine and compounds	7726-95-6	12	22%	5%	4	5.7E-05			
Butane	106-97-8	21	22%	100%	123	0.0018			
Butyraldhyde	123-72-8	198	22%	5%	42	6.1E-04			
Cadmium and compounds	7440-43-9	105	22%	1%	4.01	5.8E-05	15	0.0012	
Carbon disulfide	75-15-0	41	22%	5%	13	1.9E-04			
Carbon tetrachloride	56-23-5	278	22%	5%	111	0.0016	0.15	1.7E-05	2.0E-05
Chlorine	7782-50-5	1	22%	100%	2	2.5E-05			
Chlorobenzene	108-90-7	0,314	22%	5%	78	0.0011			
Chloroform	67-66-3	1,795	22%	5%	0,853	0.012	0.019	1.7E-05	0.0020
Chloromethane	74-87-3	57	22%	100%	76	0.0011			
Cresol	1319-77-3	102	22%	1%					
Diethyl ether	60-29-7	4,857	22%	5%	2,189	0.031			
Dimethyl formamide	68-12-2	0,859	22%	5%	0,390	0.0056			
Dimethyl sulfate	77-78-1	104	22%	5%	30	4.3E-04			
Epichlorohydrin	106-89-8	343.0	22%	5%	40.03	5.8E-04	0.080	8.0E-05	1.1E-05
Ethanol	64-17-5	1,012	22%	5%	0,483	0.0069			
Ethyl acetate	141-78-6	5,291	22%	5%	2,391	0.034			
Ethyl benzene	100-41-4	29	22%	5%	4.7	6.8E-05	0.0087	1.4E-08	
Ethyl diazoacetate	623-73-4	6.4	22%	5%					
Ethylene dibromide	106-93-4	7.4	22%	5%	1.3	1.8E-05	0.25	9.5E-06	
Ethylene glycol	107-21-1	0,391	22%	5%	185	0.0027			
Ethylene glycol butyl ether	111-76-2	55	22%	5%					
Ethylene glycol ethyl ether	110-80-5	54	22%	5%	11	1.6E-04			
Ethylene glycol methyl ether	109-86-4	579	22%	5%	228	0.0033			
Ethylene oxide	75-21-8	2.9	22%	100%			0.31		
Formaldehyde	50-00-0	32	22%	5%	2	2.6E-05	0.021	1.2E-06	1.2E-05

Table E-1
Fall 2035 TAC Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Scaling for Fall 2035[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	TAC Emission Rate [g/s]	Cancer Potency Factor (CPF)[6] [mg/kg-day]$^{-1}$	Chronic Reference Exposure Level (REL)[6] [µg/m^3]	Acute Reference Exposure Level (REL)[6] [µg/m^3]
Glutaraldehyde	111-30-8	31	22%	5%	13	1.8E-04			
Hexachlorobenzene	118-74-1	1.3	22%	1%	0.017	2.5E-07	1.8		
Hexanal	66-25-1	2	22%	5%	0.3	4.0E-06			
Hexavalent chromium	18540-29-9	590	22%	1%	43	6.2E-04		0.0013	
Hydrazine	302-01-2	88	22%	5%	29.5	4.2E-04	17	8.8E-04	
Hydrogen chloride	7647-01-0	299	22%	5%	143	0.0021			
Hydrogen fluoride	7664-39-3	29	22%	100%	44	6.4E-04			
Hydrogen sulfide	7783-06-4	4.9	22%	100%	8.6	1.2E-04			
Isopentane	78-78-4	9	22%	5%	3	5.0E-05			
Isopropyl alcohol	67-63-0	1,938	22%	100%	23,791	0.34			
Lead and compounds	7439-92-1	165	22%	1%	5.7	8.2E-05	0.042		
Maleic anhydride	108-31-6	36	22%	1%	1.9	2.7E-05			
Manganese and compounds	7439-96-5	276	22%	1%	10.68	1.5E-04			
Mercury and inorganic compounds	7439-97-6	1135	22%	5%	373	0.0054			
Methanol	67-56-1	1,257	22%	5%	0,597	0.0086			
Methyl bromide	74-83-9	109	22%	100%	216	0.0031			
Methyl ethyl ketone	78-93-3	59	22%	5%	19	2.7E-04			
Methyl methacrylate	80-62-6	43	22%	5%	12.2	1.8E-04			
Methylene chloride	75-09-2	6,823	22%	20%	12,674	0.18	0.0035	1.9E-04	3.2E-04
Naphthalene	91-20-3	18	22%	1%	1	1.8E-05	0.12	8.5E-07	
n-Heptane	142-82-5	1,284	22%	5%	548	0.0079			
n-Hexane	110-54-3	2,195	22%	5%	1,013	0.015			
Nickel and compounds	7440-02-0	238	22%	1%	12.09	1.7E-04	0.91	0.0052	0.021
Nitric acid	7697-37-2	412	22%	5%	192	0.0028			
Nitrobenzene	98-95-3	222	22%	5%	46	6.6E-04			
n-Methylpyrollidone	872-50-4	0,454	22%	5%	185	0.0027			
Octane	111-65-9	6	22%	5%	2	2.9E-05			
Osmium tetroxide	20816-12-0	15.00	22%	1%	0.763	1.1E-05			
Pentachlorophenol	87-86-5	2.9	22%	1%	0.20	2.9E-06	0.018		
Pentane	109-66-0	0,924	22%	5%	0,377	0.0054			
Phenol	108-95-2	145	22%	5%	61	8.8E-04			
Phosgene	75-44-5	0.32	22%	100%					
Phosphoric acid	7664-38-2	221	22%	5%	105	0.0015			
Propylene oxide	75-56-9	59	22%	5%			0.013		
Pyridine	110-86-1	0,412	22%	5%	185	0.0027			
Sodium hydroxide	1310-73-2	0,566	22%	1%	54	7.7E-04			
Styrene	100-42-5	45	22%	5%	11	1.5E-04			
t-Butyl alcohol	75-65-0	111	22%	5%	46	6.6E-04			
tert-Butylbenzene	98-06-6	28	22%	5%	4.0	5.7E-05			
Tetrachloroethylene	127-18-4	29	22%	5%	6	8.2E-05	0.021	9.8E-07	1.0E-07
Tetrahydrofuran	109-99-9	1,856	22%	5%	0,807	0.012			
Toluene	108-88-3	1,012	22%	5%	0,479	0.0069		9.5E-06	4.5E-06
Trichloroethylene	79-01-6	119	22%	5%	36	5.2E-04	0.0070	3.6E-07	
Trichlorotrifluroethane	76-13-1	51	22%	5%	11.1	1.6E-04			

Table E-1
Fall 2035 TAC Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Scaling for Fall 2035[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	TAC Emission Rate [g/s]	Cancer Potency Factor (CPF)[6] [mg/kg-day]$^{-1}$	Chronic Reference Exposure Level (REL)[6] [µg/m^3]	Acute Reference Exposure Level (REL)[6] [µg/m^3]
Triethylamine	121-44-8	0,424	22%	5%	185	0.0027		5.5E-06	2.3E-05
Valeraldehyde	110-62-3	12	22%	5%	1.5	2.1E-05			
Vinyl chloride	75-01-4	132	22%	100%	232	0.0033	0.27		4.5E-07
Xylenes	1330-20-7	0,496	22%	5%	217	0.0031		1.9E-06	3.4E-06
Zinc and compounds	7440-66-6	625	22%	1%	50	7.2E-04			
Total for Fall 2035					**180,525**				

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from the 2001 ChemBio HHRA, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)

   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. Scaling for Fall 2035 is based on the increase in academic square footage expected from full buildout of the 2000 GUP to full buildout of the 2018 GUP, with the assumption that the increase in laboratory space is proportional to the increase in overall academic space.

3. Emission factors represent what percentage of the mass usage of the chemical is emissted into the air. When available, chemical emission factors from the *Stanford ChemBio Human Health Risk Assessment* (ENVIRON 2001) were used. When unavailable, Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%
   Emission Factor for Liquids = 5%
   Emission Factor for Solids/Metals = 1%
   Emission Factor for Methylene Chloride = 20%

4. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

5. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

6. The cancer potency factors, chronic reference levels, and acute reference levels were obtained from the proposed BAAQMD Regulation 2-5 Table 2-5-1 (January 2016).

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstracts Service
CPF - Cancer Potency Factor
g - gram
GUP - General Use Permit
HHRA - Human Health Risk Assessment
kg - kilogram
m^3 - cubic meter
mg - miligram
REL - Reference Exposure Level
s - second
TAC - Toxic Air Contaminant
µg - microgram

Table E-2
Operational Modeling Parameters
Stanford University
Stanford, CA

Source[1]	Source Type	Number of Sources	Stack Height Above Grade	Stack Temperature	Stack Velocity	Stack Diameter
			[m]	[K]	[m/s]	[m]
Laboratory	Point	1	25.8	293	22.7	1.37

Notes:

1. All emissions were assumed to be emitted from one fume hood in the Stanford ChemBio building. Parameters from the Human Health Risk Assessment (HHRA) conducted by ENVIRON in 2001 for the Stanford ChemBio facilities were used for air dispersion modeling in AERMOD.

Abbreviations:

AERMOD - AERMIC (AMS/EPA Regulatory Model Improvement Committee) Model

HHRA - Human Health Risk Assessment

K - Kelvin

m - meter

m/s - meters per second

Table E-3
Exposure Parameters
Stanford University
Stanford, CA

Receptor Type	Period	Receptor Age Group	Exposure Parameters					
			Daily Breathing Rate (DBR)[1] [L/kg-day]	Exposure Duration (ED)[2] [years]	Fraction of Time at Home (FAH)[3] [unitless]	Exposure Frequency (EF)[4] [days/year]	Averaging Time (AT) [years]	Intake Factor, Inhalation (IF_{inh}) [m^3/kg-day]
Resident	Operation (Laboratories)	3rd Trimester	361	0.25	1	350	25550	0.0012
		Age 0-<2 Years	1090	2				0.030
		Age 2-<16 Years	745	14				0.14
		Age 16-30 Years	335	14				0.064

Notes:

1. Daily breathing rates reflect default breathing rates from OEHHA 2015, 95th percentile for all years.
2. The exposure duration for operation reflects the default residential exposure duration from OEHHA 2015.
3. Fraction of time spent at home is conservatively assumed to be 1 (i.e. 24 hours/day).
4. Exposure frequency reflects default exposure frequency from OEHHA 2015.

Calculation:

IF_{inh} = DBR * FAH * EF * ED * CF / AT

CF = 0.001 (m^3/L)

Abbreviations:

AT - average timing
DBR - daily breathing rate
ED - exposure duration
EF - exposure frequency
FAH - fraction of time at home
IF - intake factor
kg - kilogram
L - liter
m^3 - cubic meter
OEHHA - Office of Environmental Health Hazard Assessment

Reference:

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

Table E-4
Age Sensitivity Factors
Stanford University
Stanford, CA

Receptor Age Group	Age Sensitivity Factor (ASF)[1]
3rd Trimester	10
Age 0-<2 Years	10
Age 2-<16 Years	3
Age 16-30 Years	1

Notes:

1. Based on OEHHA 2015.

Abbreviations:

ASF - Age sensitivity factor

OEHHA - Office of Environmental Health Hazard Assessment

Reference:

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.