Volume V (Part 2)
RECIRCULATED PORTIONS OF THE DRAFT ENVIRONMENTAL IMPACT REPORT
State Clearinghouse No. 2009061113

LYTLE CREEK RANCH SPECIFIC PLAN

Lead Agency:
City of Rialto
Development Services Department
150 South Palm Avenue
Rialto, California 92376

February 2012

Volume V (Part 2)
RECIRCULATED PORTIONS OF THE DRAFT ENVIRONMENTAL IMPACT REPORT

State Clearinghouse No. 2009061113

LYTLE CREEK RANCH SPECIFIC PLAN

Annexation No. 170
General Plan Amendment No. 29
Specific Plan No. 12
Development Agreement
Vesting Tentative Tract Map No. 18767
Environmental Assessment Review No. 90-19

Lead Agency:
City of Rialto
Development Services Department - Planning & Business License Division
150 South Palm Avenue
Rialto, California 92376
(909) 421-7240

Applicant:
Lytle Development Joint Venture III
2050 Main Street, Suite 252
Irvine, California 92614
(949) 313-5800

February 2012

Table of Contents Volume V (Part 2)

List of Appendices

Appendix V-B REVISED CLIMATE CHANGE TECHNICAL REPORT FOR LYTLE CREEK RANCH, ENVIRON International Corporation, December 2011

Appendix V-C ADDENDUM TO THE TRAFFIC IMPACT ANALYSIS

- Appendix V-C-A ADDENDUM TO THE TRAFFIC IMPACT ANALYSIS REPORT FOTHE LYTLE CREEK RANCH PLANNED DEVELOPMENT PROJECT, Impacts to Existing Roadway Network, Crain & Associates, January 2012
- Appendix V-C-B PHASING OF LYTLE CREEK RANCH ROADWAY IMPROVEMENT MITIGATION MEASURES, Crain & Associates, January 23, 2012

Appendix V-D AIR QUALITY AND NOISE WORKSHEETS

- Appendix V-D-A CONSTRUCTION EMISSIONS, Matrix Environmental, January 2012
- Appendix V-D-B OPERATION EMISSIONS, Matrix Environmental, January 2012
- Appendix V-D-C NOISE OUTPUT SHEETS, Matrix Environmental, January 2012

Appendix V-E FINANCIAL FEASIBILITY ANALYSIS OF THE LYTLE CREEK RANCH SPECIFIC PLAN PROJECT AND ALTERNATIVES TO THE PROJECT DISCUSSED IN THE LYTLE CREEK RANCH SPECIFIC PLAN EIR, CBRE Consulting, December 2011

Appendix V-B

REVISED CLIMATE CHANGE TECHNICAL REPORT FOR LYTLE CREEK RANCH

ENVIRON International Corporation

December 2011

Revised
Climate Change Technical Report
Lytle Creek Ranch

Prepared for:
Lytle Development Company
Ontario, California

Prepared by:
ENVIRON International Corporation
Emeryville, California

Date:
November 19, 2009
(Revised December 2011 pursuant to the San Bernardino Superior Court's Ruling in *Endangered Habitats League, Inc., et al. v. City of Rialto, et al.*)

Project Number:
03-22796D

ENVIRON

Contents

		Page
Executive Summary		ES-1
1	Introduction	1
1.1	Emissions Inventory	2
1.2	Project GHG Emissions in Context	4
1.3	Comparison of GHG Emissions to Significance Threshold	4
1.4	Report Description	4
2	State of Science	5
2.1	Global Climate Change	5
2.2	The Greenhouse Effect	5
2.3	Greenhouse Gases and Sources of Their Emissions	7
2.4	Current and Projected Climatic Impacts of Global Warming	8
2.5	Socioeconomic Impacts of Global Warming	9
2.6	IPCC Fourth Assessment Report	10
2.7	Global, National, and California-wide GHG Emissions Inventories	11
2.8	Potential for Reduction of GHG Emissions	12
3	Regulatory Setting	13
3.1	Federal Action on Greenhouse Gas Emissions	13
3.1.1	Federal Action on Greenhouse Gas Emissions	13
3.1.2	April 2007 Supreme Court Ruling	13
3.1.3	Corporate Average Fuel Efficiency Standards	13
3.1.4	Energy Independence and Security Act of 2007	14
3.1.5	Reporting Requirements	14
3.2	Regional Agreements	15
3.2.1	Western Regional Climate Action Initiative	15
3.3	California Legislation	15
3.3.1	Assembly Bill 32 (Statewide GHG Reductions)	16
3.3.2	Executive Order S-3-05 (Statewide GHG Targets)	16
3.3.3	Low Carbon Fuel Standard	16
3.3.4	Senate Bill 1368 (GHG Emissions Standard for Baseload Generation)	17
3.3.5	Assembly Bill 1493 (Mobile Source Reductions)	17
3.3.6	Senate Bills 1078 and 107 (Renewables Portfolio Standard)	17
3.3.7	Executive Order S-14-08 (Renewables Portfolio Standard)	17
3.3.8	Senate Bill 375 (Land Use Planning)	18
3.3.9	Energy Conservation Standards	18
3.3.10	Senate Bill 97 (CEQA Guidelines)	19
3.3.11	Office of Planning and Research Advisory on CEQA and Climate Change	19
3.3.12	ARB Preliminary Draft Proposal: Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases Under the California Environmental Quality Act (Draft ARB Thresholds)	20

3.4	Local Air Quality Management District (SCAQMD) Policies	20
3.5	San Bernardino County Policies	21
4	Greenhouse Gas Inventory	23
4.1	GHG Emissions Baseline	23
4.2	Evaluation of “New” Emissions	23
4.3	Units of measurement: Tonnes of CO_2 and CO_2e	26
4.4	Resources	26
4.4.1	Emissions Estimation Guidance	27
4.4.2	Emissions and Energy Use Studies	27
4.4.3	Emissions Estimation Software	27
4.5	Summary of Source-Specific GHG Emissions Calculations	28
4.6	Indirect GHG Emissions from Electricity Use	28
4.7	Vegetation Change	29
4.7.1	Quantifying the One-Time Release by Changes in Carbon Sequestration Capacity	29
4.7.2	Calculating CO_2 Sequestration by Trees	31
4.8	Construction Activities	37
4.8.1	Estimating GHG Emissions from Construction Equipment	37
4.8.2	GHG Emissions from Worker Commuting	38
4.8.3	GHG Emissions from Vendor Trips	40
4.8.4	Demolition Hauling	41
4.8.5	Uncertainties in Construction GHG Emissions Calculations	42
4.9	GHG Emissions Associated with Residential Buildings	52
4.9.1	Estimate of Residential Energy Use Intensity	53
4.9.2	Energy Use in the Built Environment	53
4.9.3	Building America Research Benchmark Definition – Major Appliances	55
4.9.4	Building America Research Benchmark Definition - Plug-in Energy Use	56
4.9.5	Estimation of Annual Greenhouse Gas Emissions from Residential Buildings	56
4.9.6	Uncertainties in Residential Building GHG Calculations	58
4.10	GHG Emissions Associated with Non-Residential Buildings	75
4.10.1	Estimate of Non-residential Energy Use Intensity	76
4.10.1.1	CEUS Database	76
4.10.2	Estimation of Annual Greenhouse Gas Emissions from Non-Residential Buildings	77
4.10.3	Uncertainties in Non-residential Building GHG Calculations	78
4.11	Mobile Sources	87
4.11.1	Estimating VMT from Mobile Sources	88
4.11.1.1	Calculate final VMT based upon the above scenarios	88
4.11.2	Estimating GHG Emissions from Mobile Sources	88
4.11.3	Uncertainty in Mobile Source Calculations	90
4.12	Hearths	95
4.13	Municipal Sources	97
4.13.1	Water and wastewater supply and treatment systems	97
4.13.2	Potable Water Source Supply and Conveyance	97
4.13.3	Potable Water Treatment and Distribution	98

4.13.4	Wastewater Treatment	98
4.13.5	Public Lighting	99
4.13.6	Municipal Vehicles	99
4.14	Landscaping Equipment (Area Sources)	104
4.15	Emissions Sources Not Quantified in Inventory	106
4.15.1	Pools and Recreation Centers	106
4.15.2	Refrigeration Leaks	106
4.16	Project Design Features that Reduce GHG Emissions	106
4.16.1	Project Design Features whose Emissions Reductions were Incorporated into the Analysis	106
4.16.1.1	Reductions in emissions from mobile sources	106
4.16.1.2	Vegetation preservation	107
4.16.1.3	Energy Savings	107
4.16.1.4	Area Sources	107
4.16.2	Features whose Emissions Reductions were not Incorporated into the Analysis but would yield further GHG emissions savings	107
4.16.2.1	Energy Use in the Built Environment	107
4.16.2.2	Reductions in emissions from mobile sources	108
4.16.2.3	Water conservation	108
4.16.2.4	Solid Waste	108
4.17	Summary of Emissions from LCR	108
4.18	Life Cycle Emissions of Building Materials	113
5	Inventory in Context	115
5.1	Comparison with State, Global, and Worldwide GHG Emissions	115
5.2	Comparison to Business as Usual Scenario	115
5.2.1	Vegetation	116
5.2.2	The Built Environment	122
5.2.3	Transportation	123
5.2.3.1	Estimating reduction in trip generation rates	124
5.2.4	Municipal Sources	131
5.2.4.1	Water and Wastewater	131
5.2.4.2	Public Lighting	131
5.2.5	Overall BAU Comparison	132
6	Executive Order S-03-05	135
7	Conclusion	137

List of Tables

		Page
Table ES-1:	Summary of Greenhouse Gas Emissions for Lytle Creek Ranch	ES-4
Table 4-1:	CO_2 Sequestration Change due to Land Use Change	33
Table 4-2:	Carbon per Acre for IPCC Land Types	34
Table 4-3:	CO_2 Sequestration Capacity of New Vegetation Plantings	35
Table 4-4:	Change in CO_2 Sequestration Due to Land Use Changes and New Vegetation Plantings	36
Table 4-5:	GHG Emissions from Construction Equipment	43
Table 4-6:	GHG Emissions from Worker Commutes	45
Table 4-7:	GHG Emissions from Vendor Trips	47
Table 4-8:	GHG Emissions from Demolition Hauling Trips	49
Table 4-9:	Overall Construction GHG Emissions	50
Table 4-10:	Energy Use per Residential Dwelling Unit: Title-24 Regulated Heating and Cooling	58
Table 4-11:	Energy Use per Residential Dwelling Unit: Appliances and Plug-ins	60
Table 4-12:	Energy Use per Residential Dwelling Unit	62
Table 4-13:	Emission Factors for Different Energy Sources for Buildings	64
Table 4-14:	CO_2e Emissions per Dwelling Unit	66
Table 4-15:	CO_2e Emissions per Dwelling Unit with 2020 RPS	68
Table 4-16:	CO_2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units	70
Table 4-17:	CO_2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units with 2020 RPS	72
Table 4-18:	Categorization of Non-Residential Land Use	78
Table 4-19:	Electricity End-Use Distribution for Non-Residential Building Types	79
Table 4-20:	Natural Gas End-Use Distribution for Non-Residential Building Types	80
Table 4-21:	Emission Factors by Energy Source	81
Table 4-22:	Energy Use and Resulting GHG Emissions for Non-Residential Building Types	82
Table 4-23:	Energy Use and Resulting GHG Emissions for Non-Residential Building Types with 2020 RPS	84
Table 4-24:	Mitigated Trip Generation Rates and Vehicle Miles Based on Traffic Modeling	90
Table 4-25:	Mitigated Greenhouse Gas Emissions from Vehicles for the Year 2030	91
Table 4-26:	Mitigated Greenhouse Gas Emissions from Vehicles for the Year 2030 with Pavley Standards	92
Table 4-27:	GHG Emissions from Area Sources – Hearth Fuel Combustion	94
Table 4-28	GHG Emission Factors for Lytle Creek Ranch Municipal Sources	99
Table 4-29:	GHG Emissions from Area Sources – Landscape Equipment Fuel Combustion	103
Table 4-30:	Summary of Greenhouse Gas Emissions for Lytle Creek Ranch	108
Table 4-31:	Summary of Greenhouse Gas Emissions for Lytle Creek Ranch including Pavley Standards	19
Table 5-1:	Lytle Creek Ranch Context Supporting Calculations	114
Table 5-2:	BAU CO_2 Sequestration Change due to Land Use Change	115
Table 5-3:	BAU Carbon per Acre for IPCC Land Types	116
Table 5-4:	BAU CO_2 Sequestration Capacity of New Vegetation Plantings	117
Table 5-5:	BAU Change in CO_2 Sequestration due to Land Use Changes and New Vegetation Plantings	118

Table 5-6: URBEMIS Operational Mitigation Component Inputs for Mitigated Scenario 123
Table 5-7: Trip Generation Rates Based on URBEMIS 124
Table 5-8: BAU Generation Rates and Vehicle Miles Based on Scaled Traffic Modeling 125
Table 5-9: Mitigated Greenhouse Gas Emissions from Vehicles for the Year 2030 for BAU Scenario 126
Table 5-10: Lytle Creek Ranch Mobile Emissions in Context 127
Table 5-11: Municipal Sources Comparison of BAU to Lytle Creek Ranch 129
Table 5-12: GHG Emissions Comparison of BAU to Lytle Creek Ranch including Pavley Standards 130
Table 5-13: GHG Emissions Comparison of BAU to Lytle Creek Ranch including Pavley Standards and 33% RPS 131

List of Figures

Figure 2-1: Carbon Dioxide and Methane Concentrations have increased dramatically since the industrial revolution
Figure 2-2: Global Warming Trends and Associated Sea Level Rise and Snow Cover Decrease

List of Appendices

Appendix A URBEMIS Files for Construction Emissions and Table of Starting Emission Factors
Appendix B Crain and Associates Memorandum re: Lytle Creek Development Mobile Emissions Analysis Input
Appendix C URBEMIS Files for Mobile Emissions
Appendix D EMFAC File Output
Appendix E Life Cycle Greenhouse Gas Emissions from Building Materials

Acronyms

AAQS	ambient air quality standard
AB	Assembly Bill
AF	acre feet
ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
BARBD	Building America Research Benchmark Definition
BAU	business as usual
bhp	break horsepower
°C	degree Celsius
C	carbon
CAA	Clean Air Act
CAFE	Corporate Average Fuel Economy
CAPCOA	California Air Pollution Control Officers Association
CBECS	Commercial Buildings Energy Consumption Survey
CCAR	California Climate Action Registry
CEC	California Energy Commission
CEUS	California End Use Survey
CEQA	California Environmental Quality Act
CF_4	tetrafluoromethane
CFC	chlorinated fluorocarbons
CH_4	methane
CO_2	carbon dioxide
CO_2e	CO_2 equivalents
DHW	domestic hot water
dm	dry mass
DOE	Department of Energy
DOT	Department of Transportation
DU	dwelling unit
EF	Emission Factor
EIA	United States Energy Information Administration
EIR	Environmental Impact Report
EISA	Energy Independence and Security Act of 2007
EMFAC	emissions estimation software programs
ENVIRON	ENVIRON International Corporation
EVTM	East Valley Transportation Model
FAR	Fourth Assessment Report
ft	feet
GDP	gross domestic product
GGE	greenhouse gas equivalent
GHGs	greenhouse gases
GRP	General Reporting Protocol
GWP	global warming potential

Acronyms (continued)

HFC	hydrofluorocarbons
HHDT	heavy-heavy duty truck
hr	hour
HVAC	heating, ventilation and air conditioning
IPCC	Intergovernmental Panel on Climate Change
ITE	Institute of Transportation Engineers
k	kilo
kW	kilowatt
lbs	pounds
LCA	Life Cycle Assessment
LCFS	Low Carbon Fuel Standard
LCR	Lytle Creek Ranch
LDA	light-duty auto
LDT	light-duty truck
MA	Massachusetts
MMBTU	Million British Thermal Units
MN	Minnesota
mpg	miles per gallon
mph	miles per hour
MW	megawatts
N_2O	nitrous oxide
NHTSA	National Highway Traffic Safety Administration
NOP	notice of preparation
O_2	oxygen
O_3	ozone
OPR	Office of Planning and Research
PFC	perfluorocarbon
PG&E	Pacific Gas & Electric
PHEV	plug-in hybrid electric vehicle
PM_{10}	particulate matter less than 10 microns
ppb	parts per billion
ppm	parts per million
PUP	Power/Utility Protocol
RECS	Residential Energy Consumption Survey
RFS	Renewable Fuel Standards
RPS	Renewables Portfolio Standard
RTP	Regional Transit Plan
SAR	Second Assessment Report
SB	Senate Bill
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments

SCAQMD South Coast Air Quality Management District

Acronyms (continued)

SCE	Southern California Edison
SF_6	sulfur hexafluoride
sq ft	square feet
TAR	Third Assessment Report
TDV	Total Daily Valuation
tonnes	Metric tonnes; 1,000 kilograms
UNEP	United Nations Environment Programme
URBEMIS	Urban Emissions Model
US	United States
USEPA	United States Environmental Protection Agency
UTPS	Urban Transportation Planning Software
VMT	vehicle miles traveled
WCI	Western Regional Climate Action Initiative
WMO	World Meteorological Organization
WRI	World Resources Institute

Executive Summary

Lytle Creek Ranch (LCR) is a proposed mixed use community to be built in San Bernardino County, within and adjacent to the city of Rialto. LCR will result in approximately 8,407 new residences at full build out. The development will also include commercial space (i.e., office and retail uses) and educational institutions. This development will result in one-time and annual, direct and indirect emissions of greenhouse gases (GHGs). The term "direct emissions of GHGs" refers to GHGs that are emitted directly as a result of the project and include land use change and construction emissions. Indirect emissions are those emissions that the project entitlement will enable, but that are not controlled by the project proponent. This report discusses the scientific and regulatory developments surrounding global climate change and provides an inventory surveying the emissions that would result from approving LCR.

This report was originally prepared in November 2009 and incorporated into the Environmental Impact Report (EIR) for the LCR project, which was certified by the City of Rialto on July 13, 2010. After the EIR's certification, various petitioners filed a lawsuit pursuant to the California Environmental Quality Act (CEQA), challenging the EIR and the City's compliance with CEQA (*Endangered Habitats League, Inc., et al. v. City of Rialto, et al.*, San Bernardino County Superior Court Case No. CIV DS1011874). On September 30, 2011, the Court ruled that the City did not comply with CEQA in approving the LCR project, and ordered that various portions of the EIR be revised and recirculated.

This report has been revised in accordance with the Court's Ruling, in particular pages 17 to 20 thereof, to demonstrate more clearly how the LCR project's GHG inventory represents a 32.7% reduction in GHG emissions over a Business as Usual (BAU) scenario. The report, however, has not been revised to reflect the various changes that have occurred with respect to the regulation of GHG emissions, including (1) the adoption of amendments to the State CEQA Guidelines in 2010 for the analysis and mitigation of a project's GHG emissions; (2) the enactment of Senate Bill (SB) 2 (2011, 1st extraordinary session), which codified a requirement that retail sellers of electricity serve 33 percent of their load with renewable energy by 2020; and (3) the California Air Resources Board's (ARB) reduced estimate of emissions expected to occur in 2020 under a BAU scenario. None of those changes affect the analysis or conclusions set forth in the November 2009 report. Most notably, the amendments to the CEQA Guidelines give lead agencies the discretion to decide what threshold of significance it will apply in assessing impacts resulting from a project's GHG emissions. In addition, this revised report does not reflect newer emissions calculation methods introduced since the November 2009 report. Thus, this revised report serves only to further clarify how the 32.7% reduction set forth in the November 2009 report was calculated.

There is a general scientific consensus that most current global warming is the result of human activity on the planet. This man-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" and contributes to global climate change.

Lawmakers at the national, state and local levels have introduced legislation and regulations aimed at better tracking and controlling GHGs. On the national level, there are some incentives

for businesses and individuals to take voluntary steps to limit GHG emissions. However, no federal legislation capping GHG emissions or requiring reporting has been passed. California enacted the California Global Warming Solutions Act of 2006 (Assembly Bill 32 or AB 32), which established mandatory reductions in state-wide GHG emissions by 2020. Residents and the employees and patrons of commercial and municipal buildings and services use electricity, heating, and are transported by motor vehicles. These activities directly or indirectly emit GHGs. The most significant GHG emissions resulting from such residential and commercial developments are emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). GHG emissions are typically measured in terms of tonnes of CO_2 equivalents (CO_2e), calculated as the product of the mass emitted of a given GHG and its specific global warming potential (GWP).

The emissions inventories presented in this report are consistent with the methodologies established by the California Climate Action Registry (CCAR), where possible. Three inventories are presented: the baseline inventory, the inventory of LCR emissions under the project scenario, and the inventory of LCR emissions under the BAU scenario. The baseline inventory includes emissions associated with the physical environmental conditions at the time the notice of preparation (NOP) was published. The baseline inventory consists of de minimis sources of GHG emissions; hence, the baseline GHG emissions are assumed to be zero. The LCR emissions inventory considers six categories of GHG emissions: emissions due to vegetation changes, emissions from construction activities, residential emissions, commercial building emissions, mobile source emissions, and municipal emissions. The emissions from construction and land use change are one-time emissions events. The other emissions occur annually throughout the life of the project. The electrical power for the LCR development will be supplied by Southern California Edison (SCE). Accordingly, indirect GHG emissions from electricity usage are calculated using the SCE carbon-intensity factor. The BAU scenario consists of projected GHG emissions for LCR that would occur from the project if it were to be built without the project design features and energy reduction commitments made by Lytle Development Company, and in the absence of regulations promulgated to comply with AB 32, including GHG reduction measures discussed in the AB 32 Scoping Plan.

A variety of methods are employed to develop a complete GHG emissions inventory. In addition to well-established emission factors for certain activities and emission estimates based on similar activities in other representative communities; several emissions estimation software programs are used. These include EMFAC, OFFROAD, Urban Emissions Model (URBEMIS), and Building America Research Benchmark Definition (BARBD).

Emissions from the various aspects of LCR are presented in Table ES-1 on page ES-4. Both the one-time emissions and emissions that are expected to occur each year after build-out of the LCR development are presented. There are 256,432 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to 98,059 tonnes CO_2e/year. Of the annual emissions, slightly more than 58% result from vehicular emissions associated with residential activities, and 26% result from the energy use associated with residential and non-

residential buildings. If the one-time emissions are annualized assuming a 40-year development life[1] (which is likely low), then the one-time emissions account for approximately 6,411 tonnes, or 6% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 104,470 tonnes/year.

To determine the Project's GHG emissions impacts under CEQA, the GHG inventory was evaluated against a threshold of significance defined as consistency with AB 32 goals, as demonstrated by achieving at least a 28.5% reduction in GHG emissions over the BAU scenario. As shown in Table ES-1 on page ES-4, the total emission savings across different source categories represent a 32.7% reduction relative to the BAU scenario. This reduction is attributed both to design elements incorporated into the LCR project (e.g. higher density development, energy efficient buildings); and to decreases in emission factors due to implementation of two AB 32 scoping plan measures: the Renewables Portfolio Standard, and the Pavley regulation.

This inventory was prepared as a worst-case analysis. For example, it assumes that all emissions from LCR are "new," in the sense that, absent the development of LCR, these emissions would not occur. Given the global nature of GHG emissions, "new" global GHG emissions are those caused by economic growth and population growth (births)[2]; local development projects accommodate such growth.

[1] The one time emissions are annualized over the estimated lifetime of the project, regardless of the duration of the construction phase. This represents the expected interval before those emissions would recur (e.g. the housing would be replaced). Forty years is a conservative estimate for the lifetime of homes in this area. Life cycle assessment studies typically assume building life spans of 50 to 100 years. Scheuer, C., G.A. Keoleian, and P. Reppe. (2003) Life cycle energy and environmental performance of a new university building: Modeling challenges and design implications. *Energy and Buildings*, **35** (10): p. 1049. Keoleian, G.A., S. Blanchard, and P. Reppe. (2000) Life-cycle energy, costs, and strategies for improving a single family house. *Journal of Industrial Ecology*, **4**(2): p. 135. Sartori, I. and A.G. Hestnes. (2007) Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Buildings*, **39**(3): p. 249.

[2] Population growth leads to increased emission through increases in anthropogenic emission generating activities such as on-road vehicle operation and residential electricity use. Biogenic emissions such as breathing are not included in this analysis.

Table ES-1
GHG Emissions Comparison of BAU to Lytle Creek Ranch
Lytle Creek Ranch
Rialto, California

Source	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over BAU [1]
	BAU	Lytle Creek Ranch	(%)
Vegetation[2]	32,388	-1,120	103.5%
Construction[3]	257,552	257,552	0.0%
Total (one-time emissions)	**289,940**	**256,432**	**11.6%**
Residential Energy Use[4]	27,975	21,530	23.0%
Non-Residential Energy Use[4]	5,068	4,386	13.5%
Mobile Sources[5]	100,168	57,265	42.8%
Municipal Sources[6]	12,509	12,509	0.0%
Area Sources[7]	2,370	2,370	0.0%
Total (annual emissions)	**148,090**	**98,059**	**33.8%**
Annualized Total[8]	**155,338**	**104,470**	**32.7%**

Notes:

1. The percentage improvement over BAU is an estimate. There are some source categories for which appropriate comparisons to BAU are not available. It is estimated that this value is on the conservative side. For vegetation, the reduction in emissions exceeds 100% relative to BAU because the addition of trees will increase carbon sequestration.

2. LCR vegetation emissions are based on 1,356 acres of scrubland removed, and 30,000 net new trees being planted. BAU vegetation emissions are based on an additional 908 acres of native habitat being turned into settlements, and no trees being planted.

3. No differences between BAU and LCR were assumed for construction emissions.

4. BAU residential and non-residential energy use emissions reflect minimally 2005 Title-24 compliant buildings without Energy Star appliances, and no Renewable Portfolio Standard, which is consistent with how ARB calculated the 2008 BAU inventory. LCR estimates reflect 15% improvement over minimally 2005 Title 24-compliant buildings, Energy Star appliances (for residential buildings only), and 2010 implementation of Renewable Portfolio Standard.

5. Comparison of BAU to LCR mobile emissions is based on the ratio of BAU to LCR trip rates, as estimated using URBEMIS. BAU trip rate reflects a less dense development (comparable to nearby City of Rialto) and no traffic mitigation measures. Trip rates were used to estimate vehicle miles traveled, which were then used to estimate GHG emissions. LCR mobile source emissions also reflect implementation of Pavley Standards, whereas the BAU estimate does not.

6. Municipal emissions included here are related to water treatment, waste water treatment, street lighting, and municipal vehicles. This is a very conservative estimate because appropriate emission factors to adjust wastewater direct emission estimates were not available at the time of this analysis.

7. Area sources include landscaping equipment and natural gas fireplaces. No differences between BAU and LCR were assumed.

8. One-time emissions are annualized over 40 years and then added to the total annual emissions.

Abbreviations:
BAU - business as usual
GHG – greenhouse gas
LCR – Lytle Creek Ranch Project

1 Introduction

Lytle Creek Ranch (LCR) development will result in one-time and annual (direct and indirect) emissions of greenhouse gases (GHGs). Direct emissions of GHGs are those that are emitted directly as a result of the project and include land use change and construction emissions. Indirect emissions are those emissions that the project entitlement will enable, but that are not controlled by the project proponent. This report discusses the scientific and regulatory developments surrounding global climate change and provides an estimate of an emissions inventory that would result from entitling LCR. This report also places the emissions inventory from LCR into context.

Residents, employees, and patrons of commercial and municipal buildings use electricity, heat their homes and water (typically with natural gas), and are transported in motor vehicles, all of which directly or indirectly emit GHGs. The principal greenhouse gases resulting from such developments are emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). CO_2 is considered the most important GHG, due primarily to the large emissions produced by fossil fuel combustion, especially for the generation of electricity and powering of motor vehicles. CH_4 and N_2O are also emitted by fossil fuel combustion, though their emissions are much less significant than CO_2. CH_4 is also emitted from the transmission, storage, and incomplete combustion of natural gas.

The effect that each of these gases can have on global warming is a combination of the mass of their emissions and their global warming potential (GWP). GWP indicates, on a pound for pound basis, how much a gas is predicted to contribute to global warming relative to how much warming would be predicted to be caused by the same mass of CO_2. CH_4 and N_2O are substantially more potent GHGs than CO_2, with GWPs of 21 and 310, respectively.[3] In emissions inventories, GHG emissions are typically reported in terms of pounds (lbs) or tonnes[4] of CO_2 equivalents (CO_2e). CO_2e are calculated as the product of the mass emitted of a given GHG and its specific GWP. While CH_4 and N_2O have much higher GWPs than CO_2, CO_2 is emitted in such vastly higher quantities that it accounts for the majority of GHG emissions in CO_2e, both from residential developments and human activity in general.

The LCR project is located within the South Coast Air Quality Management District (SCAQMD) jurisdiction. However, as SCAQMD guidelines for the preparation of GHG inventories have not yet been developed, this inventory has been developed consistent with the methodologies established by the California Climate Action Registry (CCAR) where possible. When guidance from the CCAR is lacking, methodologies established by the Intergovernmental Panel on Climate Change (IPCC)[5] and best available science are used. Legislation and rules regarding climate change, as well as scientific understanding of the extent to which different activities emit

[3] GWP values from IPCC's Second Assessment Report (SAR, 1996) are still used by international convention and are used in this protocol, even though more recent (and slightly different) GWP values were developed in the IPCC's Third Assessment Report (TAR, 2001)

[4] In this report, "tonnes" will be used to refer to metric tonnes (1,000 kilograms). "Tons" will be used to refer to short tons (2,000 pounds).

[5] The WMO and the UNEP established the IPCC in 1988; it is open to all members of the United Nations and WMO.

GHGs, continue to evolve; as such, the inventory in this report is a reflection of the guidance and knowledge currently available.

At the entitlement stage of a development, while the number of homes, the approximate size of commercial areas and the locations of both are known, the exact designs of the homes, businesses and facilities are not. Even so, the types of buildings and the types of facilities at the future LCR site can be used for developing an estimate of the project's anticipated GHG emissions. Energy used in a building depends in part on the built environment; however, actual future emissions from the site will depend heavily upon the future homeowners' and business owners' habits. Because the actual future occupants and their habits are not yet known, average current behavior is assumed. That assumption is likely to be a "worst-case" assumption. Given the current regulatory environment and the media focus on global climate change, it is likely that the actual future occupants will be more sensitive to the GHG emissions caused by their activities and, therefore, their activities will result in lower GHG emissions than average current behavior shows.

1.1 Emissions Inventory

Three inventories are presented: the baseline inventory, the inventory of LCR emissions for the project scenario, and the inventory for LCR emissions for the Business as Usual (BAU) scenario. The emissions inventories consider the following categories of GHG emissions:

- emissions due to land use (vegetation) changes,
- emissions from construction activities,
- residential building operations emissions,
- non-residential building operations emissions,
- mobile source operations emissions,
- municipal operations emissions,
- area sources (fireplaces and lawn maintenance) emissions, and

The baseline inventory includes emissions associated with the physical environmental conditions at the time the notice of preparation (NOP) was published. The difference between baseline emissions and LCR emissions represents the net change in emissions resulting from the project. The BAU scenario consists of projected GHG emissions for LCR that would occur from the project if it were to be built without the project design features and energy reduction commitments made by Lytle Development Company, and in the absence of regulations promulgated to comply with AB 32, including GHG reduction measures discussed in the Assembly Bill (AB) 32 Scoping Plan.

In addition, an estimate of “life-cycle” GHG emissions from building materials is presented. Life cycle emissions include all of the emissions caused by the existence of a product or project, for example, GHG emissions from the processes used to manufacture and transport materials used in the buildings and infrastructure. This estimate is to be used for comparison purposes only and is not included in the final inventory as these emissions would be accounted for under California

Global Warming Solutions Act of 2006 (AB 32) in other industry sectors. In addition, life-cycle analyses inherently involve many uncertainties. For example, in a life-cycle analysis for building materials, somewhat arbitrary boundaries must be drawn to define the processes considered in the life-cycle analysis.[6] Although life-cycle emission estimates can provide a broader view of a project's emissions, life cycle analyses often double count emissions that might be attributable to other sectors in a comprehensive analysis. The applicability of information to a specific geographic location, climatic zone and building type can influence the life-cycle GHG emissions. Further uncertainty of life-cycle analyses come from some basic choices, such as the useful life of a building or road which can substantially change the outcome of the life-cycle analysis. The inventory does not consider GHG emissions from sources outside of LCR that may indirectly service LCR residents (e.g., a landfill)

The timeframe over which GHGs are emitted varies from category to category, which is taken into consideration in the emissions inventory. For most of the categories, GHGs will be emitted every year that the development is inhabited. For these categories (residential buildings, non-residential buildings, mobile sources, municipal services, and area sources), the inventory includes estimates of annual GHG emissions from ongoing development operations. GHG emissions from two of the categories, construction and changes in vegetation, are one-time events that will not be part of the development's ongoing activity. These one-time emissions can be divided by the estimated lifetime of the project to allow direct comparison of these two emissions classes. The inventory presents estimates of these one-time emissions, converts them to annualized estimates, and integrates them into an annual inventory.

It is worth noting that the GHG emissions estimates assume there are no reductions in GHG-generating activities over time. This is clearly unlikely, and presents a conservative analysis, given the expected reductions in GHG emissions from most activities that will take place over the years due to future regulations, greater public awareness and the likely increasing costs of energy. For example, the emissions estimate for electricity consumption assumes that there will not be an increase in energy production from renewables or non-GHG producing sources beyond currently adopted regulations; this is not realistic, given the mandates of AB 32, and other regulatory development, as discussed later in this report.

A variety of methods are employed to develop a complete GHG emissions inventory. In addition to well established emission factors for certain activities and emission estimates based on similar activities in other representative communities; several emissions estimation software programs are used. These include EMFAC, OFFROAD, Urban Emissions Model (URBEMIS), and Building America Research Benchmark Definition (BARBD). Later sections of the report describe these models and other estimation methods. The major emissions sources that exist in residential developments are described later in this report.

[6] For instance, in the case of building materials, the boundary could include the energy to make the materials, the energy used to make the machine that made the materials, and the energy used to make the machine that made the machine that made the materials.

1.2 Project GHG Emissions in Context

In order to place the magnitude of project emissions into context, emissions per capita are compared to state, national and global inventories. The comparisons are for informational purposes only; they are not meant to evaluate the significance of the project with respect to the California Environmental Quality Act (CEQA).

1.3 Comparison of GHG Emissions to Significance Threshold

To date, the SCAQMD and California Air Resources Board (ARB) have not established significance thresholds for GHG emissions under CEQA [7]. To evaluate LCR's GHG emissions, the LCR inventory is compared with a BAU scenario to determine if the development is likely to be consistent with rules propagated for California to meet its 2020 emissions reduction goal by the ARB. The BAU scenario consists of projected emissions for LCR that would occur from the project if it were to be built without the project design features and energy reduction commitments made by Lytle Development Company, and without the regulations that have been promulgated to comply with AB 32. Consistency with this goal is defined as a reduction of at least 28.5% in GHG emissions relative to BAU.

1.4 Report Description

This report contains seven sections. Following this introduction, Sections 2 and 3 detail the state of climate change science and the regulatory setting. Section 4 presents the results of the LCR GHG Inventory. Section 5 compares these results to various benchmarks to gain perspective on what impact the LCR development will have on overall GHG emissions. Section 6 generally discusses Executive Order S-03-5, which sets GHG targets for 2050. Finally, the main findings from the report are summarized in the conclusion, Section 7.

[7] Both SCAQMD and ARB have recently released proposed significance thresholds, but these have not been finalized at this time.

2 State of Science

This section summarizes the scientific issues surrounding climate change and global warming. It also provides a discussion of the actions and phenomena that contribute to climate change and puts into context global, national, and state emissions of GHGs.

2.1 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 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.[8]

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.[9] This man-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 GHGs play in it are described below.

2.2 The Greenhouse Effect

Greenhouses allow sunlight to enter and then capture some of the heat generated by the sunlight's impact on the earth's surface. The earth's atmosphere acts like a greenhouse by allowing sunlight in, but trapping some of the heat that reaches the earth's surface. 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.[10] Whereas the GHGs in the atmosphere let solar radiation through, the infrared radiation is trapped by greenhouses gases, resulting in the warming of the earth's surface.[11] 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 CO_2, CH_4, N_2O, and

[8] Other definitions of "Greenhouse Effect" and "Global Warming" can be found on Merriam-Webster online: http://www.m-w.com/. A definition for "Climate Change" can be found on dictionary.com which uses Webster's New Millennium™ Dictionary of English, Preview Edition (v 0.9.6).

[9] From the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers." Available online at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

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

[11] Infrared radiation is characterized by longer wavelengths than solar radiation. Greenhouse gases reflect radiation with longer wavelengths. As a result, instead of escaping back into space, greenhouse gases reflect much infrared radiation (i.e., heat) back to Earth.

water vapor have been naturally present for millennia at relatively stable levels in the atmosphere, adequate to keep temperatures on Earth hospitable. Without these GHGs, the earth's temperature would be too cold for life to exist.

As human industrial activity has increased, atmospheric concentrations of certain GHGs have grown dramatically. Figure 2-1 shows the increase in concentrations of CO_2 and CH_4 over time. 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.[12] As the concentrations of GHGs increase due to human activity, more infrared radiation is trapped, and the earth is heated to higher temperatures. This is the process that is described as human-induced global warming.

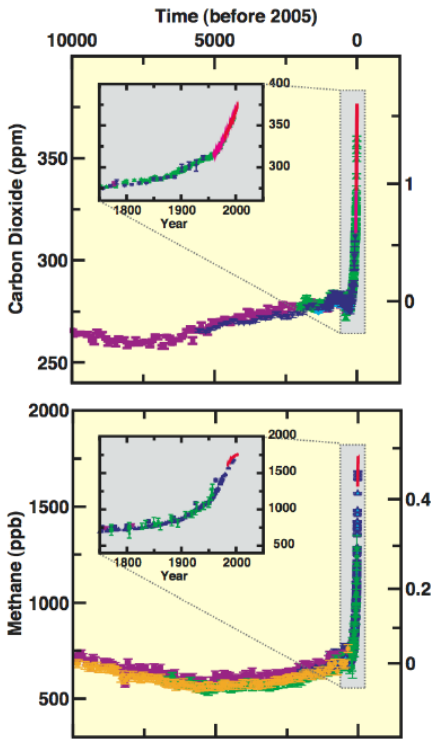

Figure 2-1. Carbon dioxide and methane concentrations have increased dramatically since the industrial revolution.[13]

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

[13] Adapted from figure SPM-1 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers." Available online at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

In 2007, the IPCC began releasing components of its Fourth Assessment Report (FAR) on climate change. In February 2007, the IPCC provided a comprehensive assessment of climate change science in its Working Group I Report.[14] It 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 greenhouse gas concentrations have contributed to global warming. Confidence levels of claims in this report have increased since 2001 due to the large number of simulations run and the broad range of available climate models.

2.3 Greenhouse Gases and Sources of Their Emissions

The term "GHGs" includes gases that contribute to the natural greenhouse effect, such as CO_2, CH_4, N_2O, and water, as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs), chlorinated fluorocarbons (CFCs), and sulfurhexafluoride (SF_6). These last three families of gases, while not naturally present in the atmosphere, have properties 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 Accords (water is not included).[15] There are other GHGs that are not recognized by the Kyoto Accords, due either to the smaller role that they play in climate change or the uncertainties surrounding their effects. Atmospheric water vapor is not recognized by the Kyoto Accords because there is not an obvious correlation between water concentrations and specific human activities. Water appears to act in a positive feedback manner; higher temperatures lead to higher water concentrations, which in turn cause more global warming.[16]

The effect each of these gases has on global warming is a combination of the volume of their emissions and their GWP. GWP indicates, on a pound 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 21 and 310, respectively. However, these natural GHGs are nowhere near as potent as SF_6 and fluoromethane, which have GWPs of up to 23,900 and 6,500 respectively.[17] 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.

The most important greenhouse gas in human-induced global warming is CO_2. While many gases have much higher GWPs than the naturally occurring 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

[14] Available online at: http://www.ipcc.ch/ipccreports/ar4-wg1.htm

[15] This Kyoto Protocol sets legally binding targets and timetables for cutting the greenhouse-gas emissions of industrialized countries. The US has not approved the Kyoto treaty.

[16] From the IPCC Third Assessment Report: http://www.grida.no/climate/ipcc_tar/wg1/143.htm and http://www.grida.no/climate/ipcc_tar/wg1/268.htm

[17] California Climate Action Registry General Reporting Protocol - Reporting Entity-Wide Greenhouse Gas Emissions. SAR values, Appendix C. http://www.climateregistry.org/resources/docs/protocols/grp/GRP_V3_April2008_FINAL.pdf

States (US).[18] 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 percent higher than the pre-industrial concentrations of about 280 ppm.[19] 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 1774 parts per billion (ppb) as compared to 715 ppb.[20] CH_4 has a relatively short atmospheric lifespan of only 12 years, but has a higher GWP than CO_2.

Nitrous oxide concentrations have increased from about 270 ppb in pre-industrial times to about 319 ppb by 2005.[21] 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. Nitrous oxide'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 tetrafluoromethane (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.

2.4 Current and Projected Climatic Impacts of Global Warming

A strong indication that global warming is currently taking place is the fact that the top seven warmest years since the 1890s occurred after 1997. Furthermore, a warming of about 0.2 degrees Celsius (°C) per decade is projected by currently accepted models.

There is a 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.[22] Figure 2-2 shows the rise of global temperatures, the global rise of sea level, and the loss of snow cover from 1850 to the present.

---

[18] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, USEPA. Available online at: http://epa.gov/climatechange/emissions/downloads/08_CR.pdf

[19] Page 2 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers."

[20] Page 4 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers."

[21] Page 4 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers."

[22] Statistics from IPCC Working Group I and II Reports.

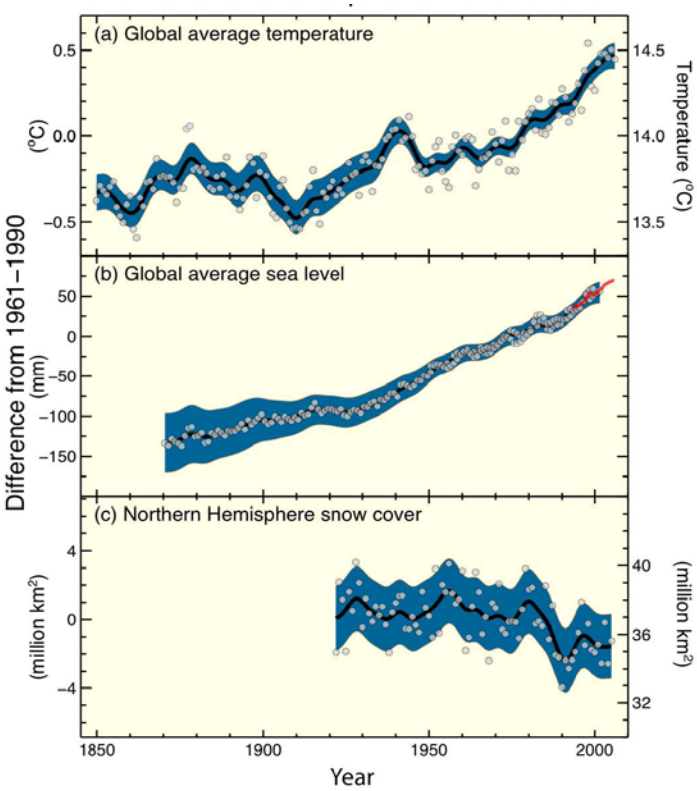

Figure 2-2. Global warming trends and associated sea level rise and snow cover decrease.[23]

2.5 Socioeconomic Impacts of Global Warming

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.[24] The availability and quality of potable water resources may be compromised by increased salinisation of ground water due to sea-level rises, decreased supply in semi-arid and arid locations, and poorer water quality arising from increased water temperatures and more frequent floods and droughts.[25] These impacts on freshwater systems, in addition to the effects of increased drought and flood frequencies, can reduce crop productivity and food supply.

In addition to compromising food and water resources, there are other means through which climatic changes associated with global warming can affect human health and welfare. Warmer temperatures can cause more ground-level ozone, a pollutant that causes eye irritation and respiratory problems. Ranges of infectious diseases will likely increase, and some areas will

[23] Figure SPM-3 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers."

[24] From the IPCC Working Group II Report.

[25] From the IPCC Technical Paper VI: "Climate Change and Water". Available online at: http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf

face greater incidences of illness and mortality associated with increased flooding and drought events.

In its April 2007 Working Group II Report, the IPCC provided an assessment of the "current scientific understanding of impacts of climate change on natural, managed and human systems, the capacity of these systems to adapt and their vulnerability".[26] Here, the IPCC states that although some people will gain and some will lose because of global climate change, the overall change will be one of social and economic losses. California in particular is an area that could be negatively impacted by global warming. Global warming could alter the seasonal pattern of snow accumulation and snowmelt, which 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 one billion dollars.[27]

2.6 IPCC Fourth Assessment Report

It is important to recognize that the climatic conditions experienced by the Project over its designed lifetime are likely to be substantially different from those observed over the past century. Consequently, it is useful to consider the implications of changing climatic conditions for Project performance. Scenarios[28] for 2100 modeled in the IPCC FAR include:

Temperature Increase

- Low Emissions Scenario: 1.8°C (best estimate), with a range of 1.1°C to 2.9°C
- High Emissions Scenario: 4.0°C (best estimate), with a range of 2.4°C to 6.4°C

Sea Level Rise

- Low Emissions Scenario: 0.18 to 0.38 meters (range)
- High Emissions Scenario: 0.26 to 0.59 meters (range)

[26] Available online at: http://www.ipcc-wg2.org/index.html

[27] Office of the Governor.

[28] 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

Potential implications for the Project include:

Sea level: Rising sea levels are unlikely to directly impact the proposed Project due to its distance from the coast and relative elevation.

Temperature: Rising temperatures could have a variety of impacts, including stress on sensitive populations (e.g., sick and elderly), additional burden on building systems (e.g., demand for conditioning), and, indirectly, increasing emissions of greenhouse gases and criteria pollutants associated with energy generation. It is not possible to reliably quantify these risks at this time.

Precipitation: Climate change is expected to alter seasonal and inter-annual patterns of precipitation. These changes continue to be one of the most uncertain aspects of future scenarios. For this Project, the most relevant direct impacts are likely to be changes in the timing and volume of stormwater runoff and changes in demand for irrigation. It is not possible to reliably quantify the implications of these changes at this time.

Wildfire: Changes in temperature and precipitation may combine to alter risks of wildfire. Changes in wildfire hazard have the potential to impact the Project; however, it is not possible to reliably quantify the implications of these changes at this time.

Water supply reliability: Changes in temperature and precipitation may also influence seasonal and inter-annual availability of water supplies. Consequently, it is reasonable to consider that climate change may affect water supply reliability. It is not possible to reliably quantify these risks for the Project at this time. For more information on the Project's water supply, please refer to the Water Supply Assessment in the Environmental Impact Report (EIR).

2.7 Global, National, and California-wide GHG Emissions Inventories

Worldwide emissions of GHGs in 2004 were 26.8 billion tonnes of CO_2e.[29] In 2004, the US emitted about 7 billion tonnes of CO_2e or about 24 tonnes of CO_2e per year per person.[30] Over 80% of the GHG emissions in the US are comprised of CO_2 emissions from energy related fossil fuel combustion. In 2004, California emitted 0.492 billion tonnes of CO_2e, or about 7% of the US emissions. If California were a country, it would be the 16th largest emitter of GHGs in the world.[31] This large number is due primarily to the sheer size of California. Compared to other states, California has one of the lowest per capita GHG emission rates in the country. This is due to California's higher energy efficiency standards, its temperate climate, and the fact that it relies on substantial out-of-state energy generation.

[29] Sum of Annex I and Annex II countries without counting Land-Use, Land-Use Change and Forestry (LULUCF) http://unfccc.int/ghg_emissions_data/predefined_queries/items/3814.php For countries that 2004 data was unavailable, the most recent year was used.

[30] 2006 Inventory of U.S. Greenhouse Gas Emissions and Sinks. Available online at: http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/RAMR6MBLP4/$File/06ES.pdf

[31] Anywhere between the 12th and 16th depending upon methodology. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. California Energy Commission.

In 2004, 81% of greenhouse gas emissions (in CO_2e) from California were comprised of CO_2 emissions from fossil fuel combustion, with 4% comprised of CO_2 from process emissions. CH_4 and N_2O accounted for 5.7% and 6.8% of total CO_2e respectively, and high GWP gases[32] accounted for 2.9% of the CO_2e emissions. Transportation is by far the largest end-use category of GHG emissions. Transportation includes that used for industry (i.e., shipping) as well as residential use.

2.8 Potential for Reduction of GHG Emissions

In May 2007, the IPCC produced its Working Group III Report on the "scientific, technological, environmental, economic and social aspects" of reducing GHG emissions to alleviate climate change.[33] The report concluded that, even with current policies for sustainable development and mitigation of climate change, global GHG emissions will continue to grow over the next several decades.

[32] Such as HFCs and PFCs.

[33] Available online at: http://www.ipcc.ch/ipccreports/ar4-wg3.htm

3 Regulatory Setting

Climate change has only recently been widely recognized as a threat to the global climate, economy and population. As a result, the climate change regulatory setting – federal, state and local – is complex and evolving. This section identifies key legislation, executive orders, and seminal court cases related to climate change germane to Lytle Creek Ranch project GHG emissions.

3.1 Federal Action on Greenhouse Gas Emissions

3.1.1 Federal Action on Greenhouse Gas Emissions

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. No binding reductions were associated with the goal. Rather, the United States Environmental Protection Agency (USEPA) administers a variety of voluntary programs and partnerships with GHG emitters in which the USEPA partners with industries producing and utilizing synthetic GHGs to reduce emissions of these particularly potent GHGs.

3.1.2 April 2007 Supreme Court Ruling

In *Massachusetts et al. vs. Environmental Protection Agency et al.* (April 2, 2007) the US Supreme Court ruled that the Clean Air Act (CAA) authorizes the USEPA 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 where 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. On April 24, 2009 the USEPA issued a proposed endangerment finding, stating that high atmospheric levels of greenhouse gases “are the unambiguous result of human emissions, and are very likely the cause of the observed increase in average temperatures and other climatic changes.” The USEPA further found that “atmospheric concentrations of greenhouse gases endanger public health and welfare within the meaning of Section 202 of the Clean Air Act.” The finding itself does not impose any requirements on industry or other entities. The public comment period for this proposed endangerment finding ended June 23, 2009, and the finding is now under final review.[34]

3.1.3 Corporate Average Fuel Efficiency Standards

In response to the *Massachusetts et al. vs. Environmental Protection Agency et al.* ruling, the Bush Administration issued an executive order on May 14, 2007, directing the USEPA and Departments of Transportation (DOT) and Energy (DOE) to establish regulations that reduce GHG emissions from motor vehicles, non-road vehicles, and non-road engines by 2008. On December 19, 2007, the Energy Independence and Security Act of 2007 (EISA) (discussed below) was signed into law, which requires an increased Corporate Average Fuel Economy (CAFE) standard of 35 miles per gallon (mpg) for the combined fleet of cars and light trucks by

[34] Available at http://www.epa.gov/climatechange/endangerment.html

model year 2020. EISA requires establishment of interim standards (from 2011 to 2020) that will be the "maximum feasible average fuel economy" for each fleet. On October 10, 2008, the National Highway Traffic Safety Administration (NHTSA) released a final environmental impact statement analyzing proposed interim standards for model years 2011 to 2015 passenger cars and light trucks. NHTSA issued a final rule for model year 2011 on March 23, 2009.[35]

On May 19, 2009, President Obama announced a national policy for fuel efficiency and emissions standards in the US auto industry. The proposed rulemaking is a collaboration between the DOT and USEPA with the support of the United Auto Workers. The proposed federal standards apply to passenger cars, light-duty trucks, and medium duty passenger vehicles built in model years 2012 through 2016. If finalized, the proposed rule would surpass the 2007 CAFE standards and require an average fuel economy standard of 35.5 mpg in 2016. On May 22, 2009, the DOT and USEPA issued a notice of upcoming joint rulemaking on this issue.[36,37] On June 30, 2009 the USEPA granted the waiver for California for its greenhouse gas emission standards for motor vehicles; this is described in more detail below.

3.1.4 Energy Independence and Security Act of 2007

In addition to setting increased CAFE standards for motor vehicles, the EISA includes other provisions:

- Renewable Fuel Standard (RFS) (Section 202);
- Appliance and Lighting Efficiency Standards (Section 301–325);
- Building Energy Efficiency (Sections 411–441).

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

3.1.5 Reporting Requirements

Congress passed "The Consolidated Appropriations Act of 2008" (HR 2764) in December 2007, which includes provisions requiring the establishment of mandatory GHG reporting requirements. The measure directs USEPA to publish draft rules by September 2008, and final rules by June 2009 mandating reporting "for all sectors of the economy." The USEPA published draft GHG reporting rules on April 10, 2009. The comment period ended on June 9, 2009. As of the time of release of this document, the USEPA has not published final rules as directed by the Act.

[35] See http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.43ac99aefa80569eea57529cdba046a0/

[36] See http://yosemite.epa.gov/opa/admpress.nsf/6fa790d452bcd7f58525750100565efa/451902cb77d4add5852575bb006d3f9b!OpenDocument

[37] See http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.43ac99aefa80569eea57529cdba046a0/

3.2 Regional Agreements

3.2.1 Western Regional Climate Action Initiative

The Western Regional Climate Action Initiative (WCI) is a partnership among seven states, including California, and four Canadian provinces that are implementing a regional, economy-wide cap-and-trade system to reduce global warming pollution. The WCI will cap the region's electricity, industrial, and transportation sectors with the goal of reducing the heat-trapping emissions that cause global warming 15% below 2005 levels by 2020. California is working closely with the other states and provinces to design a regional GHG reduction program that includes a cap-and-trade approach. ARB plans to develop a cap-and-trade program that will link California and the other member states and provinces.

3.3 California Legislation

California has enacted a variety of legislation that relates to climate change, much of which sets aggressive goals for GHG reductions within the state. However, none of this legislation provides definitive direction regarding the treatment of climate change in environmental review documents. As discussed below, the Office of Planning and Research (OPR) has been directed to develop guidelines for the mitigation of GHG emissions and their effects; ARB must adopt regulations by January 1, 2010. OPR recently released a guidance document, discussed below, for treatment of GHG under CEQA, but this document is purely advisory and serves as guidance only. On January 8, 2009, OPR released Preliminary Draft CEQA Guideline Amendments for Greenhouse Gas Emissions. These amendments propose specific obligations of public agencies to address GHG emissions as part of the CEQA requirements to determine a project's effects on the environment. In addition, on October 24 2008, ARB released a draft staff proposal entitled "Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act" (Draft ARB Thresholds). More detail was provided in another document released on December 9th, 2008. On April 13, 2009, OPR submitted proposed amendments to the state CEQA Guidelines for greenhouse gas emissions to the Secretary for Natural Resources.[38,39,40] On July 3, 2009, the Natural Resources Agency commenced the Administrative Procedure Act rulemaking process for certifying and adopting these amendments. Public comments will be accepted through August 20, 2009. The Draft ARB Thresholds provide a framework for developing CEQA significance thresholds for industrial, commercial and residential projects. But as of the release date of this document, many details remain unresolved and the ARB Thresholds document is still in draft form.

At the time of this report, few local, state, or regional agencies have promulgated binding regulations for the treatment of GHG analysis or mitigation in CEQA documents. The discussion below provides a brief overview of the ARB and OPR documents and of the primary legislation that relates to climate change which may affect the emissions associated with the proposed project.

---

[38] See http://opr.ca.gov/index.php?a=ceqa/index.html

[39] See http://ceres.ca.gov/ceqa/guidelines/

[40] See http://www.arb.ca.gov/cc/localgov/ceqa/ceqa.htm

3.3.1 Assembly Bill 32 (Statewide GHG Reductions)

The California Global Warming Solutions Act of 2006, widely known as AB 32, requires ARB to develop and enforce regulations for the reporting and verification of statewide greenhouse gas emissions. ARB is directed to set a greenhouse gas emission limit, based on 1990 levels, to be achieved by 2020. The bill sets a timeline for adopting a scoping plan for achieving greenhouse gas reductions in a technologically and economically feasible manner.

The heart of the bill is the requirement that statewide GHG emissions must be reduced to 1990 levels by 2020. California needs to reduce GHG emissions by approximately 28.5% below business-as-usual predictions of year 2020 GHG emissions to achieve this goal. The bill 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 are as follows:

- June 30, 2007—Identification of discrete early action greenhouse gas emissions reduction measures. On June 21, 2007, ARB satisfied this requirement by approving three early action measures. These were later supplemented by adding six other discrete early action measures.
- January 1, 2008—Identification of the 1990 baseline GHG emissions level and approval of a statewide limit equivalent to that level. Adoption of reporting and verification requirements concerning GHG emissions. On December 6, 2007, ARB approved a statewide limit on GHG emissions levels for the year 2020 consistent with the determined 1990 baseline.
- January 1, 2009—Adoption of a scoping plan for achieving GHG emission reductions. On October 15, 2008, ARB issued a "discussion draft" Scoping Plan entitled "Climate Change Draft Scoping Plan: A Framework for Change" (Draft Scoping Plan). ARB adopted the Draft Scoping Plan at its December 11, 2008 meeting.
- January 1, 2010—Adoption and enforcement of regulations to implement the “discrete” actions.
- January 1, 2011—Adoption of GHG emissions limits and reduction measures by regulation.
- January 1, 2012—GHG emissions limits and reduction measures adopted in 2011 become enforceable.

3.3.2 Executive Order S-3-05 (Statewide GHG Targets)

California Executive Order S-03-05 (June 1, 2005) mandates a reduction of GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 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.

3.3.3 Low Carbon Fuel Standard

Executive Order S-01-07 (January 18, 2007) requires a 10% or greater reduction in the average fuel carbon intensity for transportation fuels in California regulated by ARB. ARB identified the

Low Carbon Fuel Standard (LCFS) as a Discrete Early Action item under AB 32, and the final resolution (09-31) was issued on April 23, 2009.[41]

3.3.4 Senate Bill 1368 (GHG Emissions Standard for Baseload Generation)

Senate Bill SB1368 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. This performance standard applies to electricity generated out-of-state as well as in-state, and to publicly owned as well as investor-owned electric utilities.

3.3.5 Assembly Bill 1493 (Mobile Source Reductions)

AB 1493 requires ARB to adopt regulations by January 1, 2005, to reduce GHG emissions from noncommercial passenger vehicles and light-duty trucks of model year 2009 and thereafter. The bill requires the California Climate Action Registry to develop and adopt protocols for the reporting and certification of greenhouse gas 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 greenhouse gas emissions prior to the date of 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 CAA 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 automobiles. In January 2009, President Barack Obama issued a directive to the USEPA to reconsider California's request for a waiver. On June 30, 2009 the USEPA granted the waiver for California for its greenhouse gas emission standards for motor vehicles. As part of this waiver, USEPA specified the following provision: ARB may not hold a manufacturer liable or responsible for any noncompliance caused by emission debits generated by a manufacturer for the 2009 model year.

3.3.6 Senate Bills 1078 and 107 (Renewables Portfolio Standard)

Established in 2002 under Senate Bill 1078 and accelerated in 2006 under Senate Bill 107, California's RPS requires retail suppliers of electric services to increase procurement from eligible renewable energy resources by at least 1% of their retail sales annually, until they reach 20% by 2010.

3.3.7 Executive Order S-14-08 (Renewables Portfolio Standard)

California Executive Order S-14-08 (November 11, 2008) mandates retail suppliers of electric services to increase procurement from eligible renewable energy resources to 33% by 2020. This is a further increase in RPS over Senate Bills 1078 and 107.

[41] See http://www.arb.ca.gov/fuels/lcfs/lcfs.htm

3.3.8 Senate Bill 375 (Land Use Planning)

SB 375 provides for a new planning process to coordinate land use planning and regional transportation plans and funding priorities in order to help California meet the GHG reduction goals established in AB 32. SB 375 requires regional transportation plans, developed by Metropolitan Planning Organizations (MPOs) relevant to the project area (including the Southern California Association of Governments [SCAG])[42], to incorporate a "sustainable communities strategy" in their regional transportation plans that will achieve GHG emission reduction targets set by ARB. SB 375 also includes provisions for streamlined CEQA review for some infill projects such as transit oriented development. SB 375 will be implemented over the next several years.

SB 375 is similar to the Regional Blueprint Planning Program, established by the California Department of Transit, which provides discretionary grants to fund regional transportation and land use plans voluntarily developed by MPOs working in cooperation with Council of Governments. The Metropolitan Transportation Commission (MTC) is currently developing its 2009 Regional Transit Plan (RTP) with AB 32 goals in mind, and its 2013 RTP will be its first plan subject to SB 375.

3.3.9 Energy Conservation Standards

Energy Conservation Standards for new residential and non-residential buildings were adopted by California Energy Resources Conservation and Development Commission in June 1977 and most recently revised in 2008 (Title 24, Part 6 of the California Code of Regulations).[43] Title 24 requires the design of building shells and building components to conserve energy. The standards are updated periodically to allow for consideration and possible incorporation of new energy efficiency technologies and methods. The 2006 Appliance Efficiency Regulations (Title 20, CCR Sections 1601 through 1608), dated December 2006, were adopted by the California Energy Commission on October 11, 2006, and approved by the California Office of Administrative Law on December 14, 2006. The regulations include standards for both federally-regulated appliances and non-federally regulated appliances. While these regulations are now often seen as “business as usual,” they do exceed the standards imposed by any other state and reduce GHG emissions by reducing energy demand.

On July 17, 2008, the California Building Standards Commission adopted the nation’s first green building standards. The California Green Building Standards Code (proposed Part 11, Title 24) was adopted as part of the California Building Standards Code (Title 24, California Code of Regulations). Part 11 establishes voluntary standards, that will become mandatory in the 2010 edition of the Code, on planning and design for sustainable site development, energy efficiency (in excess of the California Energy Code requirements), water conservation, material conservation, and internal air contaminants.

---

[42] See http://www.scag.ca.gov/region/index.htm

[43] Although new building energy efficiency standards were adopted in April 2008, these standards do not go into effect until January 1, 2010. Thus, the 2005 standards that went into effect on October 1, 2005 remain the current Title 24 standards.

3.3.10 Senate Bill 97 (CEQA Guidelines)

SB 97 requires that OPR prepare guidelines to submit to the California Resources Agency regarding feasible mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions as required by CEQA. The Resources Agency is required to certify and adopt these revisions to the State CEQA Guidelines by January 1, 2010. The Guidelines will apply retroactively to any incomplete environmental impact report, negative declaration, mitigated negative declaration, or other related document. On January 8, 2009, OPR released Preliminary Draft CEQA Guideline Amendments for Greenhouse Gas Emissions. As currently proposed, these amendments state that the lead agency should consider the following when assessing the significance of impacts from GHG emissions on the environment

- Extent the project helps or hinders the goals of AB32.
- Extent project may increase consumption of fuel and energy resources.
- Extent project impacts or emissions exceed any threshold of significance

No specific methodologies for performing an assessment are indicated, but rather it is left to the lead agency to determine the appropriate methodologies in context of a particular project.

The proposed amendments state that lead agencies should consider all feasible means of mitigating greenhouse gas emissions that substantially reduce energy consumption or GHG emissions. These potential mitigation measures may include carbon sequestration. If off-site or carbon offset mitigation measure are proposed they must be part of reasonable plan of mitigation that the agency itself is committed to implementing. No threshold of significance or any specific mitigation measures are indicated.

3.3.11 Office of Planning and Research Advisory on CEQA and Climate Change

n June 2008, the OPR published a Technical advisory entitled *CEQA and Climate Change: Addressing Climate Change Through CEQA* (OPR Advisory). This guidance, which purely advisory, a three-step analysis of GHG emissions:

1. *Mandatory Quantification of GHG Project Emissions.* The environmental impact analysis must include quantitative estimates of a project's GHG emissions from different types of air emission sources. These estimates should include both construction-phase emissions, as well as completed operational emissions, using one of a variety of available modeling tools.
2. *Continued Uncertainty Regarding "Significance" of Project-Specific GHG Emissions.* Each EIR document should assess the significance of the project's impacts on climate change. The OPR Advisory recognizes uncertainty regarding what GHG impacts should be determined to be significant and encourages agencies to rely on the evolving guidance being developed in this area. According to the OPR Advisory, the environmental analysis should describe a "baseline" of existing (pre-project) environmental conditions, and then add project GHG emissions on to this baseline to evaluate whether impacts are significant.
3. *Mitigation Measures.* According to the OPR Advisory, "all feasible" mitigation measures or project alternatives should be adopted if an impact is significant, defining feasibility in

relation to scientific, technical, and economic factors. If mitigation measures cannot sufficiently reduce project impacts, the agency should adopt whatever measures are feasible and include a fact-based statement of overriding considerations explaining why additional mitigation is not feasible. OPR also identifies a menu of GHG emissions mitigation measures, ranging from balanced "mixed use" master-planned project designs to construction equipment and material selection criteria and practices.

In addition to this three-step process, the OPR Advisory contained more general policy-level guidance. It encouraged agencies to develop standard GHG emissions reduction and mitigation measures. The OPR Advisory directed ARB to recommend a method for setting the GHG emissions threshold of significance, including both qualitative and quantitative options.

3.3.12 ARB Preliminary Draft Proposal: Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases Under the California Environmental Quality Act (Draft ARB Thresholds)

In October 2008, ARB released a draft proposal for identifying CEQA thresholds of significance for industrial, commercial and residential developments. The Draft ARB Thresholds propose a framework for developing thresholds of significance that rely upon the incorporation of a variety of performance measures to reduce GHG emissions associated with a project, as well as a numerical threshold of significance above which a project must include detailed GHG analysis in an EIR and incorporate all feasible mitigation measures. Although ARB proposed a 7,000-ton per year threshold for industrial projects, a numerical threshold for commercial and residential projects was not proposed, but is under development. In addition, the Draft ARB Thresholds incorporate SB 375 by providing that commercial and residential projects that comply with a previously approved plan, which, essentially, satisfies SB 375 and for which a certified final CEQA document has been prepared, is presumed to have a less than significant impact related to climate change. As of this time, ARB has suspended its work on CEQA thresholds.

3.4 Local Air Quality Management District (SCAQMD) Policies

On December 5, 2008, the SCAQMD Governing Board adopted its staff proposal for an interim CEQA GHG significance threshold for projects where the SCAQMD is the lead agency. Currently, the Board has only adopted thresholds relevant to industrial (stationary source) projects. To achieve a policy objective of capturing 90% of GHG emissions from new residential/commercial development projects and implement a "fair share" approach to reducing emission increases from each sector, SCAQMD staff has proposed combining performance standards and screening thresholds. The performance standards suggested have primarily focused on energy efficiency measures beyond Title 24 Part 6, California's building Energy Efficiency Standards, and a screening level of 3,000 tonnes CO_2e per year based on direct operational emissions. Above this screening level, project design features designed to reduce GHGs must be implemented to reduce the impact to below a level of significance. SCAQMD staff are performing additional analyses to further define the performance standards as well as coordinating with ARB's interim GHG proposal. At this time SCAQMD is waiting for ARB's recommendations for the residential/commercial sector. Once ARB adopts the statewide

significance thresholds, staff will report back to the Board regarding any recommended changes or additions to the SCAQMD's interim threshold.[44]

3.5 San Bernardino County Policies

The County has no specific GHG emissions reduction goals or policies.[45]

The following information presents a general discussion of certain County statutes, regulations, and policies that may be applicable to an understanding of the project's regulatory setting. A portion of the project is currently within the jurisdiction of the County but, as proposed, will be annexed into the City. Should any portion of the project site remain in the County or until such time as annexation to the City occurs, the County General Plan and County Development Code policies and ordinances will continue to apply.

- San Bernardino County Superior Court Case No. CIVSS 700329. On August 21, 2007, the County and the Office of the California Attorney General entered into a settlement agreement following the State's asserting that the County General Plan Final Program EIR failed to adequacy consider the potential adverse effects of the County General Plan on air quality and climate change. The settlement agreement was executed following the Attorney General's filing of a petition in San Bernardino Superior Court on April 12, 2007 challenging the adequacy of the County General Plan Final Program EIR, alleging that the EIR did not comply with the requirements of CEQA in its analysis of GHG emissions, climate change, and diesel exhaust emissions. Under the settlement agreement, the County shall prepare an amendment to the County General Plan adding a policy that describes the County's goal of reducing those greenhouse gas emissions reasonably attributable to the County's discretionary land-use decisions and the County's internal government operations and shall adopt a greenhouse gas emissions reduction plan. The Attorney General agreed to take no action to prevent or halt the immediate effectiveness of the County General Plan subject to that action.

- San Bernardino County General Plan. As indicated in the County General Plan, the air pollutants of greatest concern in the County are ozone (O_3) and particulate matter less than 10 microns (PM_{10}) because of the current non-attainment status with the Ambient Air Quality Standards (AAQS). The "worst air quality occurs in the southwestern portion of the County. Approximately 78.0 percent of the total population residents in this area and drive over 28 million miles per day. Other contributors include pollution transported from upwind areas in the South Coast Air Basin (SCAB) region and other major sources of air pollution in San Bernardino County, such as military bases, highways, and railroad facilities, cement manufacturing, and mineral processing."[46] In the context of the proposed project, those air quality goals, objectives, and programs presented in the County General Plan that appear

[44] See http://www.aqmd.gov/hb/2008/December/081231a.htm

[45] Although the County has a "Green County" program, no specific reduction goals are mandated. See http://www.sbcounty.gov/greencountysb/about_gc.htm

[46] *Op. Cit*., County of San Bernardino 2007 General Plan, Conservation Element, pp. V-10 and V-11.

to be most closely related to the unincorporated County portion of the project site are presented below.

- Goal CO4. The County will ensure good air quality for its residents, businesses, and visitors to reduce impacts on human health and the economy. Although the program described below is related to air quality, it will also have the co-benefit of reducing GHG emissions from tailpipe exhaust.
- Programs. Locate and design new development in a manner that will minimize direct and indirect emissions of air contaminants through such means as: [a] Promoting mixed-use development to reduce the length and frequency of vehicle trips. [b] Providing for increased intensity of development along existing and proposed transit corridors. [c] Providing for the location of ancillary employee services at major employment centers for the purpose of reducing midday vehicle trips. Policy CO4.5. Reduce emissions through reduced energy consumption.[47]
- Policy LU8.2 Review development proposals to minimize impacts, such as air emissions, on sensitive receptors.[48]

[47] *Ibid*., pp. V-22 through V-25.

[48] *Ibid*., Land Use Element, p. II-36.

4 Greenhouse Gas Inventory

This section describes the methods that ENVIRON International Corporation (ENVIRON) used to estimate GHG emissions from LCR after development and full build out. It includes some aspects that are fully within the control of Lytle Development Company, such as grading and the placement of utilities; some aspects that are in control of the individuals building the houses and commercial buildings, such as construction emissions; and some aspects for which control over emissions is shared by the developers and the residents, such as energy use in the built environment and emissions from traffic by the development's future residents and employees in the commercial areas. In addition, an estimate of "life-cycle" GHG emissions (i.e., GHG emissions from the processes used to manufacture and transport materials used in the buildings and infrastructure) is presented. This estimate is to be used for comparison purposes only and is not included in the final inventory as these emissions would be attributable to other industry sectors under AB 32. The inventory does not consider GHG emissions from most sources outside of LCR that may indirectly service the residents (e.g., a landfill). Each aspect of the GHG inventory is described in this section. Actual GHG emissions at full build-out at LCR are expected to be substantially lower due to regulatory developments; therefore, the GHG emissions reported in this section are a conservative estimate.

4.1 GHG Emissions Baseline

The CEQA Guidelines specify that the physical environmental conditions at the time the NOP is published "will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant." (CEQA Guidelines § 15125(a)). The project location is undeveloped with the exception of an existing golf course and one industrial source of less than 15,000 square feet. It is assumed that GHG emissions from these sources are *de minimis*. Therefore, the total emissions associated with the project are assumed to represent total net new emissions.

4.2 Evaluation of "New" Emissions

Given the global nature of GHG impacts, it is difficult to determine which emissions from a given project are "new" on a global scale. As described in this section, there are methods of estimating emissions from certain aspects of projects, such as that from the additional vehicle travel associated with the project. However, it is not clear how to determine what proportion of those emissions are truly additional, or new, in the global sense, or what proportion of those emissions would have occurred globally without the project.

Analyses for evaluating the airborne criteria pollutant impacts of new projects for inclusion in environmental documents have already, in a sense, addressed the issue of what is "new". However, the impacts of GHG emissions differ from those of criteria pollutants in that they are a function of global concentrations rather than local concentrations and, therefore, specific locations of where emissions occur is less important than for criteria pollutants. The calculation of "project" criteria pollutants (oxides of nitrogen, sulfur oxides, carbon monoxide, volatile organic compounds, lead, and particulate matter) in air quality emissions inventories for use in EIRs has a long history. The SCAQMD first published a comprehensive manual on the analysis of air quality impacts in 1993, and the Bay Area Air Quality Management District (BAAQMD)

followed in 1999. Other smaller districts have prepared detailed guidance documents that describe the methods that should be used to calculate emissions inventories for EIRs from projects, including residential and commercial projects.

The goal of estimating emissions of criteria pollutants from projects is to understand whether there are significant new emissions in California's air basins, which have a limited ability to absorb additional criteria pollutant emissions without adverse air quality impacts. A review of how air quality analyses typically address the issue of whether emissions are "new" is instructive as to how to address the emissions of GHGs. However, unlike with criteria pollutants, the impacts of GHG emissions are a function of their global concentrations, rather than local concentrations. Thus, the question of whether or not a project's GHG impacts are significant, both on a project basis and on a cumulative basis, must be asked based on global, rather than basin-wide, considerations.

When evaluating the air quality impacts for a new project, such as a residential development, the vehicular emissions associated with the residents as they work and shop within the basin are counted as new emissions in traditional air quality analyses, even if those new residents would have moved from another house in the same air basin. The typical rationale for this approach is that the new residential development represents growth in the basin. As a result, all emissions associated with its residents' vehicle travel should be counted as new emissions, even if this might lead to some over-counting of criteria pollutant emissions from the project.

World rankings of nations' GHG emissions generally depend on which gases are accounted for, and whether land use changes are considered. Without considering land use changes, in recent years, the US has been the top GHG-emitting country in the world. When all of the developing countries are grouped together, they contribute approximately 52% of the world-wide GHG emissions.[49]

To understand the global scale impact of GHGs, it is useful to understand that the increase of new GHG emissions globally is caused by economic and population growth. Emission growth rates are the highest among developing countries. While GHG emissions in developed countries were unchanged over the 1990-2002 period, emissions increased by 47% in developing countries during that same period. Emissions in China grew about 50% during that time period -- preliminary estimates show that China's GHG emissions increased 35% in 2003 and 2004 alone. This increase in developing country GHG emissions is due to the increasing demand for higher standards of living as a result of gross domestic product (GDP) growth, requiring more vehicles and greater electricity demand. Also, developing countries often lack the technology or capital to utilize energy efficient products or to construct cleaner burning power plants. GHG emissions in China are growing slightly faster than primary energy use as the fuel mix increasingly favors coal, a high-carbon fuel. China accounts for 39% of the projected increase

[49] Baumert, K.A., T. Herzog, J. Pershing. 2005. Navigating the Numbers: Greenhouse Gas Data and International Climate Policy. (http://www.wri.org/climate/pubs_description.cfm?pid=4093)

between 2004 and 2030, and will overtake the United States as the world's biggest emitter before 2010.[50]

In the developed world, GHG increases are directly tied to population growth. Therefore, it makes sense to consider operational emissions (including vehicular emissions) from new residences as growth, as residences are rarely removed from the housing supply once constructed. There are exceptions, such as when one housing development replaces another, and, in those cases, the replacement residential development need not be considered growth.

However, it is not clear that non-residential (i.e. office space, retail space, and industrial buildings) development should be considered new growth for vehicular travel purposes. To the extent that non-residential development serves existing residential development, its vehicular travel may not be new. For instance, if the new non-residential area serves an area with a high residential/ non-residential balance, then this new non-residential growth will reduce shopping and work trip lengths and will reduce GHG emissions associated with mobile sources. If, however, the new non-residential area results in longer trips for its workers and shoppers than they would have previously made, then it adds GHGs emissions. Non-residential development that could potentially increase vehicle-miles traveled (VMT) would be facilities that draw trips from far away that otherwise would not be made. A theme park, for example, may be viewed as such a development.

In this report, it is assumed that the new non-residential area serves an area with a high residential/ non-residential balance. Therefore, this new non-residential growth likely will reduce shopping and work trip lengths from existing residences, and can reduce GHG emissions associated with mobile sources.

The approach described above is different than that for criteria emissions. For criteria pollutants, if new emissions move into the basin, although there is a reduction in criteria emissions elsewhere, these emissions are new to the basin and therefore counted. For GHGs, if the emissions simply moved from one basin to another, the emissions would not be new on a global scale. To evaluate the sustainability of new non-residential developments, one must ask if the shoppers' and workers' travel distances to the new non-residential development are longer or shorter than the distances those same individuals currently travel to their non-residential areas.

To the extent that new non-residential development serves new residential development, much of the non-residential vehicle travel would already be counted in the evaluation of the new residential development. Although the vehicle trips would be already counted elsewhere, the operational emissions from heating and cooling the non-residential areas would be considered to be new, as there are new non-residential buildings that goes along with growth in residential areas.

[50] http://www.iea.org/textbase/weo/fact_sheets/fs_GlobalEnergyTrends.pdf (accessed June 12, 2007) World Energy Outlook 2006: Fact Sheet- Global Energy Trends the World's Energy Future: Where Are We Headed?

Accordingly, GHG emissions from VMT serving non-residential areas will only be counted if the non-residential areas contribute to greater VMT as a result of their locations. If the non-residential development lowers VMT, then it will be considered to have a zero or negative GHG contribution as a result of the fact that it has generated shorter operational vehicle trip lengths than would have otherwise occurred. It should be noted that as LCR is a mixed use community, this issue does not directly affect LCR VMT calculations; all VMT from LCR residents are calculated regardless of internal or external destinations or purpose of trip.

4.3 Units of measurement: Tonnes of CO_2 and CO_2e

The term “GHGs” includes gases that contribute to the natural greenhouse effect, such as CO_2, CH_4, N_2O, and water, 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. The most important greenhouse gas in human-induced global warming is CO_2. While many gases have much higher GWPs than CO_2, CO_2 is emitted in such vastly higher quantities that it accounts for 85% of the GWP of all GHGs emitted by the US.[51]

The effect each of these gases has on global warming is a combination of the volume of their emissions and their GWP. GWP indicates, on a pound 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 21 and 310, respectively. 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.

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.

In this report, "tonnes" will be used to refer to metric tonnes (1,000 kilograms). "Tons" will be used to refer to short tons (2,000 lbs).

Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

4.4 Resources

To estimate GHG emissions from LCR, ENVIRON directly or indirectly relied primarily on five different types of resources: emissions estimation guidance from government-sponsored organizations, government-commissioned studies of energy use patterns, energy surveys by other consulting firms, emissions estimation software, and building energy modeling software. These sources are described below.

[51] Inventory of US GHG Emissions and Sinks: 1990-2004, USEPA. Available online at: http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/RAMR6MBSC3/$File/06_Complete_Report.pdf

4.4.1 Emissions Estimation Guidance

This inventory was developed using guidance from two government-sponsored organizations to assist in the estimation of GHG emissions. The first is the CCAR, which was established by the California Legislature to assist willing parties in estimating and recording their GHG emissions to use as a baseline for meeting future emissions reduction requirements. Publications by the CCAR include not only recommendations on how to compile a GHG emissions inventory, but also relevant data on energy use and emissions that are utilized in this protocol. The second organization is the IPCC, which was established in 1988 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). The IPCC's main role is to assess information on climate change which is synthesized in IPCC reports, including methodology reports. These reports also include relevant emission factors and specific scientific data that can be used to estimate GHG activities from various activities.

4.4.2 Emissions and Energy Use Studies

For estimating emissions based on electrical and natural gas energy use, literature information on patterns of energy use must often be employed. Studies commissioned by the United States Energy Information Administration (EIA) and the California Energy Commission (CEC) provide data on energy use patterns associated with municipal activities, natural resource distribution, and other activities that will take place in LCR. These data were used to estimate energy use patterns which were applied to the specific characteristics of LCR to estimate GHG emissions. In addition to EIA and CEC studies, studies performed by individual municipalities or scientific organizations are also used in this report.

4.4.3 Emissions Estimation Software

The ARB, the SCAQMD, and other public and private organizations have developed several software programs to facilitate the calculation of emissions from construction, motor vehicles, and urban developments by streamlining emissions estimation from these sources. This inventory was developed using several models to estimate GHG emissions from the LCR development. These are the OFFROAD2007 model, the EMFAC model, the URBEMIS model, the Building America Research Benchmark Definition model, and the Micropas model. The features of each of these models are described below.

OFFROAD – OFFROAD2007 is the most recent version of a model developed by the ARB to estimate the activity and emissions of off-road mobile emissions sources, such as construction equipment. OFFROAD contains a database of default values for horsepower, load factor, and hours per day of operation and can calculate emission factors based on the type of equipment and year of use. OFFROAD2007 emission rates are incorporated into URBEMIS2007.

EMFAC – EMFAC, also developed by ARB, compiles real fleet data on the county-level for the state of California, including vehicle model year distributions, vehicle class (e.g., light-duty auto [LDA]), medium-duty truck [MDT], heavy-heavy-duty truck [HHDT]) distributions, and emission rate information to generate fleet-average emission factors for most criteria pollutants and CO_2. EMFAC2007 is the newest version of the program. Emission factors from EMFAC depend on the vehicle class, vehicle technology, speed, year of operation, average ambient air temperature, and relative humidity.

URBEMIS – The URBEMIS software was created by SCAQMD, although it is used by other air districts as well. It estimates emissions associated with different aspects of urban development. The Operational Data module in URBEMIS calculates emissions from mobile sources operating during the use of a development based on emission factors from EMFAC and traffic use information specific to a development. Mobile source emissions during the construction phase are calculated separately in the construction module of URBEMIS. URBEMIS provides county, air district / air basin, or state wide averages for number of daily trips per housing unit and per student at an elementary school in the absence of more specific information from traffic engineers. URBEMIS also provides air district-specific default values for vehicle fleet characteristics (vehicle class distribution and technology categories) and travel conditions (average trip length, trip speed, and relative frequency of each type of trip). URBEMIS (Version 9.2.4), uses EMFAC2007 emission factors and calculates CO_2 emissions using District-specific default parameters for various inputs including vehicle fleet characteristics and travel conditions. URBEMIS incorporates OFFROAD2007 emission rates for off-road mobile sources.

In addition to mobile source emissions, URBEMIS can also calculate emissions associated with the construction phase of a development and emissions from area sources, such as fireplaces, once the development is operational. The URBEMIS construction module enables separate emissions calculations from each of the typical stages of any construction project: demolition, site grading, and building construction[52]. Based on the timing of construction and size of the development, URBEMIS defaults can be used to estimate emissions. Alternatively, the user can override these defaults by entering specific information about the construction project, such as what types and numbers of equipment are going to be used. In terms of area sources, URBEMIS is equipped to estimate GHG emissions from three types of GHG-emitting area sources based either on program defaults or more specific project information inputted by the user. These uses are natural gas fuel combustion, hearth fuel combustion, and landscaping equipment.

BARBD was developed by the National Renewal Energy Laboratory (NREL) in consultation with home developers and builders within the Building America Program. This benchmark tool was developed to provide a means for tracking progress toward residential energy savings. The model includes a series of user profiles, intended to represent the behavior of a typical set of occupants. This benchmark is frequently updated, with the most recent benchmark model released December 18, 2008. This information was used to determine the energy use for appliances and plug in energy use in homes.

4.5 Summary of Source-Specific GHG Emissions Calculations

4.6 Indirect GHG Emissions from Electricity Use

As noted above, indirect GHG emissions are created as a result of electricity use. When electricity is used in a building, the electricity generation typically takes place offsite at the power

[52] Grading can be differentiated as Mass Site or Fine Site Grading. In addition to these typical phases, URBEMIS 9.2.4 includes the ability to calculated emissions from trenching, paving, and architectural coating phases. Software User's Guide: URBEMIS2007 for Windows. Version 9.2. Appendix A. Page A-1

plant; electricity use in a building generally causes emissions in an indirect manner. The LCR development is supplied with power by Southern California Edison (SCE). Accordingly, indirect GHG emissions from electricity usage are calculated using the SCE carbon-intensity factor of 631 lb CO_2e per megawatts per hour (MW/hr).[53] This emission factor takes into account the current mix of energy sources used to generate electricity for SCE and the relative carbon intensities of these sources.[54]

4.7 Vegetation Change

This section presents the calculation of the positive and negative GHG emissions associated with vegetation removal and re-vegetation at the LCR development. The permanent removal of existing vegetation can contribute to net GHG increases by reducing existing carbon sequestration capacity.[55] Areas that are temporarily disturbed but re-vegetated with the same vegetation type are assumed to have no net impact. Following completion of the LCR project, some areas will become re-vegetated with trees, shrubs and other vegetation. These areas could potentially sequester more CO_2 from the atmosphere than was sequestered pre-development. The difference between the total before-development sequestered CO_2 and the after-development sequestered CO_2 is the one-time CO_2 released from clearing the vegetation less the CO_2 sequestered by new plantings.[56] The overall CO_2 emissions due to vegetation change will result from two processes: 1) the change in the amount of CO_2 sequestered by vegetation, which would lead to a one-time GHG release, and 2) the amount that can be expected to be sequestered by new plantings. Both issues are discussed in this section.

In this section of this report, the units CO_2 and CO_2e are used interchangeably. CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from vegetation change.

4.7.1 Quantifying the One-Time Release by Changes in Carbon Sequestration Capacity

The one-time release of GHGs due to permanent changes in carbon sequestration capacity was calculated using the following four steps:[57]

1. Identify and quantify the change in area of various land types due to the development (i.e. alluvial scrub, non-native grassland, agricultural, etc.). These area changes include not

[53] CCAR Database. Southern California Edison Company PUP Report. 2007.

[54] When calculating indirect emissions due to electricity usage, it is important to consider that indirect emissions from using a given amount of electricity will vary with the fuel-mix used to produce electricity. For example, CO_2 emissions per kW-hr from a coal-fired power plant are significantly higher than CO_2 emissions per kW-hr from a natural gas-fired power plant. Therefore, to most accurately estimate GHG emissions from the LCR development, the carbon intensity of the specific mix of energy sources SCE uses to generate electricity was used to calculate emissions since SCE is the most likely source of electricity for LCR.

[55] In this section, it is assumed that all mature land-types (at least 20 years old) are at steady-state. See WRI "Land Use, Land-Use Change, and Forestry Guidance for GHG Project Accounting" protocol available online at: http://www.ghgprotocol.org/DocRoot/97hb6BCSAAG2bImO7c9d/LULUCF%20Final.pdf

[56] In this section we assume that mature ecosystems do not have a net influx or outflux of carbon.

[57] This section follows the IPCC guidelines, but has been adapted for ease of use for the LCR development.

only the area of land that will be converted to houses, but also areas disrupted by the construction of utility corridors, water tank sites, and associated borrow and grading areas. Areas temporarily disturbed that will eventually recover to become vegetated will not be counted as vegetation removed as there is no net change in vegetation or land use.[58]

2. Estimate the biomass associated with each land type. – For the purposes of this report, ENVIRON has listed the land types that are present at the LCR development site and characterized them using the available general vegetation types found in the IPCC publication Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines).[59] This characterization is shown in Table 4-1 on page 33. The general IPCC vegetation types are as follows:

   - Forest Land;
   - Grass Land;
   - Wetland;
   - Cropland and
   - Settlements.

   California vegetation is heavily dominated by scrub and chaparral vegetation which may not be accurately characterized by default forest or grass land properties. Consequently, ecological zones and biomass based subdivisions identified in the IPCC Guidelines were used to sub-categorize the vegetation as tree or scrub dominated. The biomass values for each vegetation type are based on these categories which relate the LCR vegetation to the IPCC vegetation types. Forest land, grass land and crop land categories and subcategories were used to determine the CO_2 emissions resulting from land use impacts at LCR.

3. Calculate CO_2 emissions from the net change of vegetation. – When vegetation is removed, it may undergo biodegradation,[60] or it may be combusted. Either pathway results in the carbon (C) present in the plants being combined with oxygen (O_2) to form CO_2. To estimate the mass of carbon present in the biomass, biomass weight is multiplied by the mass carbon fraction, 0.47.[61] The mass of carbon is multiplied by 3.67[62] to calculate the final mass of CO_2, assuming all of this carbon is converted into CO_2. The results of this calculation are shown in Table 4-2 on page 34 for each type of vegetation.

[58] This assumption facilitates the calculation as a yearly growth rate and CO_2 removal rate does not have to be calculated. As long as the disturbed land will indeed return to its original state, this assumption is valid for time periods over 20 years.

[59] Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm

[60] Cleared vegetation may also be deposited in a landfill or compost area, where some anaerobic degradation which will generate CH_4 may take place. However, for the purposes of this section, we are assuming that only aerobic biodegradation will take place which will result in CO_2 emissions only.

[61] The fraction of the biomass weight that is carbon. Here, a carbon fraction of 0.47 is used for all vegetation types from IPCC (2006), default forestland and agricultural land ratio. CCAR assumes a similar value of 0.5 in its Forest Selector Protocol.

[62] The ratio of the molecular mass of CO_2 to the molecular mass of carbon is 44/12 or 3.67.

4. Calculate the overall change in sequestered CO_2. – For all types of land that change from one type of land to another,[63] initial and final values of sequestered CO_2 are calculated using the equation below.

Overall Change in Sequestered CO_2 [tonne CO_2]

$$= \sum_i (SeqCO_2)_i \times (area)_i - \sum_j (SeqCO_2)_j \times (area)_j$$

Where:

$SeqCO_2$	=	mass of sequestered CO_2 per unit area [tonne CO_2/acre]
area	=	area of land for specific land use type [acre]
i	=	index for final land use type
j	=	index for initial land use type

Table 4-1 on page 33 shows the effective change in the amount of sequestered CO_2 due to the change in land use of the developed area for each land type. The total equivalent CO_2 emissions attributable to the net change of vegetation are approximately 19,400 tonnes.

4.7.2 Calculating CO_2 Sequestration by Trees

Planting individual trees on residential property and elsewhere in LCR will sequester CO_2. Changing vegetation as described above results in a one-time carbon-stock change. Planting trees is also considered to result in a one-time carbon-stock change. Table 4-3 on page 35 presents default annual CO_2 sequestration rates on a per tree basis, based on values provided by the IPCC. An average of 0.035 tonne CO_2 per year per tree can be assumed for trees planted, if the tree type is not known.

Urban trees are only net carbon sinks when they are actively growing. The IPCC assumes an active growing period of 20 years. Thereafter, the accumulation of carbon in biomass slows with age, and will be completely offset by losses from clipping, pruning, and occasional death. Actual active growing periods are subject to, among other things, species, climate regime, and planting density. In this report, the IPCC default value of 20 years will be assumed. Note that trees may also be replaced at the end of the 20-year cycle, which would result in additional years of carbon sequestration. However, this would be offset by the potential net release of carbon from the removal of the replaced tree.

Approximately 30,000 new net trees will be planted in LCR community.[64] Planting these trees in the community will sequester approximately 20,520 tonnes CO_2. This was calculated by using the sequestration rate of 0.032 tonne CO_2 per year per pine tree for LCR's 8,000 new pine trees, the average tree sequestration rate of 0.035 tonne CO_2 per year per tree for LCR's

[63] For example from forestland to grassland, or from cropland to permanently developed.

[64] Site-specific planting data provided by Lytle Development Company.

22,000 new trees of undefined type, and assuming 20 years of growth. This sequestration brings the net CO_2 emissions from vegetation to: 19,400 tonnes (land use changes) – 20,520 tonnes (30,000 net new trees in the community) = -1,120 tonnes (or a net decrease in the amount of CO_2 released. The net CO_2 emissions from vegetation changes are presented in Table 4-4 on page 36.

Table 4-1

CO_2 Sequestration Change due to Land Use Change

Lytle Creek Ranch
Rialto, California

Vegetation Type[1]	IPCC Designation[2]	IPCC Sub Qualification	Tons Dry Matter Carbon/Acre[3]	Sequestered CO_2/Acre[4]	Total Impacted Area[5]	CO_2 Sequestration Capacity of Removed Vegetation
			[tonne/acre]	[tonne/acre]	[acres]	[tonne]
Scrubland	Forest Land	Scrub	3.9	14.3	1,356.3	19,400
Grand Total			**3.9**	**14.3**	**1,356.3**	**19,400**

Notes:
1. Land types shown here represent vegetation that will be potentially removed upon development.
2. Land types are mapped to generalized IPCC Land Designations (IPCC 2006).
3. Dry matter carbon per acre was determined from information contained in Table 4-2 on page 34.
4. It is conservatively assumed that all carbon is eventually converted into CO2. Multiply the mass of carbon by 3.67 to calculate the final mass of CO2 (the molecular mass of CO2 / the molecular mass of carbon is 44/12 or 3.67).
5. Data provided by Lytle Development Company. A positive number indicates the amount of land removed and a negative number indicates that this land type is added.

Sources:
Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines). Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm
Lytle Creek Ranch Specific Plan, December 2008.

Table 4-2

Carbon per Acre for IPCC Land Types

Lytle Creek Ranch

Rialto, California

IPCC Designation	Sub qualification	Above Ground Biomass[1]	Ratio of Above Ground / Below Ground Biomass[2]	Total Biomass	Total Biomass[3]	Tonnes Dry Matter Carbon/Acre[4]
		[tonne d.m./acre]		[tonne d.m./Hectare]	[tonne d.m./acre]	[tonne/acre]
Forest Land	Scrub	5.7	2.17	20.5	8.3	3.9
Forest Land	Trees	52.6	4.35	159.9	64.7	30.4

Notes:

1. Numbers listed are used in conjunction with above ground/below ground ratios to calculate total biomass per acre. Values from source converted to tonne/acre.
2. This value is used to calculate total biomass when data for the total biomass is not available for a particular land type.
3. Total biomass is either 1.) Listed directly in the IPCC protocol, or 2.) Calculated from above ground biomass and the Above Ground / Below Ground biomass ratios as follows: Total
= Above + (Above / [Above:Below Ratio]). Values from source converted to tonne/acre as necessary.
4. Total biomass multiplied by carbon fraction in plant material (0.47) to calculate carbon content. From IPCC (2006), default value for Forest Land (Table 4.3 of IPCC).

Abbreviations:

d.m. - dry mass

Sources:

Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines). Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm

Table 4-3

CO_2 Sequestration Capacity of New Vegetation Plantings

Lytle Creek Ranch

Rialto, California

Vegetation Species[1]	IPCC Species Class Designation	Sequestered CO_2 / Unit[2]	Unit	Total Quantity of New Vegetation[1]	Unit	CO_2 Sequestration Capacity of New Vegetation[3]
		[tonne/unit/year]				[tonne]
Pine	Pine	0.032	trees	8,000	trees	5,120
Miscellaneous	Miscellaneous Trees	0.035	trees	22,000	trees	15,400
Total	-	-		**30,000**	**trees**	**20,520**

Notes:

1. Site-specific planting data provided by Lytle Development Company.
2. Species class-specific sequestration values are provided in Table 8.2 of "2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4". For species that do not appear in Table 8.2, the species was classified as "miscellaneous" and the average value of all listed data was used.
3. An active growing period of 20 years was assumed for the new trees planted. This analysis assumes that all trees will live for at least 20 years.

Sources:

Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines). Available online at http://www.ipcc- nggip.iges.or.jp/public/2006gl/vol4.htm

Table 4-4

Change in CO_2 Sequestration Due to Land Use Changes and New Vegetation Plantings

Lytle Creek Ranch

Rialto, California

CO_2 Sequestration Capacity of Vegetation	CO_2 Sequestration Capacity of New Vegetation	Net Change in CO_2 Sequestration Capacity[1]
[tonne]	[tonne]	[tonne]
-19,400	20,520	1,120

Notes:

1. A positive value represents an increase in sequestration capacity and thus a net reduction in CO_2.

4.8 Construction Activities

This section describes the estimation of GHG emissions from construction activities at LCR. There are three major construction phases for an urban development: demolition, site grading, and building construction. The building construction phase can be broken down into three subphases: building construction, architectural painting, and asphalt paving. GHG emissions from these construction phases are largely attributable to fuel use from construction equipment and worker commuting.

CO_2 emissions associated with different aspects of urban development can be estimated using a combination of software programs. The OFFROAD2007[65] and the EMFAC2007[66] models are used to generate emission factor data for construction equipment and motor vehicles, respectively. These values serve as inputs for the URBEMIS[67] model, which estimates emissions from several different aspects of urban development including from construction sources based on emission factors and information specific to the development.

In this section of this report, the units CO_2 and CO_2e are used interchangeably for diesel construction equipment because CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from construction equipment.[68] For worker commuting, CH_4 and N_2O are explicitly calculated and therefore CO_2 and CO_2e for worker commuting are not equal.

4.8.1 Estimating GHG Emissions from Construction Equipment

This section describes how emissions from off-road equipment used during demolition, grading, building construction, and paving are calculated. It was assumed that negligible GHG emissions are produced by architectural painting equipment. It is important to note that GHG calculations are intended to estimate long-term emissions, while air quality emission calculations are intended to estimate worst-case daily scenarios. As such, the methodology presented in this section of the report will be different than the approach described in the corresponding air quality section.

ENVIRON calculated emissions from demolition, grading, building construction, and paving using the URBEMIS methodology. ENVIRON was provided with the number and type of equipment that will be used in the construction of LCR, as well as the duration of the different construction phases.[69] ENVIRON assumed that each piece of equipment will operate for 8 hours a day, five days a week during a given phase duration. An equipment hour is defined as

[65] ARB Mobile Source Emissions Inventory Program. December 2006. http://www.arb.ca.gov/msei/offroad/offroad.htm

[66] Emission Factors (EMFAC2007) model (Version 2.3). November 2006. ARB. http://www.arb.ca.gov/msei/onroad/latest_version.htm

[67] Urban Emissions Model (URBEMIS) (Version 8.7 – 2002 / Version 9.2.4 – 2008). Jones & Stokes Associates. Prepared for: SCAQMD. http://www.urbemis.com

[68] The OFFROAD2007 model (Dec 15, 2006 version) includes emission rates for CH_4 based on a fraction of the total hydrocarbon emission rate. Emission factors for CH_4 represent on average 0.3% of greenhouse gas emissions (taking into account GWP), with a maximum of 1.1%

[69] Received in URBEMIS files provided by PCR Services Corporation on 6/5/2009.

one hour of a piece of equipment being used. Table 4-5 on page 43 contains specifications for each type of construction equipment (horsepower, load factor, and GHG emission factor) provided by OFFROAD2007[70] and describes the detailed GHG calculations. CO_2 emissions for each type of construction equipment were calculated as follows:

*Equipment Emissions [grams] = Total equipment-hours * emission factor [grams per brake horsepower-hour] * equipment horsepower * load factor*[71]

The contributions of CH_4 and N_2O to overall GHG emissions from diesel construction equipment[72] are small (< 1.1% of total CO_2e[73]) and were therefore not included in this calculation.

The total GHG emissions from all construction equipment is 139,370 tonnes CO_2.

4.8.2 GHG Emissions from Worker Commuting

Emissions from worker commuting are associated with workers involved in the demolition, site grading phase and all construction subphases (construction, paving, architectural coating). Emissions related to trips made by vendors were calculated separately (see Section 4.6.3). GHGs are emitted from worker vehicles in two ways: running emissions, produced by driving the vehicle, and startup emissions, produced by turning the vehicle on. The majority of worker commute emissions are running emissions. Table 4-6 on page 45 details emission calculations for worker commutes.

Running emissions were calculated using the same general method for the demolition, grading, building and paving phases. For the architectural coating phase, both running and starting emissions were assumed to equal 20% of construction phase emissions, which is the URBEMIS default value. Total running emissions from worker commuting during each phase were calculated by estimating the total VMT by construction workers, and then multiplying this value by the representative GHG emission factors for the vehicles they are expected to drive. The total VMT by construction workers for a given phase is calculated as follows:

VMT = Number of worker one-way trips x average one-way commute length

For the grading and paving phases, the number of worker roundtrips is equal to the number of worker-days. URBEMIS estimates that the worker-days needed for the demolition, grading, and

[70] OFFROAD2007 emission factors and documentation are available on-line: http://www.arb.ca.gov/msei/offroad/downloads/models/offroad2007_1215_exe.zip, http://www.arb.ca.gov/msei/offroad/pubs/offroad_overview.pdf

[71] Load factor is the percentage of the maximum horsepower rating at which the equipment normally operates.

[72] CCAR. 2008. *General Reporting Protocol*. Version 3.0. ENVIRON estimates these emissions to be less than 1% of total GHG contributions for diesel fueled equipment.

[73] The OFFROAD2007 model (Dec 15, 2006 version) includes emission rates for CH_4 based on a fraction of the total hydrocarbon emission rate. Emission factors for CH_4 represent on average 0.3% of greenhouse gas emissions (taking into account GWP), with a maximum of 1.1%

paving phases is equal to the number of equipment-days multiplied by 1.25. The length of the average one-way commute was assumed to be the URBEMIS default of 12.7 miles.

For the building construction phase, the number of worker trips was determined by the type and number of buildings being constructed. URBEMIS provides trip generation rates based on four general land use categories: multifamily, single-family, commercial/retail/school/recreation, and office/industrial. The total daily roundtrips are the sum of the following:

0.36 * number of multifamily units

0.72 * number of single-family units

0.32 * (commercial/retail/school/recreation square feet [sq ft])/1000

0.42 * (office/industrial sq ft)/1000

After total VMT for LCR is calculated, GHG emissions for this development can be calculated from the following equation:

$$CO_2 \text{ emissions} = VMT * [0.5 * EF_{LDA} + 0.25 * (EF_{LDT1} + EF_{LDT2})]$$

Where:

VMT = vehicle miles traveled

EF_{LDA} = emission factor of light duty autos

EF_{LDT1} = emission factor of light duty trucks: up to 6000 GVW

EF_{LDT2} = emission factor of light duty trucks: up to 8500 GVW

The CO_2 calculation involves the following assumptions:

- URBEMIS defaults assume that half of the workers commute with light duty trucks (LDTs) and half commute in LDAs.[74]
- Half of the LDTs were assumed to be type 1 and the other half type 2.
- The emission factor depends upon the speed of the vehicle. The URBEMIS default value of 30 miles per hour (mph) was used.
- EMFAC emission factors from the year 2009 were used for EF_{LDA}, EF_{LDT1}, and EF_{LDT2}. The running emission factors for 2016 and later years were adjusted to account for the impact of Pavley standards. According to ARB, CO_2e emissions from light-duty vehicles would be reduced by 11% relative to 2002 in 2016, and by 20% relative to 2002 in 2020.[75]

[74] Page A-9 of the URBEMIS user manual.

[75] ARB. 2008. Comparison of Greenhouse Gas Reductions for the US and Canada Under CAFE standards and ARB GHG Regulations an Enhanced Technical Assessment. February 25.

Startup emissions are CO_2 emitted from starting a vehicle. For construction workers during all phases, the startup emissions were calculated using the following assumptions:

- The number of round trips were equal to the number of worker days,
- The breakdown in vehicles was 50% LDA and 50% LDT,
- Two engine startups per day with a 12 hour wait before each startup.[76]

The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their GWPs.[77] To incorporate these additional GHGs into the calculations, the total GHG footprint was calculated by dividing the CO_2 emissions by 0.95.

Table 4-6 on page 45 summarizes the emission calculations for worker commutes. The total amount of GHG emissions from worker commuting during all phases is a one-time emission of 69,928 tonnes.

4.8.3 GHG Emissions from Vendor Trips

Similar to worker commuting trips, GHGs emitted from vendor vehicles trips are based on running and startup emissions. The number of daily vendor trips was based on the size and type of buildings specified and URBEMIS defaults, which are based on four general land use categories: multifamily, single-family, commercial/retail/school/recreation, and office/industrial. The total roundtrips are the sum of the following:

0.11 * number of multifamily units

0.11 * number of single-family units

0.05 * (commercial/retail/school/recreation sq ft)/1000

0.38 * (office/industrial sq ft)/1000

The total number of daily round trips is multiplied by the number of work days, one-way trip length (13.3 miles) and a factor of 2 to account for roundtrip to give the VMT. After total VMT for LCR is calculated, CO_2 emissions from mobile running for this development can be calculated from the following equation:

$$CO_2 \text{ emissions from mobile running} = VMT * EF_{HHD}$$

[76] The emission factor grows with the length of time the engine is off before each ignition. Consequently, use of a 12 hour wait between starts is a moderately conservative assumption for workers on an 8-hour shift schedule.

[77] USEPA. 2005. Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle. Office of Transportation and Air Quality. February.

Where:

VMT = vehicle miles traveled (based on 13.3 miles one-way trip distance)

EF_{HHD} = emission factor of heavy heavy-duty trucks

The CO_2 calculation involves the following assumptions:

- URBEMIS defaults assume that vendor trips use HHDTs.[78]
- The emission factor depends upon the speed of the vehicle. The URBEMIS default value of 30 mph was used.
- EMFAC emission factors from the year 2009 were used for EF_{HHD}.

Startup emissions are CO_2 emitted from starting a vehicle. Startup emissions for vendor trips were calculated using the following assumptions:

- The breakdown in vehicles was all HHDTs,
- Two engine startups per day with a 12 hour wait before each startup.[79]

The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their GWPs.[80] To incorporate these additional GHGs into the calculations, the total GHG footprint was calculated by dividing the CO_2 emissions by 0.95. The total amount of GHG emissions from vendor trips during building construction is a one-time emission of 48,232 tonnes of CO_2e as shown in Table 4-7 on page 47.

4.8.4 Demolition Hauling

Demolition hauling involves removing material from the site during demolition phases. URBEMIS assumes that each demolition hauling truck carries 20 cubic yards of material and travels 30 miles roundtrip. Based on URBEMIS defaults, it is estimated that there will be 372.0 demolition hauling trips for LCR. The number of roundtrips is multiplied by the roundtrip length to determine total VMT. After total VMT for the demolition hauling at LCR is calculated, CO_2 emissions from mobile running for this development can be calculated from the following equation:

$$CO_2 \text{ emissions from mobile running} = VMT * EF_{HHD}$$

[78] Page A-12 of the URBEMIS user manual.

[79] The emission factor grows with the length of time the engine is off before each ignition. Use of a 12 hour wait between starts is a moderately conservative assumption.

[80] USEPA. 2005. Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle. Office of Transportation and Air Quality. February.

Where:

VMT = vehicle miles traveled (based on 15 miles round trip distance)

EF_{HHD} = emission factor of heavy heavy-duty trucks

The CO_2 calculation involves the following assumptions:

- URBEMIS defaults assume that demolition hauling trips use HHDTs.[81]
- The emission factor depends upon the speed of the vehicle. The URBEMIS default value of 30 mph was used.
- EMFAC emission factors from the year 2009 were used for EF_{HHD}.

Startup emissions are CO_2 emitted from starting a vehicle. Startup emissions for demolition hauling trips were calculated using the following assumptions:

- The breakdown in vehicles was all heavy heavy-duty trucks,
- Two engine startups per day with a 12 hour wait before each startup.[82]

The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their GWPs.[83] To incorporate these additional GHGs into the calculations, the total GHG footprint was calculated by dividing the CO_2 emissions by 0.95. The total amount of GHG emissions from demolition hauling is a one-time emission of 22.4 tonnes of CO_2e as shown in Table 4-8 on page 49.

Table 4-9 on page 50 shows total one-time GHG emissions for construction, including off-road equipment, worker commuting, vendor trips, and demolition hauling to be 257,552 tonnes CO_2e for the LCR development.

4.8.5 Uncertainties in Construction GHG Emissions Calculations

ENVIRON was provided with the phase length and the number of each type of construction equipment used during construction of buildings.[84] The number of worker and vendor trips represent URBEMIS default values and settings. As such, these values are somewhat uncertain.

[81] Page A-12 of the URBEMIS user manual.

[82] The emission factor grows with the length of time the engine is off before each ignition. Use of a 12 hour wait between starts is a moderately conservative assumption.

[83] USEPA. 2005. Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle. Office of Transportation and Air Quality. February.

[84] Provided by PCR Services Corporation on 6/5/2009.

In addition, emissions were estimated assuming “worst day” conditions (i.e., maximum equipment usage) for the entire phase duration. As a result, the emissions presented here are very conservative.

Table 4-5
GHG Emissions from Construction Equipment
Lytle Creek Ranch
Rialto, California

Equipment	Total Number of Equipment[1]	Total equipment hours[2]	Horsepower[3]	Load factor[3]	Emission factor[3] (g/bhp-hr)	CO_2 emissions[4,5] (tonnes)
Scrapers	48	383,829	313	0.72	568.3	49,158
Aerial Lifts	8	91,474	60	0.46	568.3	1,435
Rubber Tired Loaders	11	95,537	164	0.54	568.3	4,808
Air Compressors	7	68,874	106	0.48	568.3	1,992
Water Trucks	17	141,977	189	0.5	568.3	7,625
Forklifts	16	188,000	145	0.3	568.3	4,648
Mixers	9	111,674	10	0.56	568.3	355
Pavers	2	23,486	100	0.62	568.3	828
Rollers	10	108,526	95	0.56	568.3	3,281
Rubber Tired Dozers	19	148,943	357	0.59	568.3	17,829
Graders	40	308,377	174	0.61	568.3	18,601
Paving equipment	10	108,526	104	0.53	568.3	3,400
Tractors/Loaders/Backhoes	35	330,331	108	0.55	568.3	11,151
Cranes	5	55,651	399	0.43	568.3	5,426
Generator sets	10	115,303	49	0.74	568.3	2,376
Welders	10	115,303	45	0.45	568.3	1,327
Other General Industrial Equipment	6	63,846	238	0.51	568.3	4,404
Concrete Industrial Saws	5	64,703	10	0.73	568.3	268
Skid Steer Loaders	2	33,383	44	0.55	568.3	459
Total						**139,370**

Notes:
1. The lists of equipment during construction were provided by PCR Services as URBEMIS input files.
2. The equipment-hour of individual equipment is calculated based on the phase duration. ENVIRON assumes that all equipment operate 8 hours a day and five days a week during the corresponding phases duration indicated in the URBEMIS input files.
3. The values of Horsepower, Load Factor, and Emission Factor of each type of equipment are from URBEMIS and OFFROADS2007 defaults.
4. The CO_2 Emission calculation formula for each piece of equipment is:
CO_2 Emission = Equipment Hours x HP x Load Factor x Emission Factor x Unit Conversion Factor
5. Assume CO_2 = CO_2e because the contribution of CH_4 and N_2O to overall GHG emissions is likely small (< 1% of total CO_2e) from diesel construction equipment.

Table 4-5
GHG Emissions from Construction Equipment
Lytle Creek Ranch
Rialto, California

Abbreviations:
bhp - break horsepower
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
hr - hour

Table 4-6
GHG Emissions from Worker Commuting
Lytle Creek Ranch
Rialto, California

Year	Number of Worker One-Way Trips[1]	Total Worker VMT[2]	$EF^{3,7}_{LDA}$		$EF_{LDT1}^{4,7}$		$EF_{LDT2}^{4,7}$		Emission factor		CO_2 emissions[5]		Total CO_2 Emissions[6]	Total CO_2e Emissions[6]
			Running	Startup	Running	Startup	Running	Startup	Running	Startup	Running	Startup		
		miles/year	(g/mile)	(g/trip)	(g/mile)	(g/trip)	(g/mile)	(g/trip)	(g/mile)	(g/start)	tonnes			
2009	152,598	1,937,995	342	210	421	247	424	259	382	232	741	35	776	817
2010	662,908	8,418,929	342	210	421	247	424	259	382	232	3,217	154	3,370	3,548
2011	805,063	10,224,306	342	210	421	247	424	259	382	232	3,907	186	4,093	4,309
2012	1,507,134	19,140,599	342	210	421	247	424	259	382	232	7,314	349	7,663	8,066
2013	1,627,697	20,671,755	342	210	421	247	424	259	382	232	7,899	377	8,276	8,711
2014	1,627,697	20,671,755	342	210	421	247	424	259	382	232	7,899	377	8,276	8,711
2015	1,548,952	19,671,693	342	210	421	247	424	259	382	232	7,517	359	7,875	8,290
2016	1,395,921	17,728,203	304	210	375	247	378	259	340	232	6,029	323	6,352	6,687
2017	1,387,856	17,625,772	304	210	375	247	378	259	340	232	5,994	321	6,315	6,648
2018	1,267,030	16,091,277	304	210	375	247	378	259	340	232	5,472	293	5,766	6,069
2019	1,104,807	14,031,049	304	210	375	247	378	259	340	232	4,772	256	5,027	5,292
2020	419,303	5,325,150	273	210	337	247	339	259	306	232	1,628	97	1,725	1,816
2021	135,584	1,721,913	273	210	337	247	339	259	306	232	526	31	558	587
2022	0	0	273	210	337	247	339	259	306	232	0	0	0	0
2023	0	0	273	210	337	247	339	259	306	232	0	0	0	0
2024	38,884	493,821	273	210	337	247	339	259	306	232	151	9	160	168
2025	48,347	614,006	273	210	337	247	339	259	306	232	188	11	199	209
Total	**13,729,781**	**174,368,222**									**63,252**	**3,180**	**66,432**	**69,928**

Notes:

1. Worker trips were calculated for all Demolition, Grading and Paving phases as follows:
a. Operation hours for each piece of machine = 8 hr per day
b. Number of working days for each type of equipment = total hours of operation / 8hr per day
c. One-way trips per worker per working day = 2
d. Worker One-way Trips = Number of working days x 1.25
Worker one-way trips during the building construction phase are calculated based on four general land use categories: multifamily, single-family, commercial/retail/school/recreation and office/industrial. The total daily trips are the sum of the following:
i. 0.36* # multifamily units
ii. 0.72 * # single-family units
iii. 0.32 *(commercial/retail/school/recreation square ft)/1000 iv. 0.42 * (office/industrial square ft)/1000
Worker one-way trips for Coating phase are 20% of the worker one-way trips for Building Construction Phase.
2. Vehicle Miles Traveled = Worker One-way Trips x 12.7 miles per one-way trip, based on URBEMIS default.
3. The running emission factor depends on the speed of the vehicle. The emission factor used in this calculation refers to the URBEMIS 9.2.4 default vehicle speed: 30 mph.
The startup emission factor depends on the settling period before driving. The startup emissions were conservatively calculated based on a 12 hour wait before each engine startup.
4. LDT1: up to 6000 GVW; LDT2: up to 8500 GVW

Table 4-6
GHG Emissions from Worker Commuting
Lytle Creek Ranch
Rialto, California

5. GHG Running Emission calculation formula: GHG Emission = VMT x (0.5 x EF_{LDA} + 0.25 x EF_{LDT1} + 0.25 x $EF_{LDT2})_{Running}$ GHG Startup Emission calculation formula: GHG Emission = Worker Trips x (0.5 x EF_{LDA} + 0.25 x EF_{LDT1} + 0.25 x $EF_{LDT2})_{Startup}$ URBEMIS 9.2.4 assumes that LDA and LDT have a 50:50 mixing ratio.
6. CO_2e = CO_2 / 0.95: The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their global warming potentials.
7. The running emission factor values have been adjusted to account for reductions resulting from the Pavley standards. No changes to the starting emission factors were made. According to ARB, CO2e emissions from light-duty vehicles would be reduced by 11% relative to 2002 in 2016, and by 20% relative to 2002 in 2020. For this analysis, reductions were taken relative to estimated emissions for 2009 instead of 2002, which provides a conservative estimate. ENVIRON also conservatively assumed that no reductions would take place from 2009 through 2015, and that no changes in emission factors would occur between 2016 and 2019

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
EF - Emission Factor
GVW - Gross Vehicle Weight
HFC - hydro fluorocarbons
hr - hour
LDA - Light Duty Auto
LDT - Light Duty Truck
MPH: miles per hour
N_2O: nitrous oxide
URBEMIS - Urban Emissions Model
VMT - Vehicle Miles Traveled

Table 4-7
GHG Emissions from Vendor Trips
Lytle Creek Ranch
Rialto, California

Construction sub-phase	# Vendor trips	Total vendor VMT	EF^3_{HHD}		CO_2 Emissions[4]		Total CO_2 Emissions	Total CO_2e Emissions[5,6]
		miles/year	Running	Startup	Running	Startup		
			(g/mile)	(g/trip)	tonnes			
Building construction	1,803,168	23,982,140	1,905	75	45,686	135	45,821	48,232

Notes:
1. Vendor trips only occur during the building construction phase, and they are calculated based on four general land use categories: multifamily, single- family, commercial/retail/school/recreation and office/industrial. The total daily trips are the sum of the following:
i. 0.11* # multifamily units
ii. 0.11 * # single-family units
iii. 0.05 *(commercial/retail/school/recreation square ft)/1000
iv. 0.38 * (office/industrial square ft)/1000
2. Vehicle Miles Traveled = Vendor One-way Trips x 13.3 miles per one-way trip, based on URBEMIS default.
3. The running emission factor depends on the speed of the vehicle. The emission factor used in this calculation refers to the URBEMIS 9.2.4 default vehicle speed: 30 MPH.
The startup emission factor depends on the settling period before driving. The startup emissions are conservatively calculated based on a 12 hour wait before each engine startup.
4. URBEMIS 9.2.4 assumes that all vendors drive heavy-heavy-duty trucks.
CO_2 Running Emission calculation formula: CO_2 Emission = VMT x $EF_{HHD\text{-}Running}$
CO_2 Startup Emission calculation formula: CO_2 Emission = Vendor Trips x $EF_{HHD\text{-}Startup}$
5. CO_{2e} = CO_2 / 0.95: The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their global warming potentials.
6. The emission factor values of 2009, the anticipated start date of the project, are used for all calculations.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
EF - Emission Factor
GVW - Gross Vehicle Weight
HFC - Hydrofluorocarbons
HHD - Heavy-Heavy Duty

Table 4-7
GHG Emissions from Vendor Trips
Lytle Creek Ranch
Rialto, California

hr - hour
MPH - Miles Per Hour
N_2O - nitrogen dioxide
URBEMIS - Urban Emissions Model
VMT - Vehicle Miles Traveled

Table 4-8
GHG Emissions from Demolition Hauling Trips
Lytle Creek Ranch
Rialto, California

Construction sub-phase	Demolition Hauling Round Trips[1]	VMT[2]	EF^{3}_{HHD}		CO_2 Emissions[4]		Total CO_2 Emissions	Total CO_2e Emissions[5,6]
			Running	Startup	Running	Startup		
		(miles)	(g/mile)	(g/trip)	tonnes			
Demolition	372	11,160	1,905	75	21	0	21	22

Notes:
1. Demolition hauling trips only occur during the demolition phase, and they are calculated based on URBEMIS defaults which assume a 20 cubic yard truck driving 30 miles round trip per day. URBEMIS estimates 12 round trips per day for this phase.
2. Vehicle Miles Traveled = Demolition Hauling Trips x 30 miles per roundtrip.
3. The running emission factor depends on the speed of the vehicle. The emission factor used in this calculation refers to the URBEMIS 9.2.4 default vehicle speed: 30 MPH.
The startup emission factor depends on the settling period before driving. The startup emissions are conservatively calculated based on a 12 hour wait before each engine startup.
4. URBEMIS 9.2.4 assumes that all demolition haulers drive heavy-heavy-duty trucks.
CO_2 Running Emission calculation formula: CO_2 Emission = VMT x $EF_{HHD\text{-}Running}$
CO_2 Startup Emission calculation formula: CO_2 Emission = Demolition Hauler Trips x $EF_{HHD\text{-}Startup}$
5. $CO_{2e} = CO_2 / 0.95$: The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their global warming potentials.
6. The emission factor values of 2009, the anticipated start date of the project, are used for all calculations.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
EF - Emission Factor
GVW - Gross Vehicle Weight
HFC - Hydro Fluorocarbons
HHD - Heavy-Heavy Duty
hr - hour
MPH - Miles per hour
N_2O - nitrogen dioxide
URBEMIS - Urban Emissions model
VMT - Vehicle Miles Traveled

Table 4-9
Overall Construction GHG Emissions
Lytle Creek Ranch
Rialto, California

Location	Construction Equipment	Worker Commuting	Vendor Commuting	Demolition Hauling	Total GHG Emissions
	(tonnes CO_2e)				
Lytle Creek	139,370	69,928	48,232	22	257,552

Notes:
1. See previous tables for calculation detail. The table includes emissions from construction equipment, worker commuting, vendor commuting, and demolition hauling.

Abbreviations:
CO_2e - carbon dioxide equivalent
GHG - Greenhouse Gas

4.9 GHG Emissions Associated with Residential Buildings

Residential buildings include single-family homes of various sizes, attached homes, apartments, and condominiums. This section describes the methods used to estimate the GHGs associated with activities in those buildings.

The amount of energy—and, therefore, the amount of associated GHG emissions emitted per dwelling unit (DU)—will vary with the type of residential building. Accordingly, information on the types of residential buildings that are planned for LCR is required to estimate GHG emissions. Lytle Development Company provided data summarizing the main residential building categories for LCR. The major types of residential buildings are:

- Single-family detached;
- Single-family attached homes; and
- Multi-family attached units.

GHGs are emitted as a result of activities in residential buildings when electricity and natural gas are used as energy sources. Combustion of any type of fuel emits CO_2 and other GHGs directly into the atmosphere; when this occurs in a residential building, it is a direct emission source[85] associated with that building. GHGs are also emitted during the generation of electricity from fossil fuels. When electricity is used in a residential building, the electricity generation typically takes place offsite at the power plant; electricity use in a residential building generally causes emissions in an indirect manner.

While fuel combustion generates CH_4 and N_2O, the emissions of these GHGs typically comprise less than 1% of CO_2e emissions from electricity generation and natural gas consumption.[86] Fuel oil, kerosene, liquefied petroleum gas, and wood can also be used as fuels, but will likely contribute only in small amounts as combustion sources within residential buildings. Wood burning hearths are addressed in the area sources section of this report.

Energy use in residential buildings is divided into (1) energy consumed by the built environment, and (2) energy consumed by uses that are independent of the construction of the building, such as plug-in appliances. In California, Title 24 governs energy consumed by the built environment, including the heating, ventilation and air conditioning (HVAC) system, water heating, and some fixed lighting. Non-building or 'plug-in' energy use can be further subdivided by specific end-uses (refrigeration, cooking, lighting, etc.). Energy use for each was calculated separately, as described in the following sections. The resulting energy use quantities were then converted to GHG emissions by multiplying by the appropriate emission factors, incorporating information on local electricity production.[87] As discussed in Sections 3.3.6 and 3.3.7, California's RPS requires

[85] CCAR GRP, Version 3.0 (April). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_V3_April2008_FINAL.pdf , Chapter 8

[86] Ibid. Tables C1 and C2. The methane and nitrous oxide emission factors are negligible compared to the total CO_2 emission factor for electricity generation in California.

[87] The Southern California Edison specific emission factor for electricity deliveries is 641 lbs CO_2/MWhr. From the CCAR Database: SCE 2006 PUP Report. 2008. Although this emission factor accounts for only CO_2, the emissions

retail suppliers of electric services to increase procurement from eligible renewable energy resources until they reach 20% by 2010. California Executive Order S-14-08 mandates a further increase in procurement from eligible renewable energy resources to 33% by 2020. Although the project will be operational in 2030, ENVIRON conservatively assumed that 20% of the electricity would be from renewable resources, consistent with the currently enacted law. The resulting reduction in the emission factor for SCE was calculated and applied to these calculations, as will be discussed in Section 4.9.5. The emission reductions that would result from a RPS of 33% were California Executive Order S-14-08 to become law were also calculated for illustrative purposes.

In this section, the units CO_2 and CO_2e are used interchangeably for residential buildings because CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from residential buildings.

4.9.1 Estimate of Residential Energy Use Intensity

ENVIRON developed CO_2 intensity values (i.e., CO_2 emissions per DU per year) for the residential building types found in LCR using the Energy Information Administration's 2005 Residential Energy Consumption Survey (RECS) database[88] and estimation methods presented in the DOE technical report entitled, 'Building America Research Benchmark Definition'.[89] Three building types representative of the planned residences at LCR were evaluated: single-family detached houses, single-family attached homes, and units in multi-family apartment buildings (with five or more units). The methods that were used and the assumptions that were made in estimating energy use are described below.

4.9.2 Energy Use in the Built Environment

New Californian homes must be designed to meet building Energy Efficiency Standards (Title 24). Compliance with Title 24 is determined from the total daily valuation (TDV) of energy use in the built-environment (on a per square foot per year basis). The regulated energy uses include space heating and cooling, domestic hot water heating, and hard-wired lighting. TDV energy use is a parameter that reflects the burden that a building imposes on an electricity supply system. In general, there is a larger electricity demand and, hence, higher stress on the supply system during the day (peak times) than at night (off peak). To account for this variation, the calculation of TDV assigns different weights for energy used at different times. For example, a building that uses a given amount of electricity during the peak mid-day period will have a higher TDV value than a building using an equivalent amount of electricity during off-peak hours. Title 24 determines compliance by comparing the energy use of a modeled (or 'proposed') home to a minimally Title 24 compliant 'standard home' of equal dimensions. Title 24 focuses on building

associated with N_2O and CH_4 contribute to less than 1% of the electricity generation CO_2e emissions. Available at: https://www.climateregistry.org/CARROT/public/Reports.aspx

[88] US EIA. Public Use Microdata. http://www.eia.doe.gov/emeu/recs/contents.html. Accessed June 16, 2009.

[89] Robert Hendron. "Building America Research Benchmark Definition, Updated December 20, 2007". National Renewable Energy Laboratory Technical Report. NREL/TP-550-42662. January 2008. Available at: http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/42662.pdf

energy efficiency per square foot; it places no limits upon the size of the house or the actual energy used per DU.

The 2005 Energy Information Administration's RECS database was used to determine annual energy use for Title 24-regulated uses (space heating, space cooling, and domestic hot water systems). Estimates for hard-wired lighting will be discussed later in this section. Energy use estimates for this analysis are based on RECS data that was filtered by state, square footage, and dwelling type. However, it is important to note that the RECS dataset is comprised of mostly older buildings, which are typically less energy efficient (on a per square foot basis) than newer buildings constructed to meet increasingly stricter efficiency standards. Although many of the homes in the RECS database are likely less energy efficient than Title 24-compliant buildings, the energy use estimates were used to represent 2001 Title-24 compliant homes. The Title 24 standards have been updated twice (in 2005 and 2008) since the RECS study, and CEC has published reports estimating the percentage deductions in energy use resulting from these new standards.[90,91] Because buildings at Lytle Creek Ranch would conform to the most updated (and most stringent) standards, ENVIRON accounted for the impact of the Title 24 updates by deducting the estimated percentage savings from the RECS energy use estimates.

The RECs database analysis provides annual electricity use for the heating and cooling system and annual natural gas usage for both the heating and domestic hot water (DHW) systems per building. HVAC electricity use and natural gas use values are presented in Table 4-10 on page 58. Built-in lighting covered by Title 24 was calculated using values from BARBD for hard-wired lighting (as shown in Table 4-12 on page 62).

Title 24 compliant electricity use (i.e. the sum of heating, cooling and hard-wired lighting electricity use presented in Table 4-12 on page 62) on a per DU basis is 3,564 kWh per year for single family detached homes, 2,583 kilowatt hour (kWh) per year for single-family attached homes, and 2,825 kWh per year for multi-family units. Natural gas use for Title 24 uses in Title 24 compliant residences on a per DU basis is 41 million British Thermal Unit (MMBTU) per year for single family detached homes, 18 MMBTU per year for single-family attached homes, and 17 MMBTU per year for multi-family units.

Lytle Development Company has committed to making all new homes 15% more energy efficient than 2008 Energy Efficiency Standards requirements, i.e., 15% more energy efficient on a TDV basis. Although ENVIRON is aware that annual energy and TDV energy do not necessarily scale linearly with each other, ENVIRON assumed that all sources covered by Energy Efficiency Standards would uniformly use 15% less annual energy. These calculations are shown in Table 4-10 on page 58. For each type of home, the Energy Efficiency Standards compliant energy use was calculated with RECS database and BARBD as described above.

---

[90] CEC. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF

[91] CEC. 2007. Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PD F

These energy use numbers were then each multiplied by 0.85 to account for Lytle Development Company's commitment to a 15% energy efficiency improvement over 2008 Energy Efficiency Standards. This improvement over 2008 Energy Efficiency Standards reduces the electricity use to 924 kWh per year for single-family detached homes, 821 kWh per year for single-family attached homes, and 1,052 kWh per year for multi-family units. For natural gas, this improvement over 2008 Energy Efficiency Standards reduces usage on a per DU basis to 37 MMBTU per year for single-family detached homes, 16 MMBTU per year for single-family attached homes, and 16 MMBTU per year for multi-family units. Because Energy Efficiency Standards do not address the plug-in energy use, the improvement over Energy Efficiency Standards was not applied to appliances and plug-in lighting. The calculations for major appliances and plug-in energy use are discussed in the next sections.

4.9.3 Building America Research Benchmark Definition – Major Appliances

Major household appliances such as refrigerators, clothes washers and dryers, dishwashers, and cooking ranges are typically provided with a new residential unit; as a result, the developer has influence on the energy performance of these items. The energy use for these major appliances was estimated using guidance from the BARBD. This technical manual presents empirical equations for electricity usage derived using data from the 2001 RECS. The electricity usage of the major appliances was estimated using equations based on the number of bedrooms per DU. The exception is refrigerator energy use, which was set to one value for all residence types, because it was assumed not to be influenced by the floor area or number of bedrooms of the DU. For dryers and cooking ranges, which can be either gas or electric, it is assumed that 50% of the houses will use electric and 50% will use natural gas appliances. Therefore, values provided represent 50% of natural gas usage for natural gas models, and 50% electricity usage for both electric and natural gas (if applicable) models.

Table 4-11 on page 60 summarizes the estimated major appliance energy use for the three residential types. The annual electricity use of major appliances is 1,889 kWh per year for single family detached homes, 1,690 kWh for single-family attached homes, and 1,560 kWh per year for multi-family units. In addition the annual natural gas use of major appliances is 5.6 MMBTU per year for single family detached homes, 4.7 MMBTU per year for single-family attached homes, and 4.1 MMBTU per year for multi-family units

Lytle Development Company has committed to requiring Energy Star appliances for all major appliances rated by Energy Star in newly built residences when the builder supplies appliances with the new home. This includes refrigerators, dishwashers, and clothes washers. There is no Energy Star rating for dryers at this time since there is no considerable difference in energy use between different dryer models. Energy Star ratings also are not available for cooking ranges. The average energy improvement for Energy Star rated appliances over standard appliances as reported in Energy Star Annual Report was used to determine the percent reduction in energy use from major appliances.

Table 4-12 on page 62 shows the calculations for the improvement in energy use from Lytle Development Company's commitment to a 15% improvement over 2008 Energy Efficiency Standards and their commitment to requiring Energy Star major appliances where available.

This results in a 12% reduction in electricity use from Energy Star and an average combined electricity savings of 16.60%.

4.9.4 Building America Research Benchmark Definition - Plug-in Energy Use

Additional energy use from loads such as plug-in lighting, office equipment, plug-in cooking equipment, and electronics are also part of the anticipated energy use for a residential development. Similar to the major appliances above, energy use values for plug-in appliances, lighting and miscellaneous energy loads (MELs) were estimated using guidance from the BARBD.[92] Plug-in lighting energy use was estimated based on the finished floor area, whereas the electricity usage for miscellaneous energy loads (e.g. home entertainment devices, computers, and small kitchen appliances) were determined by equations involving the number of bedrooms, finished floor area, and a California-specific load multiplication factor.

Table 4-11 on page 60 summarizes the estimated plug-in energy use for each residence type. The annual electricity use for plug-in appliances, lighting, and miscellaneous energy loads (on a per-dwelling-unit per year basis) is 3,015 kWh for single family detached homes, 2,461 kWh for single-family attached homes, and 2,296 kWh for multi-family units. Table 4-10 on page 58 summarizes the combined energy use including the Title 24 systems, major appliances, and plug-ins. It should be noted that the residential plug-in energy-use values presented here are likely overestimates. The estimates are based upon currently available technologies, which are likely less energy-efficient than future equipment models. If future LCR residents install Energy Star appliances, use more energy-efficient equipment, and replace incandescent lights with fluorescent lights, the actual electricity use for plug-ins will be lower than is estimated here. Conversely, future residents may have more small plug-ins (e.g. MP3 players, cell phones, miscellaneous equipment) that could somewhat offset the savings from more energy-efficient equipment. However, because refrigerators, lighting, and large appliances contribute to the bulk of the electricity load, and these types of equipment will likely improve in energy efficiency in the future, the estimates presented here are still likely overly conservative.

4.9.5 Estimation of Annual Greenhouse Gas Emissions from Residential Buildings

Energy use data from Table 4-12 on page 62 were multiplied by the emission factors presented in Table 4-13 on page 64 to generate CO_2 intensity values (i.e., CO_2 emissions per DU) for each building type. Emission factors taking into account reductions from a 20% Renewable Portfolio Standard were used. The builder has control over energy use for the built environment and the initial major appliances. As shown in Table 4-14 on page 66, the homes that are 15% more energy efficient than 2008 Energy Efficiency Standards have lower CO_2 emissions. When combined with Energy Star appliances, as shown in Table 4-14 on page 66, the single-family detached homes, single-family attached homes, and multifamily units emit 16% less CO_2 per year than standard homes for the built environment and major appliances. As shown in Table 4-14 on page 66, when plug-in loads are considered, the single-family detached homes, single-

[92] Robert Hendron. "Building America Research Benchmark Definition, Updated December 20, 2007". National Renewable Energy Laboratory Technical Report. NREL/TP-550-42662. January 2008. Available at: http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/42662.pdf

family attached homes and multifamily units emit 18%, 18% and 18% less CO_2 per year, respectively, than the Energy Efficiency Standards compliant homes without energy star appliances. [Note: Table 4-15 on page 68 shows the reductions in CO_2 intensity that would be achieved if the 33% RPS for 2020 described in California Executive Order S-14-08 were implemented.]

Table 4-16 on page 70 shows the yearly CO_2 emissions from LCR by incorporating the aforementioned emission factors from Table 4-14 on page 66 and the number of DUs for each building type for Title 24 systems. Total CO_2 emissions from Title 24 systems would be 17,576 tonnes per year without improvements over 2008 Title 24 standards. Specifically, the single family detached homes (3,409 DUs) would emit 9,904 tonnes per year, single-family attached homes (3,673 DUs) would emit 5,575 tonnes per year, and the multi-family units (1,325 DUs) would emit 2,097 tonnes per year. With 15% improvements over 2008 Energy Efficiency Standards the annual CO_2 emissions would be reduced to 8,210 tonnes (2.4 tonnes per unit) for single-family detached homes, 4,579 tonnes (1.2 tonnes per unit) for single-family attached homes, and 1,719 tonnes (1.3 tonnes per unit) for multi-family units. The total emissions in this scenario would be 14,508 tonnes per year, which represents a 17% reduction in GHG emissions.

Table 4-16 on page 70 shows the combined yearly CO_2 emissions from Title 24 systems and major appliances for each building type. Total CO_2 emissions would be 23,995 tonnes per year without improvements over 2008 Title 24 standards and with standard major appliances Specifically, the single family detached homes (3,409 DUs) would emit 12,758 tonnes per year, the single-family attached homes (3,673 DUs) would emit 8,262 tonnes per year, and the multi-family units (1,325 DUs) would emit 2,975 tonnes. With 15% improvements over 2008 Energy Efficiency Standards and Energy Star appliances, annual CO_2 emissions would be reduced to 10,721 tonnes (3.1 tonnes per unit) for single family detached homes, 6,933 tonnes (1.9 tonnes per unit) for single-family attached homes, and 2,485 tonnes per year (1.9 tonnes per unit) for multi-family units. The total emissions in this scenario would be 20,138 tonnes per year, which represents a 16% reduction in GHG emissions.

Table 4-16 on page 70 shows the yearly CO_2 emissions from LCR by incorporating the aforementioned emission factors and the number of DUs for each building type for Title 24 systems and all plug-in energy. [Note: Table 4-17 on page 72 shows the CO_2 emissions from residential energy taking into account the 33% RPS for 2020 described in California Executive Order S-14-08.] Total CO_2 emissions would be 28,397 tonnes per year without improvements over 2008 Energy Efficiency Standards and with standard major appliances. Specifically, the single-family detached homes (3,409 DUs) would emit 13,856 tonnes per year, the single-family attached homes (3,673 DUs) would emit 9,073 tonnes per year, and the multi-family units (1,325 DUs) would emit 3,254 tonnes. With 15% improvements over 2008 Energy Efficiency Standards, Energy Star appliances, annual CO_2 emissions would be reduced to 11,394 tonnes (3.3 tonnes per unit) for single family detached homes, 7,468 tonnes (2.0 tonnes per unit) for single-family attached homes, and 2,667 tonnes per year (2.0 tonnes per unit) for multi-family units. The total emissions in this scenario would be 21,530 tonnes per year, which represents a 23% reduction in GHG emissions.

The above estimates for CO_2 emissions from the residential buildings do not take into account the State of California's requirement for builders to offer solar panels as an option to homeowners. It is unknown how many future homeowners will chose this option, therefore, while the exact reduction in CO_2 emissions due to this project design feature cannot be quantified, ones that do choose this option will decrease the CO_2 emissions for those residential buildings that choose to install renewable energy.

4.9.6 Uncertainties in Residential Building GHG Calculations

Several factors lead to uncertainties in the above analysis. As described below, it is believed that these uncertainties result in conservative estimates of the GHG emissions for the residential buildings at LCR.

Energy use will vary considerably depending upon the design of the home. The residential units to be built in LCR will vary considerably in size, layout, and overall design. Energy use estimates for a given dwelling type were calculated using RECS data for a range of dwelling sizes centered on the average square footage of each dwelling type.

Built environment energy use will vary considerably depending upon the home owners' habits regarding energy use. For instance, homeowners determine the set point of thermostats, the duration of showers, and the usage of air conditioning, among other things. Lytle Development Company will have little, if any, influence over these choices made by the homeowner. Current median behavior attributes were assumed for this report. To the extent that individuals are becoming more energy conscious, this will tend to overestimate energy use in the future.

Plug-in energy use will also vary considerably depending upon the appliances, lights, and other plug-ins installed by the homeowner. Lytle Development Company will have little, if any, influence over these choices made by the homeowner. As above, the current median behavior attributes are represented here. To the extent that individuals are becoming more energy conscious, or appliances are becoming more energy efficient, the estimates provided here will tend to overestimate energy use in the future.

Table 4-10
Energy Use per Residential Dwelling Unit: Title-24 Regulated Heating and Cooling
Lytle Creek Ranch
Rialto, California

Electricity Delivered (kW-hr/DU/year)									Natural Gas Delivered (MMBTU/DU/yr)							
Type	**Average Square Footage per DU[1]**	**RECs range[2]**	**Heat-ing[3]**	**Cooling**	**RECs Total**	**% reduction due to 2005 standards relative to 2001[4,5]**	**2005 Estimated Total**	**% reduction due to 2008 vs. 2005 standards[6]**	**2008 Estimated Total**	**Heating[3]**	**Domestic Hot Water[7]**	**RECs total**	**% reduction due to 2005 standards relative to 2001[4]**	**2005 Estimated Total**	**% reduction due to 2008 vs. 2005 standards[6]**	**2008 Estimated Total**
Single-family detached	2,585	1,350 - 3,450	188	1,303	1,491	19.8%	1,196	22.7%	924	13.3	30.7	44.1	6.7%	41.1	10%	37.0
Single-family attached	1,260	700 - 2,000	393	931	1,324	19.8%	1,062	22.7%	821	4.5	14.5	19.0	6.7%	17.8	10%	16.0
Apartment in building with 5 or more units	1,250	1,000 - 1,500	555	1,177	1,731	24.3%	1,311	19.7%	1,052	3.8	16.6	20.4	15.7%	17.2	7%	16.0

Table 4-10
Energy Use per Residential Dwelling Unit: Title-24 Regulated Heating and Cooling
Lytle Creek Ranch
Rialto, California

Notes:
1. Based on information provided by Lytle Development Company.
2. The 2005 survey collected data from 4,382 households nationwide in housing units statistically selected to represent the 111.1 million housing units in the United States. Only RECS data tabulated for California were considered in this analysis.
3. Homes can be heated using electricity and/or natural gas. The values shown for "Electricity-heating" represent the total heating electricity use of a housing subtype (e.g. apartments) divided by the total housing units of that subtype, which includes homes that use natural gas for heating instead of electricity. Similarly, the values shown for "Natural Gas-heating" represent the total heating natural gas use divided by total housing units of that subtype, which includes homes that use electricity. When comparing heating energy use for different housing types in this table, the combination of average electricity heating use and average natural gas heating use should be considered.
4. Reductions are taken with the assumption that the RECs estimate reflects heating/cooling/hot water electricity use for homes that are minimally compliant with 2001 Title 24 Standards.
According to the RECS database, less than 4% of California homes surveyed were built in 2000 or later. Because older homes tend to use more energy, the numbers shown here may overestimate actual energy use. At the same time, the homes included in the data sets have a range of cooling degree days and heating degree days, which affects the heating and cooling-related energy use.
5. Based on report by California Energy Commission on estimated first-year electricity savings due to 2005 standards for single-family and multi-family homes, relative to 2001 standards.
6. Based on California Energy Commission report on estimated first-year electricity savings due to 2008 standards for single-family and multi-family homes, relative to 2005 standards.
7. All domestic hot water systems are assumed to use natural gas.

Abbreviations:
DU - Dwelling Unit
kW-hr - kilowatt-hour
MMBTU - million british thermal units

Source:
CEC. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF
CEC. 2007. Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF
EIA 2005 RECS. Available at: http://www.eia.doe.gov/emeu/recs/

Table 4-11
Energy Use per Residential Dwelling Unit: Appliances and Plug-ins
Lytle Creek Ranch
Rialto, California

		Dwelling Size		Electricity Delivered (kW-hr/DU/year)[2]									Natural Gas Delivered (MMBTU/DU/yr)[2]		
Type	Type	Average Square Footage per DU	Bedrooms per DU[1]	Refrigerator	Clothes Washer	Clothes Dryer (Electric)[3]	Dishwasher	Cooking Range (Electric)[4]	Total Major Appliances	Plug-in Lighting	MELs	Total	Clothes Dryer (Gas)[6]	Gas Cooking Range[5]	Total
Standard Appliances	Single-family detached	2,585	3.8	669	120	520	235	345	1,889	505	622	3,015	3.0	2.6	5.6
	Single-family attached	1,260	2.7	669	100	435	197	289	1,690	293	479	2,461	2.5	2.1	4.7
	Apartment in building with 5 or more units	1,250	2.0	669	88	380	172	252	1,560	291	446	2,296	2.2	1.9	4.1
Energy Star Appliances[7]	Single-family detached	2,585	3.8	569	90	520	141	345	1,665	126	622	2,413	3.0	2.6	5.6
	Single-family attached	1,260	2.7	569	75	435	118	289	1,486	73	479	2,038	2.5	2.1	4.7
	Apartment in building with 5 or more units	1,250	2.0	569	66	380	103	252	1,369	73	446	1,887	2.2	1.9	4.1

Notes:
1. Based on information provided by Lytle Development Company.
2. Energy use per residential DU is based on information in BARBD Table 12.
3. Dryers may be either electric or natural-gas fueled. This value represents the average of the electricity requirements for the two dryer types.
4. Cooking ranges can be either gas or electric. This value represents 1/2 the energy required for electric stoves.
5. This value represents 1/2 the natural gas required for natural gas stoves.
6. This value represents 1/2 the natural gas required for natural gas dryers.
7. Average energy savings above standard products are applied to refrigeration (15%), clothes washer (25%), dishwasher (40%), and lighting (75%) as reported in Energy Star and Other Climate Protection Partnerships 2006 Annual Report Table 10.

Abbreviations:
BARBD - Building America Research Benchmark Definition
DU - Dwelling Unit
kW-hr - kilowatt-hour
MMBTU - million british thermal units

Table 4-11
Energy Use per Residential Dwelling Unit: Appliances and Plug-ins
Lytle Creek Ranch
Rialto, California

MEL - Miscellaneous electric load

Source:
R. Hendron. Building America Research Benchmark Definition. Technical Report NREL/TP-550-4816. December 2008.
USEPA. 2006 Annual Report. Energy Star and Other Climate Protection Partnerships. Available at: http://www.epa.gov/appdstar/pdf/AR%202006%20Final.pdf

Table 4-12
Energy Use per Residential Dwelling Unit
Lytle Creek Ranch
Rialto, California

	Dwelling Sizes		Electricity Delivered					Natural Gas Delivered		
			RECs	BARBD[3]	BARBD[3]	BARBD[3]		RECs	BARBD[3]	
Title 24 Compliance	Type	Average Square Footage /DU[1]	Heating and Cooling	Hard Wired Lighting	Major Appliances[4,6]	Plug-ins	Total	Heating and Domestic Hot Water	Gas Dryers and Oven Ranges[4,6]	Total
			[kW-hr / DU / year]					(MMBTU natural gas / DU / year)		
Minimally Title 24 Compliant (2005)	Single-family detached	2,585	1,196	2,368	1,889	1,126	6,579	41	6	47
	Single-family attached	1,260	1,062	1,521	1,690	772	5,044	18	5	22
	Apartment in building with 5 or more units	1,250	1,311	1,514	1,560	737	5,121	17	4	21
Minimally Title 24 Compliant (2008)	Single-family detached	2,585	924	2,368	1,889	1,126	6,308	37	6	43
	Single-family attached	1,260	821	1,521	1,690	772	4,803	16	5	21
	Apartment in building with 5 or more units	1,250	1,052	1,514	1,560	737	4,863	16	4	20
15% Better Than Title 24 and Energy Star Appliances[7]	Single-family detached	2,585	786	2,013	1,665	748	5,211	31	6	37
	Single-family attached	1,260	698	1,292	1,486	552	4,028	14	5	18
	Apartment in building with 5 or more units	1,250	894	1,287	1,369	518	4,069	14	4	18

Table 4-12
Energy Use per Residential Dwelling Unit
Lytle Creek Ranch
Rialto, California

Percentage Improvement over 2008 Title 24	Single-family detached	2,585	15%	15%	12%	34%	17.4 %	15%	--	13%
	Single-family attached	1,260	15%	15%	12%	28%	16.1 %	15%	--	12%
	Apartment in building with 5 or more units	1,250	15%	15%	12%	30%	16.3 %	15%	--	12%

Notes:

1. Information provided by Lytle Development Company.
2. Energy use shown is from a Title 24 compliant house.
3. Estimated using guidance provided by the US Department of Energy (Table 12 of "Building America Research Benchmark Definition, Updated December 19, 2008").
4. Cooking may be performed on an electric range or a natural gas stove. The values shown in these columns are 50% of the energy/heat used for each stove type.
5. "Plug-ins" refers to electricity use associated with plug-in lighting, plug-in appliances, and miscellaneous electric loads. This energy use is calculated using guidance from BARBD. Energy use for each dwelling type is based on the number of bedrooms, total finished floor area, and a California-specific plug load multiplier. Refer to Table 4-8 on page 49 for load-specific energy estimates.
6. Dryers and ovens may be electric or gas. The values presented in this table represent 50% of the electricity and/or natural gas use for each equipment type.
7. Lytle Development Company has committed to a 15% improvement in energy use in the building envelope over Title 24 standards and inclusion of energy star appliances.

Abbreviations:
BARBD - Building America Research Benchmark Definition
DU - Dwelling Unit
kW-hr - kilowatt-hour

Source:
R. Hendron. Building America Research Benchmark Definition. Technical Report NREL/TP-550-4816. December 2008.

Table 4-13
Emission Factors for Different Energy Sources for Buildings
Lytle Creek Ranch
Rialto, California

Energy Source	Scenario	lb CO_2/source unit	Source Units
Natural Gas[1]	-	117.0	(MMBTU)
Electricity[2]	without RPS	0.631	(kW-hr)
	2010 RPS (20%)	0.583	
	2020 RPS (33%)	0.488	

Derivation of GHG Emissions from Renewable Power Standards		
Renewable Energy Source[3]	**Energy Delivered[3]**	**Percentage of Renewable Energy Delivered**
	[million kWh]	**[%]**
Wind	2,359	21%
Small hydro	449	4%
Biogas	0	0%
Solar	0	6%
Biomass	786	7%
Geothermal	6,965	62%
Total[4]	11,234	100%
% of Total Energy From Renewables[3]	13%	
% of Total Energy From Non-Renewables	87%	
Total Energy Delivery[4]	83,958,770	MWh
from renewables	11,234,288	MWh
from non-renewables	72,724,482	MWh
CO_2 Emissions per Total Energy Delivered[5]	630.9	lbs CO_2/MWh delivered
Total CO2 Emissions[5]	24,026,108	metric tonnes CO_2
CO_2 Emissions per Total Non-Renewable Energy[6]	728.34	lbs CO_2/MWh delivered
Estimated Emission Factors for Total Energy Delivered[7]		
2010 RPS (20%)	582.7	lbs CO_2/MWh delivered
2020 RPS (33%)	488.0	lbs CO_2/MWh delivered

Notes:
1. Emission factor for natural gas was obtained from CCAR GRP, Table C6.
2. Emission factors as derived below.
3. The renewable energy portfolio for SCE. The renewable energy distribution is based on 2008 data available at:
http://www.sce.com/PowerandEnvironment/renewables/
4. Total energy value and emission factor reported for 2007 by SCE in CCAR. Available at:
http://www.climateregistry.org/CarrotDocs/26/2007/SCEPUP07r3.xls
5. The amount of CO_2 emissions is provided in Southern California Edison's Power/Utility Protocol (PUP) Report for 2007 available at:
http://www.climateregistry.org/CarrotDocs/26/2007/SCEPUP07r3.xls
6. The emissions metric presented here is calculated based on the total CO_2 emissions divided by the energy delivered from non-renewable sources.
7. The emission factors for total energy delivered are 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. Two emission factors are presented here for the current 20% RPS goal for 2010 and the presumed 33% RPS for 2020. The estimate provided here and the 2007 PUP report issued by Southern California Edison assume that renewable energy sources do not result in any CO_2 emissions. This is not necessarily true for biogas- and biomass-sourced energy but some consider these sources to be "carbon neutral."

Table 4-13
Emission Factors for Different Energy Sources for Buildings
Lytle Creek Ranch
Rialto, California

Abbreviations:
CO_2 = carbon dioxide
kW-hr - kilowatt-hour
lb - pound
MMBTU - million British thermal units
RPS - Renewables Portfolio Standard
MWh = Megawatt-hour
PUP = Power/Utility Protocol

Sources:
CCAR GRP, Version 3.1 (January 2009). Available at:
http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf
CCAR: SCE 2007 PUP Report. 2008. Available at:
https://www.climateregistry.org/CARROT/public/Reports.aspx

Table 4-14
CO_2e Emissions per Dwelling Unit
Lytle Creek Ranch
Rialto, California

Title 24[1] Compliance and Electricity CO_2 Emission Factor	Type	DU per Building	Average SF/DU[2]	Title-24 Systems[1]		Title-24 Systems and Major Appliances		Title-24 Systems and All MELs		Title-24 Systems	Title-24 Systems and Major Appliances	Title-24 Systems and All MELs
				CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Total	CO_2 Total	CO_2 Total
				(lbs / DU / year)						(tonnes / DU / year)		
Minimally Title 24 Compliant (2005) without RPS	Single-family detached	1	2,585	2,249	4809	3440	5462	4151	5462	3.2	4.0	4.4
	Single-family attached	2 to 4	1,260	1,629	2077	2695	2624	3182	2624	1.7	2.4	2.6
	Apartment in building with 5 or more units	5 or more	1,250	1,782	2010	2766	2488	3231	2488	1.7	2.4	2.6
Minimally Title 24 Compliant (2008) without RPS	Single-family detached	1	2,585	2,077	4328	3269	4981	3980	4981	2.9	3.7	4.1
	Single-family attached	2 to 4	1,260	1,477	1869	2543	2416	3030	2416	1.5	2.2	2.5
	Apartment in building with 5 or more units	5 or more	1,250	1,619	1870	2603	2347	3068	2347	1.6	2.2	2.5
15% Better Than Title 24, Energy Star Appliances and 2010 RPS[5,6]	Single-family detached	1	2,585	1,631	3679	2601	4332	3036	4332	2.4	3.1	3.3
	Single-family attached	2 to 4	1,260	1,160	1589	2025	2136	2347	2136	1.2	1.9	2.0
	Apartment in building with 5 or more units	5 or more	1,250	1,271	1589	2069	2067	2371	2067	1.3	1.9	2.0
Percentage Improvement over 2008 Title 24 without RPS	Single-family detached	1	2,585	21%	15%	20%	13%	24%	13%	17%	16%	18%
	Single-family attached	2 to 4	1,260	21%	15%	20%	12%	23%	12%	18%	16%	18%
	Apartment in building with 5 or more units	5 or more	1,250	21%	15%	21%	12%	23%	12%	18%	16%	18%

Table 4-14
CO_2e Emissions per Dwelling Unit
Lytle Creek Ranch
Rialto, California

Notes:
1. Title 24 - CCR, Title 24, also known as the California Building Standards Code.
2. Information provided by Lytle Development Company.
3. Converted from kW-hr to lb CO_2 using emission factor from the California Climate Action Registry Database: Southern California Edison Company 2006 PUP Report. 2008.
4. Converted from MMBTU to lb CO_2 using emission factor from California Climate Action Registry General Reporting Protocol (CCAR GRP).
5. Lytle Development Company has committed to a 15% improvement in energy use in the building envelope over Title 24 standards and inclusion of energy star appliances.
6. The project emissions take into account implementation of the 2010 Renewables Portfolio Standard.

Abbreviations:
DU - Dwelling Unit
kW-hr - kilowatt-hour
lb – pound
RPS - Renewable Portfolio Standard
SF - Square Feet

Sources:
CCAR General Reporting Protocol, Version 3.1 (June 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf
CCAR Database: Southern California Edison Company 2006 PUP Report. 2008. Available at: https://www.climateregistry.org/CARROT/public/Reports.aspx

Table 4-15
CO_2e Emissions per Dwelling Unit with 2020 RPS
Lytle Creek Ranch
Rialto, California

Title 24[1] Compliance and Electricity CO_2 Emission Factor	Type	DU per Building	Average SF/DU[2]	Title-24 Systems[1]		Title-24 Systems and Major Appliances		Title-24 Systems and All MELs		Title-24 Systems	Title-24 Systems and Major Appliances	Title-24 Systems and All MELs
				CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Total	CO_2 Total	CO_2 Total
				(lbs / DU / year)						(tonnes / DU / year)		
Minimally Title 24 Compliant (2005) without RPS	Single-family detached	1	2,585	2,249	4809	3440	5462	4151	5462	3.2	4.0	4.4
	Single-family attached	2 to 4	1,260	1,629	2077	2695	2624	3182	2624	1.7	2.4	2.6
	Apartment in building with 5 or more units	5 or more	1,250	1,782	2010	2766	2488	3231	2488	1.7	2.4	2.6
Minimally Title 24 Compliant (2008) without RPS	Single-family detached	1	2,585	2,077	4328	3269	4981	3980	4981	2.9	3.7	4.1
	Single-family attached	2 to 4	1,260	1,477	1869	2543	2416	3030	2416	1.5	2.2	2.5
	Apartment in building with 5 or more units	5 or more	1,250	1,619	1870	2603	2347	3068	2347	1.6	2.2	2.5
15% Better Than Title 24, Energy Star Appliances and 2020 RPS[5,6]	Single-family detached	1	2,585	1,366	3679	2178	4332	2543	4332	2.3	3.0	3.1
	Single-family attached	2 to 4	1,260	971	1589	1696	2136	1966	2136	1.2	1.7	1.9
	Apartment in building with 5 or more units	5 or more	1,250	1,064	1589	1733	2067	1985	2067	1.2	1.7	1.8

Table 4-15
CO_2e Emissions per Dwelling Unit with 2020 RPS
Lytle Creek Ranch
Rialto, California

Percentage Improvement over 2008 Title 24 without RPS	Single-family detached	1	2,585	34%	15%	33%	13%	36%	13%	21%	21%	23%
	Single-family attached	2 to 4	1,260	34%	15%	33%	12%	35%	12%	23%	23%	25%
	Apartment in building with 5 or more units	5 or more	1,250	34%	15%	33%	12%	35%	12%	24%	23%	25%

Notes:
1. Title 24 - California Code of Regulations (CCR), Title 24, also known as the California Building Standards Code.
2. Information provided by Lytle Development Company.
3. Converted from kW-hr to lb CO_2 using emission factor from the California Climate Action Registry Database: Southern California Edison Company 2006 PUP Report. 2008.
4. Converted from MMBTU to lb CO_2 using emission factor from California Climate Action Registry General Reporting Protocol (CCAR GRP).
5. Lytle Development Company has committed to a 15% improvement in energy use in the building envelope over Title 24 standards and inclusion of energy star appliances.
6. The project emissions take into account implementation of the 2020 Renewables Portfolio Standard.

Abbreviations:
DU - Dwelling Unit
kW-hr - kilowatt-hour
lb - pound
RPS - Renewables Portfolio Standard
SF - Square Feet

Sources:
CCAR General Reporting Protocol, Version 3.1 (June 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf
CCAR Database: Southern California Edison Company 2006 PUP Report. 2008. Available at: Available at: https://www.climateregistry.org/CARROT/public/Reports.aspx

Table 4-16
CO_2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units
Lytle Creek Ranch
Rialto, California

Title 24[1] Compliance and Electricity CO_2 Emission Factor	Housing Type	# Dwelling Units[2]	Title-24 Systems			Title-24 Systems and Major Appliances			Title-24 Systems and All MELs		
			CO_2 Emission Factor (tonne CO_2 / DU / year)	Total CO_2 Emissions (tonne CO_2 / year)		CO_2 Emission Factor (tonne CO_2 / DU / year)	Total CO_2 Emissions (tonne CO_2 / year)		CO_2 Emission Factor (tonne CO_2 / DU / year)	Total CO_2 Emissions (tonne CO_2 / year)	
Minimally Title 24 Compliant (2005) without RPS	Single-family detached	3,409	3.2	10,913	**19,367**	4.0	13,766	**25,786**	4.4	14,865	**27,975**
	Single-family attached	3,673	1.7	6,175		2.4	8,862		2.6	9,673	
	Apartment in building with 5 or more units	1,325	1.7	2,279		2.4	3,158		2.6	3,437	
Minimally Title 24 Compliant (2008) without RPS	Single-family detached	3,409	2.9	9,904	**17,576**	3.7	12,758	**23,995**	4.1	13,856	**26,184**
	Single-family attached	3,673	1.5	5,575		2.2	8,262		2.5	9,073	
	Apartment in building with 5 or more units	1,325	1.6	2,097		2.2	2,975		2.5	3,254	
15% Better Than Title 24 and Energy Star Appliances and 2010 RPS[3,4]	Single-family detached	3,409	2.4	8,210	**14,508**	3.1	10,721	**20,138**	3.3	11,394	**21,530**
	Single-family attached	3,673	1.2	4,579		1.9	6,933		2.0	7,468	
	Apartment in building with 5 or more units	1,325	1.3	1,719		1.9	2,485		2.0	2,667	
Percentage Improvement over Title 24 (2005) without RPS	Single-family detached	3,409	17%	17%	**17%**	16%	16%	**16%**	18%	18%	**23%**
	Single-family attached	3,673	18%	18%		16%	16%		18%	18%	
	Apartment in building with 5 or more units	1,325	18%	18%		16%	16%		18%	18%	

Table 4-16
CO_2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units
Lytle Creek Ranch
Rialto, California

Notes:
1. Title 24 - CCR, Title 24, also known as the California Building Standards Code.
2. Information provided by Lytle Development Company.
3. Lytle Development Company has committed to a 15% improvement in energy use in the building envelope over Title 24 standards and inclusion of energy star appliances.
4. The project emissions take into account implementation of the 2010 Renewables Portfolio Standard.

Abbreviations:
CO_2 - carbon dioxide
DU - Dwelling Units
MEL - Miscellaneous electric loads
RPS - Renewables Portfolio Standard

Sources:
CCAR General Reporting Protocol, Version 3.0 (April 2008). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_V3_April2008_FINAL.pdf
CCAR General Reporting Protocol, Version 3.1 (January 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

Table 4-17
CO_2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units with 2020 RPS
Lytle Creek Ranch
Rialto, California

Title 24[1] Compliance and Electricity CO_2 Emission Factor	Housing Type	# Dwelling Units[2]	Title-24 Systems			Title-24 Systems and Major Appliances			Title-24 Systems and All MELs		
			CO_2 Emission Factor	Total CO_2 Emissions		CO_2 Emission Factor	Total CO_2 Emissions		CO_2 Emission Factor	Total CO_2 Emissions	
			(tonne CO_2 / DU / year)	(tonne CO_2 / year)		(tonne CO_2 / DU / year)	(tonne CO_2 / year)		(tonne CO_2 / DU / year)	(tonne CO_2 / year)	
Minimally Title 24 Compliant (2005) without RPS	Single-family detached	3,409	3.2	10,913	**19,367**	4.0	13,766	**25,786**	4.4	14,865	**27,975**
	Single-family attached	3,673	1.7	6,175		2.4	8,862		2.6	9,673	
	Apartment in building with 5 or more units	1,325	1.7	2,279		2.4	3,158		2.6	3,437	
Minimally Title 24 Compliant (2008) without RPS	Single-family detached	3,409	2.9	9,904	**17,576**	3.7	12,758	**23,995**	4.1	13,856	**26,184**
	Single-family attached	3,673	1.5	5,575		2.2	8,262		2.5	9,073	
	Apartment in building with 5 or more units	1,325	1.6	2,097		2.2	2,975		2.5	3,254	
15% Better Than Title 24 and Energy Star Appliances and 2020 RPS[3,4]	Single-family detached	3,409	2.3	7,800	**13,660**	3.0	10,067	**18,734**	3.1	10,631	**19,900**
	Single-family attached	3,673	1.2	4,265		1.7	6,384		1.9	6,833	
	Apartment in building with 5 or more units	1,325	1.2	1,595		1.7	2,283		1.8	2,435	
Percentage Improvement over Title 24 (2005) without	Single-family detached	3,409	29%	29%	**29%**	27%	27%	**27%**	28%	28%	**29%**
	Single-family attached	3,673	31%	31%		28%	28%		29%	29%	

Table 4-17
CO_2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units with 2020 RPS
Lytle Creek Ranch
Rialto, California

	Apartment in building with 5 or more units	1,325	30%	30%		28%	28%		29%	29%	

Notes:
1. Title 24 - CCR, Title 24, also known as the California Building Standards Code.
2. Information provided by Lytle Development Company.
3. Lytle Development Company has committed to a 15% improvement in energy use in the building envelope over Title 24 standards and inclusion of energy star appliances.
4. The project emissions take into account implementation of the 2020 Renewables Portfolio Standard.

Abbreviations:
CO_2 - carbon dioxide
DU - Dwelling Units
MEL - Miscellaneous electric loads
RPS - Renewables Portfolio Standard

Sources:
CCAR General Reporting Protocol, Version 3.0 (April 2008). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_V3_April2008_FINAL.pdf
CCAR General Reporting Protocol, Version 3.1 (January 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

4.10 GHG Emissions Associated with Non-Residential Buildings

Non-residential buildings include all structures except residences that may exist in a development such as government, municipal, commercial, retail, and office space. This section describes the methods used to estimate the GHGs associated with activities in non-residential buildings.

The amount of energy used and the associated GHG emissions emitted per square foot of available space vary with the type of non-residential building. For example, food stores are far more energy intensive than warehouses, which have little climate-conditioned space. Lytle Development Company provided data[93] summarizing the general non-residential building categories planned for LCR and the area of floor space planned for each building type. For new developments, the exact types of buildings are typically unknown. As such, not all building categories that may actually exist in LCR are represented below. However, all of the non-residential building area is accounted for, and the tables provided in this section present the differences in energy intensities from building type to building type. The types of non-residential buildings as provided to ENVIRON are:

- Commercial
- School
  - Elementary (1)
  - K through 8 (1)

Similar to the case for residential buildings, GHGs are emitted as a result of activities in non-residential buildings for which electricity and natural gas are used as energy sources. Combustion of any type of fuel emits CO_2 and other GHGs directly into the atmosphere; when this occurs in a non-residential building this is a direct emission source[94] associated with that building. GHGs are also emitted during the generation of electricity from fossil fuels. When electricity is used in a non-residential building, the electricity generation typically takes place offsite at the power plant; electricity use in a non-residential building generally causes emissions in an indirect manner.

While fuel combustion generates CH_4 and N_2O, the emissions of these GHGs typically comprise less than 1% of CO_2e emissions from electricity generation and natural gas consumption.[95] Fuel oil, kerosene, liquefied petroleum gas, and wood can also be used as fuels, but generally contribute only in small amounts as combustion sources within non-residential buildings. As such, these minor emissions are not accounted for here.

[93] The LCR Specific Plan was used to estimate total square footage of buildings. Information from Lytle Development Company was used to refine the types of building present.

[94] CCAR GRP, Version 3.0 (April). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_V3_April2008_FINAL.pdf, Chapter 8

[95] Ibid. Tables C1 and C2. The methane and nitrous oxide emission factors are negligible compared to the total CO_2 emission factor for electricity generation in California.

Similar to energy use in residential buildings, energy use in non-residential buildings is divided into energy consumed by the built environment and energy consumed by uses that are independent of the construction of the building such as plug-in appliances. In California, Title 24 governs energy consumed by the built environment, mechanical systems, and some fixed lighting. Non-building energy use, or "plug-in" energy use can be further subdivided by specific end-use (refrigeration, cooking, office equipment, etc.). The following two steps were performed to quantify the energy use due to non-residential buildings:

1. Calculate energy use from systems covered by Title 24[96] (HVAC system, water heating system, and the lighting system).
2. Calculate energy use from office equipment, plug-in lighting, and other sources not covered by Title 24.

The resulting energy use quantities were then converted to GHG emissions by multiplying by the appropriate emission factors obtained by incorporating information on local electricity production.[97] The total GHG emissions for non-residential buildings in LCR is estimated to be 4,386 tonnes CO_2 per year. The following sections describe the methodologies employed to estimate GHG emissions.

In this section of this report, the units CO_2 and CO_2e are used interchangeably for non-residential buildings because CH_4 and N_2O are assumed to contribute a negligible[98] amount of GWP when compared to the CO_2 emissions from non-residential buildings.

4.10.1 Estimate of Non-residential Energy Use Intensity

ENVIRON developed CO_2 intensity values (CO_2 emissions per sqft per year) for building types found in LCR using data from the California Commercial End-Use Survey (CEUS).[99] The methods that were used to estimate these emissions for LCR are described below.

4.10.1.1 CEUS Database

The overall electricity use for the building types was calculated based on data provided by the CEC.[100] The building types and subcategories are shown in Table 4-18 on page 78. Table 4-18 on page 78 also provides the mapping used to relate LCR building types to CEUS building types.

[96] Title 24, Part 6, of the CCR: California's Energy Efficiency Standards for Residential and Nonresidential Buildings. http://www.energy.ca.gov/title24/

[97] The SCE specific emission factor for electricity deliveries is 631 lbs CO_2/MWh. From the CCAR. SCE PUP Report. 2007.

[98] The SCE specific emission factor for electricity deliveries is 631 lbs CO_2/MWh. From the CCAR Database. PG&E PUP Report. 2007. Although this emission factor accounts for only CO_2, the emissions associated with N_2O and CH_4 contribute to less than 1% of the electricity generation CO_2e emissions.

[99] CEC. CEUS Results. Data available from Itron Inc. at http://capabilities.itron.com/CeusWeb/Chart.aspx

[100] Workbooks for "SCE – FCZ10" downloaded from http://capabilities.itron.com/CeusWeb/Chart.aspx for all building categories. Access 6/12/2009.

The CEUS data is based on a survey conducted in 2002 of existing buildings. Each building type has a characteristic electricity and natural gas use per square foot of building space. Electricity use per square foot (electricity intensity) for each building sample was extracted from the CEUS data. Similarly, the natural gas use per square foot (natural gas intensity) for each building sample was also extracted.

For this analysis, energy use was based upon buildings in California climate zone 10. Table 4-19 on page 79 lists the breakdown of electricity use among several end uses for electricity in various non-residential building types. Table 4-20 on page 80 lists the percentage breakdown of end uses for natural gas in various non-residential building types. The end use data provide an estimate of the percent of the total energy use comprised by Title 24 regulated (built environment) and plug-in electricity in each building type. The Title 24-regulated electricity use (cooling, space heating, water heating, lighting, ventilation) and the non-built electricity use (office equipment, refrigeration, cooking, etc.) are presented in Table 4-19 on page 79. The Title 24-regulated natural gas use and the non-built natural gas use (primarily from cooking) are presented in Table 4-20 on page 80.

Energy use data from Tables 4-19 and 4-20, on page 70 and 80, respectively, were multiplied by the emission factors presented in Table 4-21 on page 81 to generate CO_2 intensity values (CO_2 emissions per sqft building area), as discussed below.

4.10.2 Estimation of Annual Greenhouse Gas Emissions from Non-Residential Buildings

Lytle Development Company has committed to making all new non-residential buildings 15% more energy efficient than 2008 Energy Efficiency Standards or 15% more energy efficient on a TDV basis. Although ENVIRON is aware that annual energy use and TDV energy do not necessarily scale linearly with each other, as discussed in the residential section, ENVIRON assumed that all sources covered by Energy Efficiency Standards would uniformly use 15% less annual energy. These calculations are shown in Table 4-22 on page 82. Non-Energy Efficiency Standards regulated energy use is assumed to still use the same amount of energy as a minimally Energy Efficiency Standards compliant building. There is no credit taken for any Energy Star appliances in the non-residential building category since it is difficult to determine which appliances may be present in the various non-residential building categories. In addition these are generally not supplied with the building. Baseline Energy Efficiency Standards usage rates shown in this table have been adjusted to reflect improvements in Energy Efficiency Standards since their introduction in 2002. CEC discusses average savings for improvements from 2002 to 2005 ("Impact Analysis for 2005 Energy Efficiency Standards") as well as from 2005 to 2008 ("Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings"). ENVIRON used these CEC average savings percentages to account for reductions in energy use due to Energy Efficiency Standards. The average savings percentages are: for electricity: 8.5% reduction in 2005 and 4.9% reduction in 2008; for natural gas: 5.8% reduction in 2005 and 9.4% reduction in 2008. This methodology results in a reduction of energy use for all building types. Because plug-ins are not covered under Energy Efficiency Standards, the decrease in energy use is typically less than 15%, yet still substantial. For instance, GHG emissions in commercial buildings decreased from 4.81 to 4.29 tonnes CO_2e per 1,000 sqft; an 11% decrease in GHG emissions.

The CO_2 intensity values presented in Table 4-22 on page 82 represent the non-residential building types in LCR described earlier. The annual CO_2 emissions for different building types at Lytle Creek Ranch range from 2.85 tonnes per 1,000 sqft for schools to 4.29 tonnes per 1,000 sqft for commercial space.

Table 4-22 on page 82 also shows the yearly CO_2 emissions from LCR by incorporating the emission factors developed as discussed above and the square footage of each of the main building categories. [Note: Table 4-23 on page 84 shows the CO_2 emissions from non-residential energy taking into account the 33% RPS for 2020 described in California Executive Order S-14-08.] Due to the project design feature of reducing built energy use 15% below that in 2008 Energy Efficiency Standards, a reduction of 551 tonnes of CO_2 per year is realized from the non-residential buildings, or approximately 13% of the CO_2 emissions associated with non-residential buildings. These measures bring the overall CO_2 emissions associated with non-residential energy use down to 4,386 tonnes CO_2 per year.

4.10.3 Uncertainties in Non-residential Building GHG Calculations

Several factors lead to uncertainties in the above analysis. These are described below.

For new developments, the exact types of buildings are typically unknown. As such, not all building categories that may actually exist in LCR are represented in this analysis. However, all of the commercial building area is accounted for and the best available assessment of the building type composition of LCR was used. The tables provided in this section present the differences in energy intensities from building type to building type.

Although it is unknown exactly how the buildings will be designed, each building will be Title 24 compliant. Therefore all design features of the building that make it less energy efficient will be offset by design features that make it more energy efficient.

Table 4-18
Categorization of Non-Residential Land Use
Lytle Creek Ranch
Rialto, California

Building Type[1]	CEUS Building Type[2]	Total Area[1] [SF]
Commercial	All Commercial	849,420
School	School	261,360
Grand Total Area		1,110,780

Notes:
1. Building types and areas were provided by Lytle Development Company.
2. ENVIRON selected building types from the CEUS that most closely matched the building types specified by Lytle Development Company. Allocation of commercial space to the "All Commercial" CEUS building type provides a conservative approach to estimating energy use.

Abbreviations:
CEUS - California Commercial End-Use Survey
SF - square feet

Table 4-19
Electricity End-Use Distribution for Non-Residential Building Types
Lytle Creek Ranch
Rialto, California

CEUS Building Type	Air Compressors	Cooking	Cooling	Exterior Lighting	Heating	Interior Lighting	Miscellaneous	Motors	Office Equipment	Process	Refrigeration	Ventilation	Water Heating
All Commercial	1.0%	4%	18%	7%	1%	30%	7%	5%	4%	0.3%	12%	11%	1%
School	---	1%	26%	9%	0.4%	38%	3%	1.0%	6%	---	4%	11%	1.0%
Included in Title 24 Building Envelope Energy Budget?[1]	No	No	Yes	No	Yes	No	No	No	No	No	No	Yes	Yes

Notes:
1. Only end uses regulated by Title 24 are included in the Title 24 building envelope energy budget. Hard-wired lighting (exterior lighting and some interior lighting) are part of Title 24, but are not considered part of the building envelope energy budget.

Abbreviations:
CEUS - California Commercial End-Use Survey

Source:
CEUS. Performed by Itron, under contract to the California Energy Commission. 2006.

Table 4-20
Natural Gas End-Use Distribution for Non-Residential Building Types
Lytle Creek Ranch
Rialto, California

CEUS Building Type	Cooking	Cooling	Heating	Miscellaneous	Process	Water Heating
All Commercial	18%	1%	29%	0.7%	18%	33%
School	11%	---	47%	0.2%	7%	35%
Included in Title 24 Building Envelope Energy Budget?[a]	No	No	Yes	No	No	Yes

Notes:
a. Only end uses regulated by Title 24 are included in the Title 24 building envelope energy budget.

Abbreviations:
CEUS - California Commercial End-Use Survey

Source:
CEUS. Performed by Itron, under contract to the CEC. 2006.

Table 4-21
Emission Factors by Energy Source
Lytle Creek Ranch
Rialto, California

Energy Source	Scenario	Unit	Conversion Factor [lb CO_2 /Unit]	Conversion Factor [tonne CO_2 /Unit]
Electricity[1]	without RPS[3]	kWh	0.631	2.86E-04
	2010 RPS (20%)		0.583	2.64E-04
	2020 RPS (33%)		0.488	2.21E-04
Natural Gas[2]	-	kBTU	0.117	5.31E-05

Notes:
1. Emission factor for electricity provided by Southern California Edison for the year 2006, obtained from the California Climate Action Registry Database.
2. Emission factor for natural gas obtained from California Climate Action Registry Reporting Protocol, Table C7.
3. Estimated emission factors for total energy delivered before and after implementation of the Renewables Portfolio Standard. See Table 6-1 for derivation of these factors.

Abbreviations:
CO_2e - carbon dioxide equivalent
kBTU - 1000 British thermal units
kWh - kilowatt-hour
lb - pound
RPS - Renewables Portfolio Standard

Sources:
CCAR GRP, Version 3.1 (January 2009). Available at:
http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf
CCAR Database: SCE 2007 PUP Report. 2008. Available at:
https://www.climateregistry.org/CARROT/public/Reports.aspx

Table 4-22
Energy Usage and Resulting GHG Emissions for Non-Residential Building Types
Lytle Creek Ranch
Rialto, California

Baseline								15% Improvement over Title 24 and RPS		Baseline	Annual Total (with 15% Improvement over Title 24 and RPS)	
CEUS Building Type	**Total Area [SF]**	**Energy Source**	**Unit**	**Usage Rate[1] [Unit/SF-yr]**			**CO_2e EF[5] [tonnes/SF-yr]**	**Usage Rate[6] [Unit/SF-yr]**	**CO_2e EF[5] [tonnes/SF-yr]**	**CO_2e Emissions[5] [tonnes/yr]**	**Usage[7] [Unit/yr]**	**CO_2e Emissions[5] [tonnes/y**
				Title 24[2,3]	**Non-Title 24[4]**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**
All Commercial	849,420	Electricity	kWh	3.58 +	9.01 =	12.59	3.60E-03	12.05	3.19E-03	3.06E+03	10,237,481	2,706
		Natural Gas	kBTU	13.43 +	9.35 =	22.78	1.21E-03	20.76	1.10E-03	1.03E+03	17,637,123	936
School	261,360	Electricity	kWh	3.40 +	6.30 =	9.70	2.78E-03	9.19	2.43E-03	7.25E+02	2,401,816	635
		Natural Gas	kBTU	7.19 +	1.79 =	8.98	4.77E-04	7.90	4.20E-04	1.25E+02	2,066,037	110
Grand Total Area	1,110,780							**Electricity Total**		3,786	12,639,297	3,341
								Natural Gas Total		1,151	19,703,160	1,046
								Grand Total				4,386

Table 4-22
Energy Usage and Resulting GHG Emissions for Non-Residential Building Types
Lytle Creek Ranch
Rialto, California

Notes:
1. Baseline usage rates were taken from the 2006 CEUS, performed by Itron under contract to the CEC. ENVIRON used data for SCE, Zone 10, which is the sector in which the Lytle Creek Ranch development is located.
2. Baseline Title 24 usage rates shown in this table have been adjusted to reflect improvements in Title 24 building codes since their introduction in 2002. CEC discusses average savings for improvements from 2002 to 2005 ("Impact Analysis for 2005 Energy Efficiency Standards") as well as from 2005 to 2008 ("Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings"). ENVIRON used these CEC average savings percentages, which are: for electricity: 7.7% reduction in 2005 and 4.9% reduction in 2008; for gas: 3.2% reduction in 2005 and 9.4% reduction in 2008.3. Includes only Title 24-regulated building envelope uses of electricity (heating, cooling, ventilation, water heating) and gas (heating, water heating), as discussed in footnote (a) of Table 4-17.
4. Includes all other uses of electricity (cooking, refrigeration, exterior lighting, interior lighting, office equipment, miscellaneous, process, motors, air compressors) and gas (cooling, cooking, miscellaneous, process) not included in the Title 24-regulated building envelope, as discussed in footnote 3 above.
5. GHG EF are calculated by multiplying the corresponding usage rates or usages by the conversion factors listed in Table 4-19.
6. The usage rate with 15% improvement over Title 24 is calculated as the baseline Title 24 usage reduced by 15% plus the baseline non-Title 24 usage.
7. The total annual usage is calculated as the usage rate (with 15% improvement over Title 24) multiplied by the total area.

Abbreviations:
CEC - California Energy Commission
CEUS - California Commercial End-Use Survey
CO_2e - carbon dioxide equivalent
EF - emission factor
GHG - greenhouse gas
kBTU - kilo (1000) British thermal units
RPS = Renewables Portfolio Standard
SCE - Southern California Edison
SF - square feet
tonnes - metric tonnes
yr - year

Table 4-23
Energy Usage and Resulting GHG Emissions for Non-Residential Building Types with 2020 RPS
Lytle Creek Ranch
Rialto, California

Baseline						15% Improvement over Title 24 and RPS		Baseline	Annual Total (with 15% Improvement over Title 24 and RPS)	
CEUS Building Type	**Total Area [SF]**	**Energy Source**	**Unit**	**Usage Rate[1] [Unit/SF-yr]**	**CO_2e EF[5] [tonnes/SF-yr]**	**Usage Rate[6] [Unit/SF-yr]**	**CO_2e EF[5] [tonnes/SF-yr]**	**CO_2e Emissions[5] [tonnes/yr]**	**Usage[7] [Unit/yr]**	**CO_2e Emissions[5] [tonnes/yr]**
				Title 24[2,3] Non-Title 24[4] Overall	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**
All Commercial	849,420	Electricity Natural Gas	kWh kBTU	3.58 + 9.01 = 12.59 13.43 + 9.35 = 22.78	3.60E-03 1.21E-03	12.05 20.76	2.67E-03 1.10E-03	3.06E+03 1.03E+03	10,237,481 17,637,123	2,266 936
School	261,360	Electricity Natural Gas	kWh kBTU	3.40 + 6.30 = 9.70 7.19 + 1.79 = 8.98	2.78E-03 4.77E-04	9.19 7.90	2.03E-03 4.20E-04	7.25E+02 1.25E+02	2,401,816 2,066,037	532 110
Grand Total Area	1,110,780					**Electricity Total**		3,786	12,639,297	2,798
						Natural Gas Total		1,151	19,703,160	1,046
						Grand Total				3,843

Table 4-23
Energy Usage and Resulting GHG Emissions for Non-Residential Building Types with 2020 RPS
Lytle Creek Ranch
Rialto, California

Notes:
1. Baseline usage rates were taken from the 2006 CEUS, performed by Itron under contract to the CEC. ENVIRON used data for SCE, Zone 10, which is the sector in which the Lytle Creek Ranch development is located.2. Baseline Title 24 usage rates shown in this table have been adjusted to reflect improvements in Title 24 building codes since their introduction in 2002. CEC discusses average savings for improvements from 2002 to 2005 ("Impact Analysis for 2005 Energy Efficiency Standards") as well as from 2005 to 2008 ("Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings"). ENVIRON used these CEC average savings percentages, which are: for electricity: 7.7% reduction in 2005 and 4.9% reduction in 2008; for gas: 3.2% reduction in 2005 and 9.4% reduction in 2008.
3. Includes only Title 24-regulated building envelope uses of electricity (heating, cooling, ventilation, water heating) and gas (heating, water heating), as discussed in footnote (a) of Table 4-17.
4. Includes all other uses of electricity (cooking, refrigeration, exterior lighting, interior lighting, office equipment, miscellaneous, process, motors, air compressors) and gas (cooling, cooking, miscellaneous, process) not included in the Title 24-regulated building envelope, as discussed in footnote 3 above.
5. GHG EF are calculated by multiplying the corresponding usage rates or usages by the conversion factors listed in Table 4-19.
6. The usage rate with 15% improvement over Title 24 is calculated as the baseline Title 24 usage reduced by 15% plus the baseline non-Title 24 usage.
7. The total annual usage is calculated as the usage rate (with 15% improvement over Title 24) multiplied by the total area.

Abbreviations:
CEC - California Energy Commission
CEUS - California Commercial End-Use Survey
CO_2e - carbon dioxide equivalent
EF - emission factor
GHG - greenhouse gas
kBTU - kilo (1000) British thermal units
RPS = Renewables Portfolio Standard
SCE - Southern California Edison
SF - square feet
tonnes – metric tonnes

4.11 Mobile Sources

This section estimates GHG emissions from mobile sources in LCR. The mobile source emissions considered for this project will be from the typical daily operation of motor vehicles by LCR residents. ENVIRON estimated GHG emissions based upon all miles traveled by LCR residents regardless of internal or external destinations or purpose of trip. Traffic patterns, trip rates, and trip lengths are based upon modeling results provided by Crain and Associates.[101] Appendix B is a memorandum from Crain and Associates describing the modeling methodology and results.

Mobile source emissions from new residences are considered to be growth, as residences are rarely removed from the housing supply once constructed. There are exceptions, such as when one housing development replaces another, and, in those cases, the replacement residential development need not be considered growth. However, it is not clear that commercial development should be considered new growth for vehicular travel purposes. To the extent that commercial development serves existing residential development its vehicular travel may not be new. For instance, if the new commercial area serves an area with a high residential/commercial balance, then this new commercial growth will reduce shopping and work trip lengths and will reduce GHG emissions associated with mobile sources. If, however, the new commercial area results in longer trips for its workers and residents than they would have previously made, then it adds GHG emissions. Commercial development that could potentially increase VMT would be facilities that draw trips from far away that otherwise would not be made. A theme park, for example, may be viewed as such a development.

In this report, it is assumed that new non-residential (i.e. office space, retail space, and industrial buildings) area serves an area with a high residential/ non-residential balance. Therefore, this new non-residential growth will not, independent of the new residential areas, result in new shopping and work trips. Accordingly, new non-residential space in the LCR development area will not contribute to mobile GHG emissions. However, the emissions from heating and cooling the non-residential areas would be considered to be new, as that would reflect growth in non-residential areas that goes along with growth in residential areas.

Accordingly, GHG emissions from VMT serving non-residential areas will only be counted if the non-residential areas contribute to greater VMT as a result of its location. It should be noted that as LCR is a mixed use community, this issue does not directly affect LCR VMT calculations; all VMT from LCR residents is calculated regardless of internal or external destinations or purpose of trip.

The CCAR General Reporting Protocol (GRP)[102] recommends estimating GHG emissions from mobile sources at an individual vehicle level, assuming knowledge of the fuel consumption rate for each vehicle as well as the miles traveled per car. Since these parameters are not known for a future development, the CCAR guidance is too specific to use as recommended.

[101] Memorandum from George Rhyner of Crain and Associates to Peter Lewandowski of Environmental Impact Sciences dated 9/15/2009.

[102] CCAR. 2008. *General Reporting Protocol*. Version 3.0. April.

For mobile sources, CH_4 and N_2O are explicitly calculated, multiplied by their respective GWP, and added to the CO_2 emissions, to result in total CO_2e emissions from mobile sources.

4.11.1 Estimating VMT from Mobile Sources

This section summarizes the general approach used to estimate VMT made by the residents of LCR. Model results were provided to ENVIRON by Crain and Associates.

Traditional traffic models focus upon designing roads and planning a development such that traffic delays will be avoided during peak travel hours. Traditional traffic analyses also provide the total number of daily vehicles on a road which can then be used to calculate toxic or criteria emissions that may have localized health effects. Several steps must be taken to go from a traditional traffic model to a set of calculations that describe VMT made by LCR residents.

The trip generation data was taken from the East Valley Transportation Model (EVTM) which was also used to generate the traffic analysis. The EVTM was run by the SCAG Inland Empire office based on inputs provided by Crain and Associates and the Lytle Development Company. Trip ends are then adjusted based on the proportion of production ends only, based on the methodology of the federally issued Urban Transportation Planning Software (UTPS) package.[103] The analysis is described in Appendix B. Added daily trips, based on weekday estimates, as well as added VMT are shown in Table 4-24 on page 90.

4.11.1.1 Calculate final VMT based upon the above scenarios

Trips for each neighborhood are associated with an average trip length as provided by Crain and Associates.[104] Total VMT were calculated by multiplying the number of trips by the average trip length for each type of trip.

$$\text{VMT} = \text{Number of Trips} * \text{Average Trip Length}$$

The value calculated here includes all VMT generated by LCR residents commuting within LCR and all VMT generated by LCR residents commuting to and from LCR. According to the methodology above, each LCR DU generates 21,638 VMT per year. The total VMT for LCR residents is 181,911,255 as shown in Table 4-25 on page 91. This VMT was multiplied by the appropriate emission factors in the next section to calculate GHG emissions from mobile sources at LCR.

4.11.2 Estimating GHG Emissions from Mobile Sources

The CO_2 emissions from mobile sources were calculated with the trip rates, trip lengths and emission factors for running and starting emissions from EMFAC2007 as follows:

$$CO_2 \text{ emissions} = \text{VMT} * EF_{running}$$

[103] Memorandum from George Rhyner of Crain and Associates to Peter Lewandowski of Environmental Impact Sciences dated 9/15/2009.

[104] Ibid.

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

The CO_2 calculation involves the following assumptions:

- The emission factor depends upon the speed of the vehicle. Here, it was assumed that internal trips were 30 mph[105].
- EMFAC emission factors from the year 2030 were used for $EF_{running}$ based on San Bernardino County fleet mix.

Startup emissions are CO_2 emitted from starting a vehicle. Startup emissions were calculated using the following assumptions:

- The number of starts is equal to the number of trips made annually.
- The breakdown in vehicles was EMFAC fleet mix for San Bernardino County in 2030.
- The emission factor for startup was calculated based on a conservative assumption of long waits between starts.

Fleet distribution types from EMFAC2007 were used for the year 2030, a year selected to represent full build out.

Table 4-25 on page 91 shows the CO_2 emissions from vehicles associated with residents of LCR as calculated according to the methodology described above. Since the EVTM modeled trip generation rates were based on weekday conditions, ENVIRON calculated weekend traffic by applying differences between the weekend and the weekday traffic based upon the analysis conducted by Crain and Associates based on Institute of Transportation Engineers (ITE) weekend and weekday trip generation rates. The ITE projection for the weekend trip ends was less than five percent less than the weekday trip end generation value.[106] Weekend traffic was assumed to be 95% of the weekday capacity.[107] Consequently, CO_2 emissions in Table 4-25 on page 91 were multiplied by 98.6% to account for the difference between weekday and weekend conditions.

N_2O, CH_4, and HFCs[108] are also emitted from mobile sources. The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of mobile source GHG emissions, taking

[105] URBEMIS defaults to a vehicle speed of 30 mph for all trip types if no project specific data is entered.

[106] Memorandum from George Rhyner of Crain and Associates to Peter Lewandowski of Environmental Impact Sciences dated 9/15/2009

[107] A conservative adjustment for weekend travel was assumed for all the trips since information was not available to distinguish between trips on major highways and trips on small streets.

[108] HFCs can be emitted from air conditioning systems.

into account their GWPs.[109] Therefore, CO_2 emissions in Table 4-25 on page 91 were divided by 0.95 to account for non-CO_2 GHGs. Vehicles associated with the LCR development will emit approximately 71,114 tonnes CO_2e per year without taking into account future regulatory activity.

As discussed in Section 3.3.5, the USEPA recently granted the waiver for California for its greenhouse gas emission standards for motor vehicles. AB 1493 is expected to reduce running emissions for passenger cars and light trucks by 20% relative to the year 2009 by the year 2020.[110] Starting emissions will not be affected. Table 4-26 on page 92 shows the CO_2 emissions from vehicles associated with residents of LCR as calculated incorporating the emissions reductions resulting from AB 1493. CO_2 emissions in Table 4-26 on page 92 were divided by 0.95 to account for non-CO_2 GHGs. Vehicles associated with the LCR development will emit approximately 57,265 tonnes CO_2e per year. A sample EMFAC run for San Bernardino County is given in Appendix D.

4.11.3 Uncertainty in Mobile Source Calculations

In an effort to evaluate the assumptions described in the section it should be noted that the VMT and GHG emissions will change based on further reductions that are likely due to the benefits of the community design to encourage mode shifts. In addition changes in estimated fleet distribution and emission factors will likely improve based on current and anticipated regulations.

[109] USEPA. 2005. *Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle.* Office of Transportation and Air Quality. February. (http://www.epa.gov/otaq/climate/420f05004.pdf)

[110] ARB. "Comparison of Greenhouse Gas Reductions for the United States and Canada Under CAFÉ Standards and ARB GHG Regulations". February 25, 2008. Table 11.

Table 4-24
Mitigated Trip Generation Rates and Vehicle Miles Based on Traffic Modeling[1]
Lytle Creek Ranch
Rialto, California

Zone	Neighborhood	Total Daily Trip Ends[2]	Percent Production Ends (%)	Production (Added Daily Trips)[3]	Average Trip Length (miles)	Added Daily Vehicle Miles of Travel (VMT)
80	I	7,533	68.1%	5,130	14.5	74,385
81	I	2,697	72.1%	1,945	14.4	28,008
82	II	24,225	54.6%	13,227	9.2	121,688
83	III	46,614	46.3%	21,582	9.3	200,713
84	IV	10,444	54.2%	5,661	13	73,593
				47,545		**498,387**

Notes:
1. The data in this table was provided to ENVIRON by Crain and Associates in their memorandum dated September 15, 2009 re: Lytle Creek Development Mobile Emission Analysis Input. The analysis was conducted using the EVTM. The EVTM model accounts for "physical design" mitigation measures inherent in the project plan, such as high residential density and local serving retail.
2. Daily trip ends per weekday.
3. "Production" refers to the origin of the trip (rather than the destination).

Abbreviations:
EVTM - East Valley Transportation Model
VMT - Vehicle Miles Traveled

Sources:
Crain and Associates. 2009. Re: Lytle Creek Development Mobile Emission Analysis Input.

Table 4-25
Mitigated Greenhouse Gas Emissions from Vehicles for the Year 2030
Lytle Creek Ranch
Rialto, California

Neighborhood	Annual Products (Added Annual Trips)[1]	Added Annual Vehicle Miles of Travel (VMT)[1]	Emission Factor Running (g/mile)[2]	Emission Factor Starts (g/start)[3]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual Adjusted CO_2 Emissions (tonne)[4]	Total Annual CO_2e Emissions (tonne)[5]
I	1,872,450	27,150,525			9,960	194	10,155	10,010	10,536
I	709,925	10,222,920			3,750	74	3,824	3,769	3,968
II	4,827,855	44,416,120			16,294	501	16,796	16,556	17,427
III	7,877,430	73,260,245	**367**	**104**	26,876	818	27,694	27,298	28,735
IV	2,066,265	26,861,445			9,854	215	10,069	9,925	10,447
Total	**17,353,925**	**181,911,255**			**66,735**	**1,802**	**68,537**	**67,558**	**71,114**

Notes:
1. Daily trips and VMT were modeled for weekday activity, consequently these estimates assume 365 weekdays.
2. Emission factors for vehicles based on EMFAC files for 2030, based on LDA, LDT1, LDT2, and motorcycle for San Bernardino at 30 mph (URBEMIS default).
3. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.
4. Weekend traffic is approximately 95% of weekday traffic. Overall CO_2 emissions are consequently 98.6% of those calculated based on weekday activity only (1.0*5/7 + 0.95*2/7).
5. $CO_2e=CO_2/0.95$: The USEPA recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent g - gram
GHG - Greenhouse Gas HFC - Hydro fluorocarbon mph - miles per hour
N_2O - Nitrous oxide
USEPA - United States Environmental Protection Agency
VMT - Vehicle Miles Traveled

Table 4-26
Mitigated Greenhouse Gas Emissions from Vehicles for the Year 2030 with Pavley Standards
Lytle Creek Ranch
Rialto, California

Neighborhood	Annual Products (Added Annual Trips)[1]	Added Annual Vehicle Miles of Travel (VMT)[1]	Emission Factor Running (g/mile)[2]	Emission Factor Starts (g/start)[3]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual Adjusted CO_2 Emissions (tonne)[4]	Total Annual CO_2e Emissions (tonne)[5]
I	1,872,450	27,150,525			**7,968**	194	8,163	8,046	8,470
I	709,925	10,222,920			3,000	74	3,074	3,030	3,190
II	4,827,855	44,416,120			13,035	501	13,537	13,343	14,046
III	7,877,430	73,260,245	**293**	**104**	21,501	818	22,319	22,000	23,158
IV	2,066,265	26,861,445			7,883	215	8,098	7,982	8,402
Total	**17,353,925**	**181,911,255**			**53,388**	**1,802**	**55,190**	**54,402**	**57,265**

Notes:
1. Daily trips and VMT were modeled for weekday activity, consequently these estimates assume 365 weekdays.
2. Emission factors for vehicles based on EMFAC files for 2030, based on LDA, LDT1, LDT2, and motorcycle for San Bernardino at 30 mph (URBEMIS default).
3. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.
4. Weekend traffic is approximately 95% of weekday traffic. Overall CO_2 emissions are consequently 98.6% of those calculated based on weekday activity only (1.0*5/7 + 0.95*2/7).
5. $CO_2e=CO_2/0.95$: The USEPA recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent g - gram
GHG - Greenhouse Gas HFC - Hydro fluorocarbon mph - miles per hour
N_2O - Nitrous oxide
USEPA - United States Environmental Protection Agency
VMT - Vehicle Miles Traveled

4.12 Hearths

Area sources emissions stem from hearths (including gas fireplaces, wood-burning fireplaces, and wood-burning stoves) and small mobile fuel combustion sources such as lawnmowers. Fuel combustion associated with these sources produce direct GHG emissions. Emissions from natural gas-fired stoves and natural gas heating are already included in the residential and non-residential source categories (see Table 4-11 through 4-23 on pages 60-73, 78-85).[111] Calculations based on the URBEMIS method were performed for the remaining types of area sources, natural gas fireplaces and lawn maintenance.

LCR will have 8,407 natural gas fireplaces in its residential units. Wood-burning stoves or fireplaces are prohibited. Direct GHG emissions from these sources were estimated by multiplying the energy use per year by the CO_2 emission factor for natural gas combustion. Annual energy use was determined by the number of fireplaces, the average energy use of each fireplace, and the URBEMIS default fireplace usage rate value of 200 hours/year. In the absence of site-specific energy use values for fireplaces at LCR, the URBEMIS default values of 20,000 BTU/hour/fireplace for multi-family residences, and 30,000 BTU/hour/fireplace for single-family houses were used. Table 4-27 on page 94 shows an estimated 2,339 tonnes CO_2 will be generated annually by fuel combustion in natural-gas fireplaces.

[111] The methods used to calculate natural gas use for heating, water heating, and cooking described in the residential emission calculations are conservative and may cause slight differences in the natural gas usage determined using URBEMIS as was used in the air quality section of the draft EIR for Lytle Creek Ranch. Both methods are appropriate for the purpose of the individual sections. URBEMIS is designed for worst day local emissions of criteria pollutants as opposed to total emissions of GHGs.

Table 4-27
GHG Emissions from Area Sources-Hearth Fuel Combustion
Lytle Creek Ranch
Rialto, California

Wood-burning Source	Quantity[1]	Amount of Wood per Fireplace[1]	Total Wood Burned Annually	CO_2 Emission Rate	Annual CO_2 Emission
		(lbs/year/unit)	(tonne/year)	(lbs CO2/tonne wood)	(tonne/year)
Wood stoves	0	--	--	--	0
Wood fireplaces	0	--	--	--	0
Wood Stoves and Fireplaces Total:					**0**

Natural Gas Fireplace Dwelling Unit Type	Quantity[2]	Average Energy Use[3]	Usage Rate[4]	Energy Use per Year	CO_2 Emission[5]	Annual CO_2 Emission
		(Btu/hour/unit)	(hours/year)	(MMBTU/year)	(lb CO_2/MMBTU)	(tonne/year)
Single-family	5,254	30,000	200	31,524	117	1,671
Multi-family	3,153	20,000	200	12,612	117	668
Natural Gas Fireplaces Total:					**2,339**	
Hearth Fuel Combustion Total:					**2,339**	

Notes:
1. There will be no wood-burning stoves or fireplaces at Lytle Creek Ranch.
2. For a conservative estimate, all single-family and multi-family residences were assumed to each have a natural gas fireplace. In addition, all DUs in the SFR-1, SFR-2, and SFR-3 land use categories were conservatively treated as single-family dwellings, regardless of the number of units per building.
3. Average energy use values are URBEMIS default values.
4. Usage rate of 200 hours/year is the URBEMIS default value.
5. Emission factor based on AP-42 value for natural gas combustion.

Abbreviations:
SFR = Single-Family Residential

Sources:
USEPA. 1995. AP-42, Fifth Edition. Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. January. Available at: http://www.epa.gov/ttn/chief/ap42/
SCAQMD. Software User's Guide: URBEMIS2007 for Windows. Prepared by Jones & Stokes Associates. November.

4.13 Municipal Sources

This section explains estimates for emissions stemming from municipal sources such as drinking water and wastewater supply and treatment, lighting in public areas, and municipal vehicles.

4.13.1 Water and wastewater supply and treatment systems

In general, the majority of municipal sector GHG emissions are related to the energy used to convey, treat and distribute water and wastewater. Thus, these emissions are generally indirect emissions from the production of electricity to power these systems. Additional emissions from wastewater treatment include CH_4 and N_2O, which are emitted directly from the wastewater.

The amount of electricity required to treat and supply water depends on the volume of water involved. According to Lytle Development Company, the development would generate a total water demand of 10,174 acre-feet (AF) per year. The entire amount is assumed to be potable water supplied by West Valley Water District.[112] Three processes are necessary to supply potable water to residential and commercial users: (1) supply and conveyance of the water from the source; (2) treatment of the water to potable standards; and (3) distribution of the water to individual users. After use, the wastewater is treated and reused as reclaimed water.

Indirect emissions resulting from electricity use were determined by multiplying electricity use by the CO_2 emission factor provided by the local electricity supplier, SCE. The implementation of the RPS will reduce carbon dioxide emissions from this source somewhat, but this has not been quantified. Energy use for different aspects of water treatment (e.g. source water pumping and conveyance, water treatment, distribution to users) was determined using the stated volumes of water and energy intensities values (i.e., energy use per unit volume of water) provided by reports from the CEC and a report by Robert Wilkinson on energy use for California's water systems[113]. The emission factors and GHG emissions for all these processes are shown in Table 4-28 on page 99. The annual emissions from water treatment and distribution, wastewater treatment, and distribution of recycled water are approximately 8,891 tonnes CO_2e per year. Details on the emissions generated by specific aspects of water treatment and supply systems are provided in the following sections.

4.13.2 Potable Water Source Supply and Conveyance

Water is typically supplied to communities from several sources including the local underground aquifer, the State Water Supply, and recycled and reclaimed water.

---

[112] West Valley Water District expects that the water for Lytle Creek Ranch will be sourced from groundwater basins, surface water, and purchased water. Groundwater sources are the Lytle Creek, Rialto, Chino, North Riverside, and Bunker Hill basins. Surface water is from Lytle Creek, and purchased water is from the State Water Project. http://www.scag.ca.gov/rcp/pdf/uwmp/SanBernardino/WVWD-UWMP-2006-2.pdf

[113] CEC 2005. California's Water-Energy Relationship. Final Staff Report. CEC-700-2005-011-SF, CEC 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.

Wilkinson, Robert. 2000. Methodology for Analysis of the Energy Intensity of California's Water Systems, and An Assessment of Multiple Potential Benefits through Integrated Water-Energy Efficiency Measures.

Supplying and conveying water in LCR is estimated to account for 3,212 tonnes of CO_2e emissions per year. To supply the annual demand for 10,174 AF of potable water LCR will draw upon water from the State Water Project, groundwater, and surface water.[114] The energy needed to supply and convey LCR's water will be used to pump this water from the sources and distribute it throughout the development. The CEC estimated that 950 kW-hr would be required to extract one AF of water from Chino Basin groundwater, and 370 kW-hr would be required to extract one AF of water from surface water. Wilkinson estimated that 3,236 kW-hr would be required to extract one AF of water from the State Water Project. Using these energy intensity factors, the expected potable water demand, and the SCE carbon-intensity factor, GHG emissions from potable water supply and conveyance were calculated (see Table 4-28 on page 99). Supplying and conveying water in LCR from the State Water Project, groundwater, and surface water is estimated to account 1,053 tonnes, 1,940 tonnes, and 219 tonnes of CO_2e emissions per year, respectively.

4.13.3 Potable Water Treatment and Distribution

Treating and distributing potable water in LCR are estimated to account for 1,371 tonnes[115] and 1,157 tonnes of CO_2e emissions per year, respectively. Based on the estimated potable water demand, these energy intensity factors, and the SCE-carbon intensity factor, GHG emissions from potable water treatment and distribution were calculated as shown in Table 4-28 on page 99.

4.13.4 Wastewater Treatment

Emissions associated with wastewater treatment include indirect emissions necessary to power the treatment process and direct emissions from degradation of organic material in the wastewater. Wastewater treatment indirect emissions in LCR are estimated to account for 2,411 tonnes of CO_2e emissions per year. Wastewater treatment direct emissions in LCR are estimated to account for 2,070 tonnes of CO_2e emissions per year.

Indirect GHG emissions from the electricity necessary to power the wastewater treatment process were calculated for LCR. The electricity required to operate a wastewater treatment plant is estimated to be 815 kWh per AF.[116] Based on the expected amount of wastewater requiring treatment (10,174 AF per year, this energy intensity factor and the SCE carbon-intensity factor, indirect emissions due to wastewater treatment were calculated as shown in Table 4-28 on page 99.

Direct emissions from wastewater treatment include emissions of CH_4 and N_2O. A per capita emission factor for these GHG emissions was developed based on a 2005 US GHG inventory for domestic and industrial wastewater treatment (25 teragrams CO_2e/year or 25 million tonnes

[114] Lytle Creek Ranch water supplies are based on West Valley Water District expected sources for the area. It is estimated that 69% will come from groundwater, 11% will come from the State Water Project, and 20% will come from surface water.

[115] Treatment is based on the average value presented by CEC. CEC 2005. California's Water-Energy Relationship. Final Staff Report. CEC-700-2005-011-SF.

[116] CEC. 2005. California's Water-Energy Relationship. Final Staff Report. CEC-700-2005-011-SF.

CO_2e/year)[117] and the 2005 US population (approximately 296,410,404)[118]. Direct emissions from wastewater treatment were calculated using the emission factor developed from this data (0.084 tonnes CO_2e per capita per year) and the projected population at LCR (24,539 residents[119]) as shown in Table 4-28 on page 99.

In total, all water and wastewater supply, treatment and distribution for LCR is expected to produce 10,221 tonnes of CO_2e annually.

4.13.5 Public Lighting

Lighting sources contribute to GHG emissions indirectly, via the production of the electricity that powers these lights. Lighting sources considered in this source category include streetlights, traffic signals, area lighting for parks and lots, and lighting in public buildings. The emission factor for public lighting is shown in Table 4-28 on page 99. Data from a report by the City of Duluth shows that the amount of electricity demand for all types of public lighting is 149 kWh per capita per year.[120] Lytle Development Company plans to incorporate energy-saving light fixtures where feasible. Energy savings from this potential measure were not quantified for this analysis. Using the Duluth study, the SCE-specific carbon-intensity emission factor and the expected LCR population of 24,539, emissions from public lighting were calculated.[121] Thus, the LCR-specific emission factor for public lighting would be 0.043 tonnes CO_2e per capita per year. Public lighting emissions in LCR are estimated to account for 1,061 tonnes CO_2 per year. This number is likely a conservative estimate since LCR is a master-planned compact community and may require fewer lights than the City of Duluth.

4.13.6 Municipal Vehicles

GHG emissions from municipal vehicles are due to direct emissions from the burning of fossil fuels. Municipal vehicles considered in this source category include vehicles such as police cars, fire trucks, and garbage trucks. The emission factor for municipal vehicles is shown in Table 4-28 on page 99. Data from reports by Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, California[122] show that the CO_2 emissions from municipal vehicles would be

---

[117] USEPA. 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. #430-R-07-002. April. http://epa.gov/climatechange/emissions/downloads06/07Waste.pdf

[118] This per capita emission factor distributes both domestic (municipal sewage) and industrial waste treatment emissions over the population.

[119] Provided to ENVIRON by Lytle Development Company.

[120] Skoog, C. 2001. This factor was calculated by summing the total electricity needs for municipal uses and dividing by the Duluth population. The Duluth population was calculated by dividing the city's reported GHG emissions by its reported per capita emissions. The City of Duluth is assumed to contained balanced commercial and residential land uses.

[121] Population estimate provided by Lytle Development Company.

[122] City of Medford. 2001. Climate Action Plan. October. http://www.massclimateaction.org/pdf/MedfordPlan2001.pdf

City of Northampton. 2006. Greenhouse Gas Emissions Inventory. Cities for Climate Protection Campaign. June. http://www.northamptonma.gov/uploads/listWidget/3208/NorthamptonInventoryClimateProtection.pdf

City of Santa Rosa. 2001. Cities for Climate Protection: Santa Rosa. http://ci.santa-rosa.ca.us/City_Hall/City_Manager/CCPFinalReport.pdf

Skoog, C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives. October.

approximately[123] [124] 0.05 tonnes per capita per year. Using these studies and the expected LCR population of 24,539, emissions from municipal vehicles in LCR were calculated. Municipal vehicle emissions in LCR are estimated to account for 1,227 tonnes CO_2e per year.

In total, all municipal sources including water, wastewater, public lighting and municipal vehicles for LCR is expected to produce 12,509 tonnes of CO_2e annually.

http://www.ci.duluth.mn.us/city/information/ccp/GHGEmissions.pdf

[123] In an effort to be conservative, the largest per capita number from these four reports was used.

[124] While the emission factor used is expressed as a per capita value, emissions due to residential and non-residential land uses were incorporated into the total emissions distributed among the population.

Table 4-28
GHG Emission Factors for Lytle Creek Ranch Municipal Sources
Rialto, California

Source[1]	Energy Requirements	Units	Emission Factor	Units	Source Quantity	Units	Total CO_2e Emissions [Tonne CO_2e per year]
Lighting							
Public Lighting[2]	149	kW-hr/capita/yr	0.043	tonne CO_2e/capita/year	24,539	residents (capita)	1,061
Public Lighting Total: 1,061							
Municipal Vehicles							
Municipal Vehicles[3]	--	--	0.05	tonne CO_2e/capita/year	24,539	residents (capita)	1,227
Municipal Vehicles Total: 1,227							
Water and Wastewater [12]							
Groundwater Supply and Conveyance (Potable)[4,5]	950	kW-hr/acre-foot	0.28	tonne CO_2e/acre-foot	7,020	acre-feet/yr	1,940
State Water Project Supply and Conveyance (Potable)[4,6]	3,236	kW-hr/acre-foot	0.94	tonne CO_2e/acre-foot	1,119	acre-feet/yr	1,053
Surface Water[4,6]	370	kW-hr/acre-foot	0.11	tonne CO_2e/acre-foot	2,035	acre-feet/yr	219
Water Treatment (Potable)[7]	463	kW-hr/acre-foot	0.13	tonne CO_2e/acre-foot	10,174	acre-feet/yr	1,371
Water Distribution (Potable)[8]	391	kW-hr/acre-foot	0.11	tonne CO_2e/acre-foot	10,174	acre-feet/yr	1,157
Wastewater Treatment (Indirect Emissions)[9]	815	kW-hr/acre-foot	0.24	tonne CO_2e/acre-foot	10,174	acre-feet/yr	2,411
Wastewater Treatment Plant (Direct Emissions)[10]	--	--	0.084	tonne CO_2e/acre-foot	24,539	residents (capita)	2,070

Table 4-28
GHG Emission Factors for Lytle Creek Ranch Municipal Sources
Rialto, California

Recycled Water Distribution (Non-Potable)[11]	400	kW-hr/acre-foot	0.12	tonne CO_2e/acre-foot	0	acre-feet/yr	0
Water and Wastewater Total:							**10,221**
Municipal Sources Total:							**12,509**

Notes:
1. Public Lighting includes streetlights, traffic signals, area lighting and lighting municipal buildings. Emissions from the Water and Wastewater category are primarily due to the energy required for supply, treatment and distribution. GHG emissions attributed to electricity use are calculated using the SCE carbon-intensity factor.
2. Emission factor for public lighting is based on a study of energy usage and GHG emissions from Duluth, MN (Skoog, 2001) and the electricity generation emission factor from Southern California Edison. Lytle Development Company plans to incorporate energy-saving light fixtures where feasible (Lytle Creek Ranch Specific Plan, 2008). Energy savings from this potential measure were not quantified for this analysis.
3. Emission factors for municipal vehicles are based on the most conservative number from studies of GHG emissions for four cities of different sizes: Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, CA. Population data provided by the US Census (2000).
4. Water supply and conveyance is based on three different sources: groundwater, water purchased from the State Water Project, and surface water. According to the Urban Water Management Plan for West Valley Water District, 69% of the water supply is from groundwater pumping, 11% is from the State Water Project, and 20% is from surface water.
5. Emission factor for groundwater supply and conveyance is based on information provided in CEC 2005 for Chino Basin and the electricity generation emission factor from SCE. This factor is applied to potable water demand.
6. Emission factors for the State Water Project and surface water supply and conveyance are based on information provided by Wilkinson 2000 and CEC 2005. The electricity generation emission factor is based on information from Southern California Edison.
7. Emission factor for water treatment is based on information provided in CEC 2005 and the electricity generation emission factor from Southern California Edison. This factor is applied to potable water demand.
8. Emission factor for water distribution is based on a Navigant Consulting refinement of a CEC study on the energy necessary to distribute 1 million gallons of treated water and the Southern California-specific electricity generation emission factor from Southern California Edison. This factor is applied to potable water demand.
9. Emission factor for wastewater treatment is based information provided in CEC 2005 and the electricity generation emission factor from Southern California Edison.
10. Emission factor for the wastewater treatment plant accounts for direct methane and nitrous oxide emissions from wastewater. The value used here is based on the 2005 US inventory of GHG emissions for domestic wastewater treatment plants (USEPA) divided by the 2005 US population.(25 Tg CO_2e/year/296,410,404 people = 0.084 tonne CO_2e/capita/year)
11. Emission factor for recycled water distribution is based on information provided in CEC 2005 and the electricity generation emission factor from SCE. This factor is applied to non-potable water demand.

Abbreviations:
CEC - California Energy Commission
CO_2e - carbon dioxide equivalent
EMWD - Eastern Municipal Water District
GHG - greenhouse gas
kW-hr - kilowatt hour
MW-hr - megawatt hour
NYSERDA - New York State Energy Research and Development Authority
USEPA - United States Environmental Protection Agency

Table 4-28
GHG Emission Factors for Lytle Creek Ranch Municipal Sources
Rialto, California

Sources:
CCAR Database. SCE PUP Report. 2006.
CEC. 2005. *California's Water-Energy Relationship*. Final Staff Report. CEC-700-2005-011-SF.
CEC. 2006. *Refining Estimates of Water-Related Energy Use in California.* PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December. City of Medford. 2001. Climate Action Plan. October. http://www.massclimateaction.org/pdf/MedfordPlan2001.pdf
City of Northampton. 2006. Greenhouse Gas Emissions Inventory. Cities for Climate Protection Campaign. June. http://www.northamptonma.gov/uploads/listWidget/3208/NorthamptonInventoryClimateProtection.pdf
City of Santa Rosa. Cities for Climate Protection: Santa Rosa. http://ci.santa-rosa.ca.us/City_Hall/City_Manager/CCPFinalReport.pdf
West Valley Water District. 2006. Urban Water Management Plan. January. http://www.scag.ca.gov/rcp/pdf/uwmp/SanBernardino/WVWD-UWMP-2006-2.pdf
Skoog., C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives. October.http://www.ci.duluth.mn.us/city/information/ccp/GHGE USEPA. 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. #430-R-07-002. April. http://epa.gov/climatechange/emissions/downloads06/07Waste.pdf
Wilkinson, Robert. 2000. Methodology for Analysis of the Energy Intensity of California's Water Systems, and An Assessment of Multiple Potential Benefits through Integrated Water-Energy Efficiency Measures.

4.14 Landscaping Equipment (Area Sources)

Landscaping emissions originate from equipment such as lawn mowers, blowers, trimmers and chain saws.[125] For residential areas, landscape-based GHG emissions are directly related to the number of residential units, the annual equipment usage rate, and landscape equipment CO_2 emissions factors. URBEMIS default values were employed for the annual usage rate. Table 4-29 on page 103 shows an estimated 31 tonnes CO_2 will be generated per year.

[125] According to Appendix B of the URBEMIS User's Guide, landscaping emissions from non-residential land uses also includes contributions from air compressors, generators and pumps, which are affiliated with commercial applications.

Table 4-29
GHG Emissions from Area Sources-Landscape Equipment Fuel Combustion
Lytle Creek Ranch
Rialto, California

Land Use Type	Quantity[1]	CO_2 emission factor[2]	Equipment Use Period[3]	Annual CO_2 emission
	(units)	(lbs/unit/day)	(days/year)	(tonne/year)
Single-family residential (DU)[4]	5,254	0.07	180	31
Landscape Equipment Fuel Combustion Total				**31**

Notes:
1. Land use information provided by Lytle Creek Ranch Specific Plan. All DUs in the SFR-1, SFR-2, and SFR-3 land use categories were conservatively treated as single-family dwellings, regardless of the number of units per building.
2. Emission factors provided by URBEMIS, based on estimates using ARB's OFFROAD2007 model.
3. Use period is assumed to be equal to the summer period of 180 days.
4. Based on estimates using the URBEMIS model, emissions from landscaping are mainly attributed to single-family residential land uses; the total acreage of non- residential land uses did not significantly impact the total landscaping CO_2 emissions. Thus, only landscaping emissions associated with single-family residences are calculated here.

Abbreviations:
BU = business unit
DU = dwelling unit
SFR = Single-Family Residential

Sources:
SCAQMD. Software User's Guide: URBEMIS 2007 9.2.4 for Windows. Prepared by Jones & Stokes Associates. November. Available at: http://www.aqmd.gov/CEQA/urbemis.html

4.15 Emissions Sources Not Quantified in Inventory

Several emissions sources were not quantified in this inventory, due to their estimated relatively small[126] contribution to GHG emissions. These sources include emissions from recreational sources and refrigeration leaks which are described in more detail below.[127] Emissions from these sources are expected to be *de minimis*.

4.15.1 Pools and Recreation Centers

The LCR Specific Plan includes neighborhood community areas and parks which may also include pools and recreation centers. At the entitlement stage of development, the degree of uncertainty in the potential end-uses of these recreational areas makes a meaningful quantification of GHG emissions difficult. As a result of this uncertainty, ENVIRON did not quantify these emissions at this time.

4.15.2 Refrigeration Leaks

Emissions associated with leaks of high global warming potential gases such as from refrigeration leaks were not quantified. At the entitlement stage of development, the degree of uncertainty in the potential facilities with sources that may have refrigeration leaks make a meaningful quantification of GHG emissions difficult. In addition, since refrigeration systems will be new, they are likely efficient and should be designed to reduce the amount of leaks of high global warming potential gases. As a result of this uncertainty, ENVIRON did not quantify these emissions at this time.

4.16 Project Design Features that Reduce GHG Emissions

The LCR development incorporates many design features to reduce GHG emissions. This section describes the design features that were incorporated into this analysis either directly or indirectly. This section also lists those features that were not quantified in this analysis, but would likely yield further GHG emissions reductions.

4.16.1 Project Design Features whose Emissions Reductions were Incorporated into the Analysis

4.16.1.1 Reductions in emissions from mobile sources

Project design will provide physical linkages between land uses that promote walking and bicycling and provide alternatives to automobile use.

Lytle Creek Ranch will link together parks and other activity nodes on-site via a 23.5-acre “Grand Paseo”.

The compact building design approach to be used at LCR will reduce its footprint and allow for transportation and open space corridors.

[126] Typically less than 1% of the overall inventory based upon previous studies.

[127] Black carbon was also not considered. Major sources of black carbon emissions are not present at LCR.

The commercial areas in each will be centrally located and walkable.

The circulation system has been designed to encourage residents to make multiple stops per trip[128].

4.16.1.2 Vegetation preservation

829 acres will be preserved in its existing natural habitat, as part of the Open Space and Conservation Plan prepared for Lytle Creek Ranch.

Up to 30,000 trees will live within Lytle Creek Ranch.

4.16.1.3 Energy Savings

Homes and businesses will exceed the 2008 Energy Efficiency Standards by at least 15%.

Where appliances are offered by homebuilders, Energy Star appliances will be installed.

The following project design features, while not individually quantified, may be incorporated to meet the 15 percent reduction over 2008 Energy Efficiency Standards to which the applicant has committed. Installation of (a) energy-efficient heating and cooling systems, equipment, and control systems: (b) GE Energy Monitoring Dashboards to provide real-time and historical feedback to residents on their homes' energy consumption; lighting control systems; and (d) light-colored "cool" roofs.

4.16.1.4 Area Sources

Wood-burning fireplaces are prohibited.

4.16.2 Features whose Emissions Reductions were not Incorporated into the Analysis but would yield further GHG emissions savings

There are number of design features that will result in the reduction of GHG emissions from the project. These cannot be quantified, but they are listed in this section.

4.16.2.1 Energy Use in the Built Environment

- Purchase of green power beyond the requirements of the RPS
- Installing additional energy efficient appliances (clothes dryers, ventilation fans, and ceiling fans) – e.g., Energy Star or equivalent
- Installing efficient pumps and motors for pools and spas
- Installing LEDs for traffic and street
- Providing education on energy efficiency, water conservation, and waste recycling services
- Installing HVAC, refrigeration, and fire suppression equipment that do not contain CFCs

[128] This design encourages pass-by trips, which decrease overall VMT as estimated by URBEMIS. Pass-by trips are discussed in section 4.10.1.5.

- For mechanically or naturally ventilated spaces in the building, meet the minimum requirements of Section 121 of the California Energy Code or the applicable local code, whichever is more stringent
- MERV 6 or higher filters are installed on central air and heating systems

4.16.2.2 Reductions in emissions from mobile sources

- Connections to mass transit facilitate and promote alternative transportation.
- Bicycle friendly environment

4.16.2.3 Water conservation

- Turf will not occupy more than 60% of the landscaped area in the home lots.

4.16.2.4 Solid Waste

- Recycling centers will be provided in readily accessible areas within buildings for depositing, storage, and collection of non-hazardous materials for recycling.

4.17 Summary of Emissions from LCR

The emissions and relative magnitude of emissions from the various aspects of LCR when AB 1493 is excluded and included in the analysis are presented in Tables 4-30 and 4-31 on pages 108 and 109, respectively. One-time vegetation emissions are estimated to be -1,120 tonnes CO_2; the negative value indicates a one-time net decrease in emissions. One-time construction emissions are estimated to be 257,552 tonnes CO_2e. Emissions from mobile sources are estimated to be 57,265 tonnes CO_2e per year when Pavley is considered, or 58% of the annual project emissions. Emissions from residential buildings of 21,530 tonnes CO_2e per year comprise 22% of the annual project emissions. Emissions from non-residential buildings of 4,386 tonnes CO_2e per year comprise 4% of the annual project emissions. Emissions from municipal sources (water distribution, public lighting, and municipal vehicles) are estimated to be 12,509 tonnes or 13% of the annual project emissions. Emissions from area sources (fireplaces and lawn maintenance) are estimated to be 2,370 tonnes, or 2% of annual project emissions. If the one-time emissions are annualized assuming a 40-year development life the annual emissions are 104,470 tonnes per year including the impact of Pavley standards.

As noted in Section 3 of this report, AB 32 requires that GHG emissions from California be reduced to 1990 levels by 2020. This represents a reduction of approximately 28.5% from projected 2020 growth. In addition to reducing overall energy consumption, the goals of AB 32 are likely to be reached by increasing renewable or non-carbon producing electricity production, and changing the transportation system to rely on a set of low carbon fuels. Although some measures that are being implemented as a part of AB 32 are incorporated into the calculations, such as the new fuel efficiency standards and the renewable power standard, other measures that have yet to be implemented are not included. Accordingly, actual emissions are likely to be lower as more measures to implement AB 32 are enacted. Section 5 puts LCR emissions in context, and includes an analysis of a BAU scenario compared to LCR.

Furthermore, Governor Schwarzenegger's Executive Order S-3-05 set a target to reduce GHG emissions by 2050 to levels 80% less than the 1990 levels. It is likely that future measures will be implemented to reach this goal that similarly may result in reductions of GHG emissions for sources in LCR beyond those stated in this report.

Table 4-30
Summary of Greenhouse Gas Emissions for Lytle Creek Ranch Excluding Pavley Standards
Lytle Creek Ranch
Rialto, California

Source	GHG Emissions		Percentage of Annual CO_2e Emissions[7]
			(%)
Vegetation[1]	tonnes CO_2e total	-1,120	NA
Construction (Non-Building)[2]		118,160	NA
Construction (Buildings)[2]		139,392	NA
Total (one time emissions)		256,432	NA
Residential[3]	tonnes CO_2e/year	21,530	19%
Non-Residential[4]		4,386	4%
Mobile[5]		71,114	64%
Municipal[6]		12,509	11%
Area		2,370	2%
Total (annual emissions)		111,908	NA
Annualized Total[8]	**tonnes CO_2e/year**	**118,319**	**NA**

Notes:
1. Vegetation emissions are one-time emissions resulting from the removal of existing vegetation and planting of new vegetation in Lytle Creek Ranch. The emissions are estimated assuming that all carbon currently sequestered in the biomass of the vegetation is released to the atmosphere upon removal of the vegetation. A total of 1356.3 acres of existing vegetation is considered to be removed for development purposes. Data for emissions calculations are primarily from the IPCC Guidelines for National Greenhouse Gas Inventories.
2. Construction emissions are one-time emissions reported in total metric tonnes during the construction period 2009-2011. Emissions are calculated using URBEMIS default values, EMFAC2007 and model inputs prepared by PCR Services. Sources of emissions include construction equipment (building-related emissions) and vehicles associated with worker commuting and vendor trips (non- building emissions).
3. Residential emissions for single family and apartment DUs include emissions associated with electricity and natural gas use. Emissions estimates were developed from RECS database and the BARBD. As specified in the report "Lytle Creek Ranch DEIR No. 471", a total of 8407 DUs are considered.
4. Non-Residential emissions for grocery, misc. retail/commercial/office, hotel, public safety, and institutional buildings account for electricity and natural gas use. Emissions estimates for non- residential buildings were developed from the 2003 Commercial Buildings Energy Consumption Survey (CBECS), published by the US EIA.
5. Mobile source emissions were calculated using EMFAC emission factors with trip rates and VMT prepared by Crain and Associates. Mobile source emissions account for residential trips. CO2 emissions were scaled to reflect CO2e emissions based on data from the USEPA.
6. Municipal emissions account for emissions due to energy production associated with water supply, public/street lighting, and municipal vehicles. Energy use estimates for water supply are based primarily on CEC's 2005 "California's Water-Energy Relationship" report Emissions from street lighting and municipal vehicles were based upon studies of other cities.
7. Percentages only apply to annual CO_2e emissions; annual and one-time CO_2e emissions cannot be directly compared.
8. One-time emissions (vegetation and construction) are "annualized" in this Total row. This is done by dividing by an annualization factor, 40 years, effectively converting the one-time emission into an annual emission rate. One-time emissions are not annualized in their respective rows above.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
EIA - Energy Information Administration
EIR - Environmental Impact Report
EMFAC - Emission Factors Database
GHG - Greenhouse Gas
N_2O - nitrous oxide
TBD - to be determined
VMT - Vehicle Miles Traveled

Table 4-31
Summary of Greenhouse Gas Emissions for Lytle Creek Ranch including Pavley Standards
Lytle Creek Ranch
Rialto, California

Source	GHG Emissions		Percentage of Annual CO_2e Emissions[7]
			(%)
Vegetation[1]	tonnes CO_2e total	-1,120	NA
Construction (Non-Building)[2]		118,160	NA
Construction (Buildings)[2]		139,392	NA
Total (one time emissions)		**256,432**	NA
Residential[3]	tonnes CO_2e / year	21,530	22%
Non-Residential[4]		4,386	4%
Mobile[5]		57,265	58%
Municipal[6]		12,509	13%
Area		2,370	2%
Total (annual emissions)		**98,059**	NA
Annualized Total[8]	**tonnes CO_2e / year**	**104,470**	**NA**

Notes:

1. Vegetation emissions are one-time emissions resulting from the removal of existing vegetation and planting of new vegetation in Lytle Creek Ranch. The emissions are estimated assuming that all carbon currently sequestered in the biomass of the vegetation is released to the atmosphere upon removal of the vegetation. A total of 1356.3 acres of existing vegetation is considered to be removed for development purposes. Data for emissions calculations are primarily from the IPCC Guidelines for National Greenhouse Gas Inventories.
2. Construction emissions are one-time emissions reported in total metric tonnes during the construction period 2009-2011. Emissions are calculated using URBEMIS default values, EMFAC2007 and model inputs prepared by PCR Services. Sources of emissions include construction equipment (building-related emissions) and vehicles associated with worker commuting and vendor trips (non- building emissions).
3. Residential emissions for single family and apartment DUs include emissions associated with electricity and natural gas use. Emissions estimates were developed from RECS database and the BARBD. As specified in the report "Lytle Creek Ranch DEIR No. 471", a total of 8407 DUs are considered.
4. Non-Residential emissions for grocery, misc. retail/commercial/office, hotel, public safety, and institutional buildings account for electricity and natural gas use. Emissions estimates for non- residential buildings were developed from the 2003 Commercial Buildings Energy Consumption Survey (CBECS), published by the US EIA.
5. Mobile source emissions were calculated using EMFAC emission factors with trip rates and VMT prepared by Crain and Associates. Mobile source emissions account for residential trips. CO2 emissions were scaled to reflect CO2e emissions based on data from the USEPA.
6. Municipal emissions account for emissions due to energy production associated with water supply, public/street lighting, and municipal vehicles. Energy use estimates for water supply are based primarily on CEC's 2005 "California's Water-Energy Relationship" report Emissions from street lighting and municipal vehicles were based upon studies of other cities.
7. Percentages only apply to annual CO_2e emissions; annual and one-time CO_2e emissions cannot be directly compared.
8. One-time emissions (vegetation and construction) are "annualized" in this Total row. This is done by dividing by an annualization factor, 40 years, effectively converting the one-time emission into an annual emission rate. One-time emissions are not annualized in their respective rows above.

Abbreviations:

CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
EIA - Energy Information Administration
EIR - Environmental Impact Report
EMFAC - Emission Factors Database
GHG - Greenhouse Gas
N_2O - nitrous oxide
TBD - to be determined
VMT - Vehicle Miles Traveled

4.18 Life Cycle Emissions of Building Materials

An estimate of "life-cycle" GHG emissions (i.e., GHG emissions from the processes used to manufacture and transport materials used in the buildings and infrastructure) is presented in this section and attached as Appendix E. This estimate is to be used for comparison purposes only and is not included in the final inventory as these emissions would be attributable to other industry sectors under AB 32. For instance, the concrete industry is required by law to report emissions and undergo certain early action emission reduction measures under AB 32. Furthermore, for a life-cycle analysis for building materials, somewhat arbitrary boundaries must be drawn to define the processes considered in the life-cycle analysis.[129] Recognizing the uncertainties associated with a life-cycle analysis, the California Air Pollution Control Officers Association (CAPCOA) released a white paper which states: "The full life-cycle of GHG emissions from construction activities is not accounted for in the modeling tools available, and the information needed to characterize GHG emissions from manufacture, transport, and end-of-life of construction materials would be speculative at the CEQA analysis level.[130]"

The calculations and results discussed here and presented more fully in Appendix E are estimates and should be used only for a general comparison to the overall GHG emissions estimated in the Climate Change Technical Report. Life Cycle Assessment (LCA) emissions vary based on input assumptions and assessment boundaries (e.g., how far back to trace the origin of a material). Assumptions made in this report are generally conservative. However, due to the open-ended nature of LCAs, the analysis is highly uncertain.

Appendix E is an ENVIRON report that evaluates the life cycle GHG emissions associated with the building materials for this project. The life cycle GHG emissions include the embodied energy from the materials manufacture and the energy used to transport those materials to the site. The report then compares the life cycle GHG emissions to the overall annual operational emissions. The materials analyzed in the report include materials for 1) residential and non-residential buildings, and 2) site infrastructure. This report calculates the overall life cycle emissions from construction materials to be approximately 32,061 – 345,545 tonnes CO_2 / year. This represents 1% to 9% of the annualized GHG emissions[131] from the LCR area, assuming a 40 year lifespan of the project as described below.

The report estimated the life cycle GHG emissions for buildings by conducting an analysis of available literature on LCAs for buildings. According to these studies, approximately 75 - 97% of GHG emissions from buildings are associated with energy usage during the operational phase; the other 3 - 25% of the GHG emissions are due to material manufacture and transport. Using

[129] For instance, in the case of building materials, the boundary could include the energy to make the materials, the energy used to make the machine that made the materials, and the energy used to make the machine that made the machine that made the materials.

[130] CAPCOA. 2008. CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act. Available online at: http://www.capcoa.org/ceqa/?docID=ceqa&PHPSESSID=df1348d6f7eff0fc2a8263d19f6d10dd

[131] The LCA emissions occur one time throughout the life of the project, and consequently are annualized over a 40 year project life for comparison to the annual project emission total.

the GHG emissions from the operation of buildings, 3% to 25% of building emissions corresponds to approximately 0.8 - 9% of the project emissions.

The report calculated the life cycle GHG emissions for certain components of infrastructure (roads, storm drains, utilities, gas, electricity, and cable). This analysis considered the manufacture and transport of concrete and asphalt only, as ENVIRON assumed that other construction materials such as steel would be present in much smaller quantities. Because the manufacture of concrete has a higher CO_2 emission factor and most construction estimates higher quantities of concrete than asphalt, the majority of the emissions for infrastructure result from the manufacture of concrete. Because the asphalt and concrete are locally sourced, the transportation emissions are relatively small. If a 40 year lifespan of the infrastructure is assumed, the total annualized emissions from embodied energy in infrastructure materials are approximately 0.2% of the project emissions.

The overall life cycle emissions, annualized by 40 years, are 1,044 – 8,881 tonnes CO_2 / year, or 1.1% – 9% of the annualized GHG emissions from the LCR project. The bulk of these emissions (0.8 – 9%) are from general life cycle analysis studies and do not reflect specific information from LCR.

Again, note that the calculations and results presented in this life cycle report are estimates and should be used only for a general comparison to the overall GHG emissions estimated in the Climate Change Technical Report. LCA emissions vary based on input assumptions and assessment boundaries (e.g., how far back to trace the origin of a material). Assumptions made in this report are generally conservative. However, due to the open-ended nature of LCAs, and the fact that literature evaluation, not site-specific studies were used to analyze the embodied energy, the analysis should be considered to yield highly uncertain results. Additionally, these estimates likely double count emissions from other industry sectors.

5 Inventory in Context

5.1 Comparison with State, Global, and Worldwide GHG Emissions

The emissions from the project at build-out are compared to California and global GHG emissions to put the emissions from the project in context. The project's annual emissions are approximately 98,059 metric tonnes CO_2e per year, and 256,432 tonnes of one-time emissions. (Table 4-31 on page 109). If the one-time emissions are annualized by a development lifetime of 40 years (6,411 tonnes CO_2e per year), the overall yearly emissions are approximately 104,470 tonnes CO_2e per year. (Table 4-31 on page 109). This is equivalent to approximately 4.3 tonnes per capita per year.[132]

In comparison, worldwide emissions of GHGs in 2004 were 26.8 billion tonnes of CO_2e per year (Table 5-1 on page 114).[133] In 2004, the US emitted about 7 billion tonnes of CO_2e.[134] In 2004, California emitted 0.480 billion tonnes of CO_2e, or about 7% of the US emissions. The 98,059 tonnes of CO_2e per year from LCR would be approximately 0.00037% of the world wide emissions, 0.00140% of the United State's emissions, or 0.0204% of California's annual GHG emissions.

5.2 Comparison to Business as Usual Scenario

As noted earlier, AB 32 requires that statewide GHG emission in 2020 be equal to 1990 levels. California-wide GHG emissions in 1990 were 0.427 billion tonnes. It is projected that emissions in 2020 under a BAU scenario accounting for growth will be 0.596 billion tonnes. This would require a 28.5% decrease in emissions from BAU by 2020 to achieve AB 32 goals.

To determine the Project's GHG emissions impacts under CEQA, the GHG inventory was evaluated against a threshold of significance defined as consistency with AB 32 goals, as demonstrated by achieving at least a 28.5% reduction in GHG emissions over the BAU scenario. The BAU scenario consists of projected emissions for LCR that would occur from the project if it were to be built without the project design features and energy reduction commitments made by Lytle Development Company, and without the regulations that have been promulgated to comply with AB 32.

The major categories of the GHG emission inventory are considered separately below. These include residential and non-residential buildings, mobile sources, municipal lighting, and water sources. or each source category the BAU scenario assumptions and the estimated emissions associated with these assumptions are presented; project scenario assumptions and emissions have already been summarized in Chapter 4. The remaining source categories (municipal vehicles and area sources) represent a small fraction of the total inventory and do not have

[132] Assuming a LCR population of 24,539.

[133] Sum of Annex I and Annex II countries without counting Land-Use, Land-Use Change and Forestry (LULUCF) http://unfccc.int/ghg_emissions_data/predefined_queries/items/3814.php For countries that 2004 data was unavailable, the most recent year was used.

[134] 2006 Inventory of US GHG Emissions and Sinks. Available online at: http://www.epa.gov/climatechange/emissions/downloads06/06_Complete_Report.pdf

appropriate emission factors to quantify the reductions that are likely to occur at LCR compared to BAU. The chapter concludes with an overall summary of the emission reductions relative to BAU, when all source categories are considered cumulatively.

5.2.1 Vegetation

Lytle Development Company has committed to preserving 908 acres of land in its natural state instead of building out in this area. In addition, Lytle Development Company has committed to planting 30,000 new trees. The BAU analysis for vegetation assumes that neither of these commitments are taken and the land is fully developed, without replanting. Tables 5-2 through 5-5 on pages 115 through 118 follow the same methodology presented in section 4.5 of this report. The BAU vegetation results in a one-time release of 32,388 tonnes CO_2e, the sequestration capacity of the removed vegetation, which contrasts with the net increase in sequestration capacity for the project.

Table 5-1
Lytle Creek Ranch Context Supporting Calculations
Lytle Creek Ranch
Rialto, California

	Tonnes / Year	%
2004 World Emissions	2.68E+10	0.00039%
2004 USA Emissions	7.00E+09	0.00149%
2004 CA Emissions	4.80E+08	0.0218%
Total Project Annual Emissions	1.04E+05	

Lytle Creek Ranch Population	**24,539**

	Tonnes CO_2 / year	Tonnes / capita / year
Lytle Creek Ranch Mobile Emissions	57,265	2.3
Lytle Creek Ranch Residential Emissions	21,530	0.9
Lytle Creek Ranch Mobile + Residential	78,794	3.2

Table 5-2
BAU CO_2 Sequestration Change due to Land Use Change
Lytle Creek Ranch
Rialto, California

Vegetation Type[1]	IPCC Designation[2]	IPCC Sub qualification	Tons Dry Matter Carbon/Acre[3]	Sequestered CO_2 / Acre[4]	Total Impacted Area[5]	CO_2 Sequestration Capacity of Removed Vegetation
			[tonne/acre]	[tonne/acre]	[acres]	[tonne]
Scrubland	Forest Land	Scrub	3.9	14.3	2,264.3	32,388
GRAND TOTAL			3.9	14.3	2,264.3	32,388

Notes:
1. Land types shown here represent vegetation that will be potentially removed upon development.
2. Land types are mapped to generalized IPCC Land Designations (IPCC 2006).
3. Dry matter carbon per acre was determined from information contained in Table 5-3.
4. It is conservatively assumed that all carbon is eventually converted into CO_2. Multiply the mass of carbon by 3.67 to calculate the final mass of CO_2 (the molecular mass of CO_2/ the molecular mass of carbon is 44/12 or 3.67).
5. Data provided by Lytle Development Company. A positive number indicates land is removed. For the BAU scenario, approximately 908 additional acres of shrublands are converted to settlements, relative to the Project scenario (which includes 1,356.3 converted acres).

Abbreviations:
BAU - business as usual

Sources:
Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines). Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm

Table 5-3
BAU Carbon per Acre for IPCC Land Types
Lytle Creek Ranch
Rialto, California

IPCC Designation	Sub qualification	Above Ground Biomass[1]	Ratio of Above Ground / Below Ground Biomass[2]	Total Biomass	Total Biomass[3]	Tonnes Dry Matter Carbon/Acre[4]
		[tonne d.m./acre]		[tonne d.m./Hectare]	[tonne d.m./acre]	[tonne/acre]
Forest Land	Scrub	5.7	2.17	20.5	8.3	3.9
Forest Land	Trees	52.6	4.35	159.9	64.7	30.4

Notes:
1. Numbers listed are used in conjunction with above ground/below ground ratios to calculate total biomass per acre. Values from source converted to tonne/acre.
2. This value is used to calculate total biomass when data for the total biomass is not available for a particular land type.
3. Total biomass is either 1.) Listed directly in the IPCC protocol, or 2.) Calculated from above ground biomass and the Above Ground / Below Ground biomass ratios as follows: Total
= Above + (Above / [Above:Below Ratio]). Values from source converted to tonne/acre as necessary.
4. Total biomass multiplied by carbon fraction in plant material (0.47) to calculate carbon content. From IPCC (2006), default value for Forest Land (Table 4.3 of IPCC). Here, it is assumed that agricultural vegetation has the same carbon fraction as other vegetation types.

Abbreviations:
BAU - business as usual
d.m. - dry mass

Sources:
Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines). Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm

Table 5-4
BAU CO_2 Sequestration Capacity of New Vegetation Plantings
Lytle Creek Ranch
Rialto, California

Vegetation Species[1]	IPCC Species Class Designation	Sequestered CO_2 / Unit[2] [tonne/unit/year]	Unit	Total Quantity of New Vegetation[1]	Unit	CO_2 Sequestration Capacity of New Vegetation[3] [tonne]
Pine	Pine	0.032	trees	0	trees	0
Miscellaneous	Miscellaneous	0.035	trees	0	trees	0
Total				**0**	**tree**	**0**

Notes:
1. Site-specific planting data provided by Lytle Development Company.
2. Species class-specific sequestration values are provided in Table 8.2 of "2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume
4". For species that do not appear in Table 8.2, the species was classified as "miscellaneous" and the average value of all listed data was used.
3. An active growing period of 20 years was assumed for the new trees planted.

Abbreviations:
BAU - business as usual

Sources:
Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines). Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm

Table 5-5
BAU Change in CO_2 Sequestration due to Land Use Changes and New Vegetation Plantings
Lytle Creek Ranch
Rialto, California

CO_2 Sequestration Capacity of Vegetation	CO_2 Sequestration Capacity of New Vegetation	Net Change in CO_2 Sequestration Capacity[1]
[tonne]	[tonne]	[tonne]
-32,388	0	-32,388

Notes:
1. A positive value represents an increase in sequestration capacity and thus a net reduction in CO_2.

Abbreviations:
BAU - business as usual

5.2.2 The Built Environment

The energy use and GHG emissions from the modeled homes for LCR were compared to the energy use and GHG emissions from a minimally Title 24 compliant building of the same size, based on 2005 Title 24 requirements. It was also assumed that the comparison homes had standard appliances instead of Energy Star appliances. Finally, it was assumed that the fraction of renewable energy supplied to the project would remain at present levels. The input parameters to the URBEMIS operational mitigation component that were used to model the mitigated scenario are shown in Table 5-6 on page 123.The same distribution of home sizes and climate zone location is used for the BAU analysis. As illustrated in the tables presented in Section 4.7, LCR is 29% lower than the BAU home for emissions from energy use covered by 2008 Energy Efficiency Standards. In addition, when major appliances are considered, GHG emissions from the homes of LCR are 27% lower than homes meeting the 2005 Energy Efficiency Standards (and approximately 22% more efficient than the 2008 Energy Efficiency Standards homes). When the rest of plug-in energy use is considered, emissions from LCR homes are 29% lower than 2005 homes and approximately 24% lower than the 2008 Energy Efficiency Standards homes. These comparisons are summarized in Table 4-17 on page 72. It is important to recognize areas in which the developer has control over the energy use, i.e. building envelope and major appliances, show an improvement over BAU. This comparison does not take into account the energy use of occupants, which is expected to decrease as people become more conscious of energy use and climate change issues, and more sensitive to the cost of energy.

CO_2 emissions per DU for LCR homes are approximately 13.5 tonnes per DU per year excluding renewable energy reductions. For the BAU housing, emissions are approximately 16.7 tonnes per DU per year. LCR homes, per DU, emit approximately 3.2 tonnes less CO_2 per year than the BAU housing.

Homes in LCR are 15% more energy efficient than a minimally 2008 Energy Efficiency Standards compliant home. As such, LCR residential units are heading toward meeting AB 32 goals on a per DU basis, without any decrease in GHG intensity from energy production, which is likely to occur. It also does not account for changes in occupant behavior and on-site renewable energy.

A similar comparison for non-residential buildings compares LCR non-residential building energy use and GHG emissions from a minimally 2005 Energy Efficiency Standards compliant building[135]. The same mix of non-residential building types and square footage is assumed. For energy use subject to Title 24, the LCR non-residential buildings will be 15% more efficient than the 2008 Energy Efficiency Standards (per the Lytle Development Company's commitment). Unlike residential homes, the developer has little control over the appliances and plug-in energy use that will occur in the buildings.

[135] The comparison is to the 2005 Title 24 standards, which were in effect in 2008.

There are some uncertainties and limitations that need to be pointed out for the non-residential building BAU comparison. ENVIRON used a baseline energy use value for non-residential buildings based upon survey data of current building stock. Although the correct comparison for BAU is with the Title 24 standards that were in effect in 2008 (i.e., the 2005 version of Title 24) as assumed in the scoping plan[136], a direct comparison with these standards are not available. Current building stock is likely less efficient than the requirements for new buildings under Title 24, however, this was assumed to be the baseline values in this analysis since a better comparison of a standard Title 24 compliant building was not available.[137] Additionally, a generic mix of non-residential building uses was assumed in determining percentage reduction from electricity and natural gas. To the extent that LCR's mix changes the calculated savings may differ.

5.2.3 Transportation

The BAU scenario differs from the project scenario in two main ways: trip rates and emission factors. With respect to emission factors, transportation emissions presented here are based upon EMFAC2007 values for the year 2030, which are based upon past vehicle emission trends and do not incorporate future regulatory actions. ENVIRON estimated the trip rates for a BAU scenario assuming no project design features such as mixed use, local serving retail, and pedestrian friendliness. In addition, it was assumed that the same 8,407 DUs would be developed at a lower density, comparable to that of the nearby areas of the City of Rialto. It was further assumed that the 8,407 dwelling units would be built with a mix of single family and multifamily residences proportional to that in the City of Rialto. The density for single family homes in the BAU case was based on the minimum lot size in the City of Rialto. The density for multi-family homes in the City of Rialto was based on URBEMIS defaults.[138,139]

URBEMIS methodology was used to estimate the impact on trip generation of both the increased density of the project relative to the BAU scenario and the mitigation factors. The input parameters for URBEMIS that were used to model the mitigated scenario for transportation GHGs are shown in Table 5-6 on page 123. Two scenarios were modeled in URBEMIS, one using the LCR housing mix and density as well as the LCR mitigation factors (the "mitigated scenario") and one using the housing mix and density based on the City of Rialto, and not including mitigation factors (the "low-density unmitigated scenario"). The URBEMIS methodology for adjusting ITE trip generation rates results in an increase in the trip rates associated with these 8,407 dwelling units in the low-density unmitigated scenario due to the decreased density of the dwelling units and removal of other project design features. Table

[136] Standards in effect in 2008 were the 2005 Title 24 Standards. 2008 Standards take effect in 2009.

[137] In a comparative analysis it is important to consider the percent difference between the proposed scenario and the BAU scenario. The proposed scenario is based on energy consumption data for current building stock (rather than new buildings compliant with current building energy standards). Since the BAU scenario is based on the same core data set, the calculated percent difference is due only to the differences between the two scenarios.

[138] The ratio of single family to multi-family houses in the BAU case was based on 2005-2007 census data for the City of Rialto. 1-unit attached, 1-unit detached, and 2-unit buildings were considered to be single family. All others excluding mobile homes and vans were assumed to be multi-family.

[139] The default for low-rise apartments (three or fewer levels) and condo/townhouses (two or fewer levels) was used. It is ENVIRON's understanding that Rialto has few, if any, residential high-rises.

5-7 on page 124 shows the residential land use inputs and the trip rates and daily trips for the two scenarios, based on the URBEMIS output.[140]

5.2.3.1 Estimating reduction in trip generation rates

This section summarizes the general approach used to estimate trip rates made by the residents for the BAU scenario. As described above, the first step was to quantify the impact of the density of the LCR project and the mitigation factors included in the project relative to the BAU scenario. This was done using URBEMIS. Both scenarios were modeled using the same methodology, described in more detail below.

As discussed above, the trips generated by the residents of LCR represent growth. However, new non-residential areas do not necessarily represent growth since people would already be taking these trips. The new non-residential areas will only serve to displace the location of trips. Therefore we will only account for trips generated from the residential land uses to determine the GHG emissions from the LCR scenario and the low-density unmitigated scenario.

URBEMIS uses the trip generation rates based on ITE trip generation rates for each land use type. ITE trip generation rates vary over a range depending on several factors. For housing types, a key feature that changes trip rate is housing density. It has been determined that housing density scales with trip rates according to the following equation[141]:

$$Trip\ reduction = 0.6 \cdot \frac{1 - 19749 \cdot \left(\frac{4.814 + DU / Ac}{4.814 + 7.14} \right)^{-.0639}}{25914}$$

Where:

Trip reduction = The percent reduction from average ITE trip generation rate.

DU/ac = The number of dwelling units per acre for a specific land use type.

Thus, there is a sizable reduction in trips as compared to the average ITE trip generation rate for the housing density planned for LCR. URBEMIS has adopted the methodology of accounting for other project design features as reductions in the number of trips taken for a specific land use. For LCR, this includes a trip reduction for mixed-use development, local serving retail, mass transit, a pedestrian factor, and a bicycle friendliness factor.[142] These along with housing density modify the trip rate for the housing land use categories.

[140] URBEMIS files provided to ENVIRON by PCR Services Corporation on 6/5/2009.

[141] Appendix D page D-15 of URBEMIS User's Guide.

[142] All of these trip rate reductions follow the methods described in URBEMIS User's Guide Appendix D.

It is likely that a portion of the LCR residents would take public transportation when travelling out of LCR. Lytle Development Company has committed to enhancements of the public transportation in the region. Trip reductions due to bus and Metrolink rail travel were taken into account in the URBEMIS model, as were reductions due to pedestrian and bicycle-friendly design. URBEMIS uses a Transit Service Index which incorporates frequency of service but weights rail more heavily than bus transit. Trip reductions due to mode shifts incorporate the Transit Service Index and a pedestrian/bicycle score.[143]

The value calculated here includes all VMT generated by LCR residents commuting within LCR and all VMT generated by LCR residents commuting to and from LCR. According to the methodology above, 49,946[144] added trips per day are associated with LCR (the mitigated scenario), as shown in Table 5-7 on page 124. The low-density unmitigated scenario generates an added 70,377 added trips per day, or 141% of the trips associated with the mitigated scenario.

This ratio of trips generated for the low-density unmitigated scenario relative to the mitigated scenario was used to scale the VMT estimated using the EVTM model, resulting in an estimate of the VMT associated with the BAU scenario. This approach assumes that trip distances are the same in the two scenarios. This methodology results in an estimate of 66,970 added trips per day and 702,010 added vehicle miles traveled per day associated with the BAU scenario, as shown in Table 5-8 on page 125.

These modified trip rates were applied to the same methodology outlined for the traffic calculations including the weekend trip rate adjustment. Table 5-8 on page 125 shows a total VMT for the BAU scenario as 256,263,761 miles per year. In addition the BAU scenario would release 100,168 tonnes of CO_2e per year, as shown in Table 5-9 on page 126. Table 5-10 on page 127 shows that this is equivalent to 30,479 miles per dwelling unit.

Table 5-10 on page 127 shows that the annual VMT per dwelling unit for LCR is 21,638 miles. A 1995 study prepared for ARB determined that annual VMT per dwelling units under “smart growth” principles should be 22,000 to 25,000 miles for sub urban level 3 areas[145]. Thus, LCR will generate less VMT on a per-dwelling-unit basis than the ARB report suggests for a "smart growth" development.

Table 5-10 on page 127 also shows that LCR represents a 29% reduction in VMT and 43% reduction in CO_2e emissions per year compared to BAU.

[143] Equations can be found on page 38 of the URBEMIS User’s Guide.

[144] 49,946 added weekday trips were predicted using the URBEMIS model as described in this section. This URBMIS based value was used in this analysis only to establish the percent trip reduction relative to the BAU scenario also modeled in URBEMIS. The EVTM model estimate of 47,545 added daily trips provided by Crain and Associates was used to calculate project emissions. Note that the difference between the two methodologies is less than 5%.

[145] JHK & Associates, Inc. 1995. Transportation-Related Land Use Strategies to Minimize Motor Vehicle Emissions: An Indirect Source Research Study. June.

Table 5-6
URBEMIS Operational Mitigation Component Inputs for Mitigated Scenario
Lytle Creek Ranch
Rialto, California

Category	URBEMIS Operational Mitigation Parameter	Value
Residential and Nonresidential Mix of Uses	Number of Housing Units within 1/2 mile radius[1]	11,723
	Study Area Employment	3,596
Local Serving Retail	Presence of Local Serving Retail	Present
Transit Enhancing Infrastructure[2]	Number of Daily Weekday Buses	34
	Number of Daily Rail or Rapid Transit Buses	19
	Number of Dedicated Daily Shuttles	0
Bicycle and Pedestrian[3]	Number Intersections per Square Mile	0
	Percent of Streets with Sidewalks on One Side	100%
	Percent of Streets with Sidewalks on Both Sides	70%
	Percent of Arterials/Collectors with Bike Lanes	100%

Notes:
1. Number of Housing Units within a 1/2 mile radius and Study Area Employment were provided by PCR Services. URBEMIS files provided on 6/5/2009.
2. Number of daily buses, rail, and rapid transit buses were provided by Lytle Development Company
3. Bike and pedestrian physical design features were provided by Lytle Development Company

Sources:
Software User's Guide: URBEMIS2007 for Windows. November 2007. Appendix D. URBEMIS2007 Mobile Source Mitigation Component

Table 5-7
Trip Generation Rates Based on URBEMIS
Lytle Creek Ranch
Rialto, California

Residential Housing Type	Number of Units[1]	URBEMIS Trip Rate[4] (trips per day per unit)	URBEMIS based Unadjusted Daily Production Trips[2]
Mitigated Scenario[2]			
Single Family House	3,409	6.86	23,401
Condo/townhouse General	4,998	5.31	26,562
		Total Trips:	**49,964**
Unmitigated Low-Density Scenario[3]			
Single Family House	6,759	8.73	59,006
Condo/townhouse General	1,648	6.90	11,371
		Total Trips:	**70,377**
Ratio of low-density unmitigated scenario trips to mitigated scenario trips:			**141%**

Notes:
1. Number of units and housing type for each phase for the mitigated scenario are based on the Lytle Creek Ranch Specific Plan. Numbers of units and housing types for the low-density scenario are based on the City of Rialto. Proportions are derived from the 2005-2007 American Community Survey Housing Units data.
2. The mitigated scenario takes into account housing density, mixed of uses, local serving retail, mass transit, and pedestrian and bicycle friendliness.
3. The unmitigated low-density scenario takes into account the average density of the nearby section of the City of Rialto and does not account for any mitigation measures.
4. Based on numbers from URBEMIS file output. Unadjusted Daily Trips = No. Units x Trip Rate

Sources:
United States Census Bureau. Selected Housing Characteristics: 2005-2007. American Community Survey. http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=16000US0660466&- qr_name=ACS_2007_3YR_G00_DP3YR4&-ds_name=ACS_2007_3YR_G00_&-_lang=en&-_sse=on

Table 5-8
BAU Generation Rates and Vehicle Miles Based on Scaled Traffic Modeling
Lytle Creek Ranch
Rialto, California

EVTM Mitigated Project Scenario[1]			URBEMIS based Ratio of Mitigated Trips to Unmitigated Low Density Trips[2]	Unmitigated Low-Density Scenario	
Total Daily Trip Ends	Product (Added Daily Trips)	Added Daily Vehicle Miles of Travel (VMT)		Equivalent Unmitigated Low- Density Daily Added Trip Productions	Equivalent Unmitigated Low- Density Daily VMT[3]
91,513	47,545	498,387	141%	66,970	702,010

Notes:
1. The data for this scenario was provided to ENVIRON by Crain and Associates in their memorandum dated September 15, 2009 re: Lytle Creek Development Mobile Emission Analysis Input. The analysis was conducted using the EVTM. The EVTM model accounts for "physical design" mitigation measures inherent in the project plan, such as high residential density and local serving retail.
2. URBEMIS was used to quantify the relative difference in trip generation rates between the mitigated scenario and the unmitigated low-density scenario (see Table 4-27). The ratio of added trips in the two scenarios and the results of the EVTM model for the mitigated scenario were used to estimate the added daily trips and VMT for an unmitigated low-density scenario.
3. The two scenarios are assumed to have the same trip lengths, resulting in an increase in VMT proportional to the increase in trips.

Abbreviations:
BAU - business as usual
EVTM - East Valley Transportation Model
VMT - Vehicle Miles Traveled

Sources:
Crain and Associates. 2009. Re: Lytle Creek Development Mobile Emission Analysis Input.

Table 5-9
Mitigated Greenhouse Gas Emissions from Vehicles for the Year 2030 for BAU Scenario
Lytle Creek Ranch
Rialto, California

Neighborhood	Annual Products (Added Annual Trips)[1]	Added Annual Vehicle Miles of Travel (VMT)[1]	Emission Factor Running (g/mile)[2]	Emission Factor Starts (g/start)[3]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual Adjusted CO_2 Emissions (tonne)[4]	Total Annual CO_2e Emissions (tonne)[5]
Total	24,444,125	256,233,761	367	104	94,001	2,538	96,539	95,160	100,168

Notes:
1. Daily trips and VMT were modeled for weekday activity, consequently these estimates assume 365 weekdays.
2. Emission factors for vehicles based on EMFAC files for based on LDA, LDT1, LDT2, and motorcycle for San Bernardino at 30 mph (URBEMIS default).
3. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.
4. Weekend traffic is approximately 95% of weekday traffic. Overall CO_2 emissions are consequently 98.6% of those calculated based on weekday activity only (1.0*5/7 + 0.95*2/7)
5. $CO_2e=CO_2/0.95$: The USEPA recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
g - gram
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
mph - miles per hour
N_2O - Nitrous oxide
USEPA - United States Environmental Protection Agency
VMT - Vehicle Miles Traveled

Table 5-10
Lytle Creek Ranch Mobile Emissions in Context
Lytle Creek Ranch
Rialto, California

	Annual Vehicle Miles Traveled		Annual Mobile CO_2e Emissions		Comparison to BAU % Reduction (VMT)	Comparison to BAU % Reduction (CO_2e)
	Total Miles[1,2]	Miles per Dwelling Unit[3]	Total Tonnes	Tonnes per Dwelling Unit[3]		
Lytle Creek Ranch	181,911,255	21,638	71,114	8	29%	29%
Lytle Creek Ranch with Pavley	181,911,255	21,638	57,265	7	29%	43%
BAU	256,233,761	30,479	100,168	12		

Notes:
1. Lytle Creek Ranch vehicle miles as developed in mobile sources section.
2. "Business as usual" VMT assumes that no mitigation measures are taken and that the housing stock of Lytle Creek Ranch (8407 units) were built out at the same density as the nearby section of the City of Rialto.
3. Assumes Lytle Creek Ranch number of dwelling units is 8407.

Abbreviations:
BAU - business as usual
CO_2e - Carbon Dioxide Equivalent
LCR - Lytle Creek Ranch
VMT - Vehicle miles travelled

5.2.4 Municipal Sources

5.2.4.1 Water and Wastewater

The BAU comparison for water and wastewater treatment and distribution was based on a community that would use approximately 10,174 acre-feet of water annually with 10,174 acre-feet of potable water, no recycled water, and 10,174 acre-feet of wastewater. Since Lytle Development Company does not plan to implement any project design features beyond BAU for water and wastewater, these CO_2e emissions from Lytle Creek Ranch are expected to be equivalent to BAU. Table 5-11 on page 129 summarizes this analysis. The implementation of the RPS will reduce carbon dioxide emissions from this source somewhat, but this has not been quantified.

5.2.4.2 Public Lighting

The BAU comparison for public lighting assumes that energy efficient street lights will not be used. The Lytle Creek Ranch Specific Plan encourages, but does not require, strategies to improve energy efficiency in lighting public areas[146]. Lytle Development Company plans to incorporate energy-saving lighting fixtures where feasible; however, any potential benefits were not quantified for this analysis. Therefore, Table 5-11 on page 129 shows that LCR's public lighting is equivalent to BAU.

[146] Draft Lytle Creek Ranch Specific Plan. December 2008. p. 4-124.

Table 5-11
Municipal Sources Comparison of Business as Usual to Lytle Creek Ranch
Lytle Creek Ranch
Rialto, California

Scenario	Water/Wastewater Energy Use	Public Lighting	Municipal Vehicles	Total Municipal[1]
	kW-hr/yr	Tonne CO_2e/yr		
BAU	8,151	1,061	1,227	12,509
Lytle Creek Ranch	8,151	1,061	1,227	12,509
Percent Reduction	0%	0%	0%	0%

Notes:
1. Total municipal includes water/wastewater treatment, public lighting, and municipal vehicles. The direct wastewater emissions and municipal vehicle calculations are based on per capita usage and there are no emission factors available to reflect improvements over BAU.

Abbreviations:
BAU - business as usual
CO_2e - Carbon Dioxide equivalents kW-hr - kilowatt-hour
yr - year

5.2.5 Overall BAU Comparison

The BAU comparison presented in this report compares projected GHG emissions for LCR that would occur from the project if it were to be built without the project design features and energy reduction commitments made by Lytle Development Company, and in the absence of regulations promulgated to comply with AB 32.

That BAU comparison, including all sources described in Chapters 4 and 5 of this report, is summarized in Table 5-12 on page 130. As discussed previously, there are no differences between BAU and project emissions for construction, municipal and area sources; but there are differences in vegetation, building energy, and mobile source emissions. To determine the overall percentage reduction in CO_2e emissions, the annual and annualized emissions were summed for each scenario, and then the two total scenario values were compared. Using the approach, the overall reduction in GHG emissions for the project relative to BAU is 32.7%. In addition, Table 5-13 on page 131 summarizes the BAU comparison if 33% RPS mandated for 2020 is accounted for in the LCR inventory. The greater reduction in energy-related emissions associated with RPS results in a greater reduction in CO_2e emissions relative to BAU.

Table 5-12
GHG Emissions Comparison of BAU to Lytle Creek Ranch including Pavley Standards
Lytle Creek Ranch
Rialto, California

Source	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over BAU[1]
	BAU	Lytle Creek Ranch	(%)
Vegetation[2]	32,388	-1,120	103.5%
Construction	257,552	257,552	0.0%
Total (one-time emissions)	**289,940**	**256,432**	**11.6%**
Residential[3]	27,975	21,530	23.0%
Non-Residential[4]	5,068	4,386	13.5%
Mobile[5]	100,168	57,265	42.8%
Municipal[6]	12,509	12,509	0.0%
Area	2,370	2,370	0.0%
Total (annual emissions)	**148,090**	**98,059**	**33.8%**
Annualized Total[7]	**155,338**	**104,470**	**32.7%**

Notes:
1. The percentage improvement over BAU is an estimate. There are some source categories where appropriate comparisons are available. It is estimated that this value is on the conservative side. For vegetation, the reduction in emissions exceeds 100% relative to BAU because the addition of trees will increase carbon sequestration.
2. BAU vegetation emissions are based on an additional 908 acres of native habitat being turned into settlements and no trees being planted.
3. BAU residential emissions reflect minimally Title-24 compliant homes without Energy Star appliances.
4. BAU non-residential emissions reflect minimally Title-24 compliant buildings with no renewable credits.
5. BAU mobile emissions are based on a comparison of trip rates adjusted for a less dense development (comparable to nearby City of Rialto) and no traffic mitigation measures.
6. Municipal emissions included here are related to water treatment, waste water treatment, street lighting, and municipal vehicles. This is a very conservative estimate since appropriate emission factors to adjust wastewater direct emissions are unavailable.
7. One-time emissions are annualized over 40 years and then added to the total annual emissions.

Abbreviations:
BAU - business as usual

Table 5-13

GHG Emissions Comparison of BAU to Lytle Creek Ranch including Pavley Standards and 33% RPS
Lytle Creek Ranch
Rialto, California

Source	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over BAU[1]
	BAU	Lytle Creek Ranch	(%)
Vegetation[2]	32,388	-1,120	103.5%
Construction	257,552	257,552	0%
Total (one-time emissions)	**289,940**	**256,432**	**11.6%**
Residential[3]	27,975	19,900	28.9%
Non-Residential[4]	5,068	3,843	24.2%
Mobile[5]	100,168	57,265	42.8%
Municipal[6]	12,509	12,509	0%
Area	2,370	2,370	0%
Total (annual emissions)	**148,090**	**95,887**	**35.3%**
Annualized Total[7]	**155,338**	**102,297**	**34.1%**

Notes:
1. The percentage improvement over BAU is an estimate. There are some source categories where appropriate comparisons are available. It is estimated that this value is on the conservative side. For vegetation, the reduction in emissions exceeds 100% relative to BAU because the addition of trees will increase carbon sequestration.
2. BAU vegetation emissions are based on an additional 908 acres of native habitat being turned into settlements and no trees being planted.
3. BAU residential emissions reflect minimally Title-24 compliant homes without Energy Star appliances.
4. BAU non-residential emissions reflect minimally Title-24 compliant buildings with no renewable credits.
5. BAU mobile emissions are based on a comparison of trip rates adjusted for a less dense development (Comparable to nearby City of Rialto) and no traffic mitigation measures.
6. Municipal emissions included here are related to water treatment, waste water treatment, street lighting, and municipal vehicles. This is a very conservative estimate since appropriate emission factors to adjust wastewater direct emissions are unavailable.
7. One-time emissions are annualized over 40 years and then added to the total annual emissions.

Abbreviations:
BAU - business as usual
RPS - Renewable Portfolio Standard

6 Executive Order S-03-05

Executive order S-03-05 sets a goal for California to emit 80% less GHGs in 2050 than it emitted in 1990. As of 2004, California was emitting 12% more GHG emissions than in 1990. For California to emit 80% less than it emitted in 1990, the emissions would be only 18% of the 2004 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% of what they were in 2004. This means 88% reductions in per capita GHG emissions from today's 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 traffic at LCR 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' needs. As discussed above, renewable power requirements, the low carbon fuel standard, and vehicle emissions standards will all decrease GHG emissions per unit of energy delivered or per vehicle mile traveled. In this section we discuss the impact that future regulated fuel decarbonization may have on vehicular emissions at LCR.

The CEC published "State Alternative Fuels Plan"[147] in which it noted the existence of "challenging but plausible ways to meet 2050 [transportation] goals." The main finding from this analysis is that reducing today's average per capita driving miles by about 5 percent (or back to 1990 levels), in addition to the decarbonization strategies listed below, would achieve S-03-05 goals of 80% below 1990 levels. The approach described below is directly[148] from the CEC report.

An 80 percent reduction in GHG emissions associated with personal transportation can be achieved even though population grows to 55 million, an increase of 50 percent. The following set of measures could be combined to produce this result:

Lowering the energy needed for personal transportation by tripling the energy efficiency of on-road vehicles in 2050 with:

a. Conventional gas, diesel, and flexible fuel vehicles (FFVs) averaging more than 40 mpg.

b. Hybrid gas, diesel, and FFVs averaging almost 60 mpg.

c. All electric and plug-in hybrid electric vehicles (PHEVs) averaging well over 100 mpg (on a greenhouse gas equivalents (GGE) basis) on the electricity cycle.

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

[148] Ibid. Page 67 and 68.

d. Fuel cell vehicles (FCVs) averaging over 80 mpg (on a GGE basis).

Moderating growth in per capita driving, reducing today's average per capita driving miles by about 5 percent or back to 1990 levels.

Changing the energy sources for transportation fuels from the current 96 percent petroleum-based to approximately:

a. 30 percent from gasoline and diesel from traditional petroleum sources or lower GHG emission fossil fuels such as natural gas.

b. 30 percent from transportation biofuels.

c. 40 percent from a mix of electricity and hydrogen.

Producing transportation biofuels, electricity, and hydrogen from renewable or very low carbon-emitting technologies that result in, on average, at least 80 percent lower life cycle GHG emissions than conventional fuels.

Encouraging more efficient land uses and greater use of mass transit, public transportation, and other means of moving goods and people.

The measures described above are the types of measures that will yield required reductions. Although these types of measures are expected to occur and are consistent with the LCR development plan, the LCR emissions inventory does not account for emission reductions associated with these measures.

7 Conclusion

ENVIRON prepared a GHG emissions inventory for the LCR development. This emissions inventory was prepared consistent with the methodologies established by the CCAR where possible. The LCR emissions inventory considers seven categories of GHG emissions: emissions due to vegetation changes, emissions from construction activities, residential emissions, commercial building emissions, mobile source emissions, municipal emissions, and area source emissions. Emission from recreation centers were not calculated since they are a small fraction of the overall inventory. The emissions from construction and land use change would be one-time emissions events, while the other emissions would occur annually, throughout the life of the project.

A variety of methods were employed to develop the GHG emissions inventory. In addition to well established emission factors for certain activities and emission estimates based on similar activities in other representative communities, several different estimation software were used. These included EMFAC, OFFROAD, BARBD, and URBEMIS.

Emissions from the various components of the LCR development are presented in Table 4-31 on page 109. This table identifies the one-time emissions that would be attributable to project entitlement, and the annual emissions expected to occur each year after the full build out of the development. There are approximately 256,432 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to approximately 98,059 tonnes. Of this amount, 58% result from vehicular emissions associated with residential and commercial activities, and 26% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately 6% of the overall emissions. As discussed below, these figures reflect conservative assumptions that likely overstate the GHG emissions that would result from this project.

As a result of the various design elements incorporated into the LCR project, the development meets AB 32's goal of at least 28.5% below BAU overall. As designed, homes in LCR are expected to be 18% more energy efficient than the current housing stock in California, as shown in Table 4-16 on page 70. The non-residential units are 13% more energy efficient than the average California non-residential buildings stock. Vehicular emissions from LCR residents are 43% less per dwelling unit than BAU[149]. As shown in Table 5-12 on page 130, the emission savings combined for LCR represent a 32.7% reduction from a BAU scenario taking into consideration changes in emission factors due to implementation of two AB 32 scoping plan measures: the Renewables Portfolio Standard and the Pavley regulation. Differences between the vegetation change-related emissions in the proposed LCR project scenario and the BAU scenario were annualized over a 40-year project lifetime for purposes of this comparison. Emissions from construction, municipal sources, and area sources were included in the total inventory for both the proposed LCR project and BAU scenarios, but no differences between the two scenarios were quantified for these categories.

[149] Taking into account emissions reductions due to the Pavley regulation.

The GHG emission inventory for LCR was based on several conservative assumptions. In addition, anticipated state and federal regulatory developments are expected to result in lower GHG emissions from LCR than are represented in this analysis. For example, the increased CAFE standards under the EISA of 2007 will result in a moderate decrease in LCR's GHG inventory as tailpipe emissions would be roughly 26 - 40% lower.

Thus, while the LCR project already results in an improvement over the BAU scenario equivalent to the 28.5% improvement necessary to achieve AB 32's mandates, upon implementation of existing and anticipated legislative and regulatory mandates, actual emissions associated with the project will likely be considerably lower.

Appendix A

URBEMIS Files for Construction Emissions and Table of Starting Emission Factors

Appendix B

Crain and Associates Memorandum
re: Lytle Creek Development Mobile Emissions Analysis Input

Appendix C

URBEMIS Files for Mobile Emissions

Appendix D

EMFAC File Output

Appendix E

Life Cycle Greenhouse Gas Emissions from Building Materials

Appendix A:

URBEMIS files for Construction Emissions
(Excerpt from Air Quality Technical Report)

Page: 1

3/31/2008 06:12:20 PM

Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Mitigated Emissions (Pounds/Day)

File Name: V:\AQNOISE DIVISION\Active Projects\Rialto Specific Plan\Construction\URBEMIS\Phase I.urb924

Project Name: Lytle Creek Rialto Construction - Phase I

Project Location: San Bernadino County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Mitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 1/1/2009-5/29/2009 Active	32.50	288.92	143.45	0.01	859.53	12.96	872.49	179.51	11.92	191.43	25,911.05
Mass Grading 01/01/2009-	32.50	288.92	143.45	0.01	859.53	12.96	872.49	179.51	11.92	191.43	25,911.05
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	32.28	288.50	136.57	0.00	0.00	12.94	12.94	0.00	11.90	11.90	25,197.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.22	0.41	6.88	0.01	0.03	0.02	0.06	0.01	0.02	0.03	713.21
Time Slice 6/1/2009-6/30/2009 Active	45.29	361.45	342.43	0.22	860.48	16.80	877.28	179.85	15.41	195.26	50,668.21
Building 06/01/2009-08/31/2015	12.79	72.53	198.98	0.22	0.94	3.84	4.78	0.34	3.49	3.83	24,757.15
Building Off Road Diesel	5.47	37.09	18.48	0.00	0.00	2.27	2.27	0.00	2.09	2.09	3,719.82
Building Vendor Trips	2.12	25.78	19.74	0.04	0.15	1.06	1.21	0.05	0.97	1.02	4,382.61
Building Worker Trips	5.21	9.66	160.76	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,654.72
Mass Grading 01/01/2009-	32.50	288.92	143.45	0.01	859.53	12.96	872.49	179.51	11.92	191.43	25,911.05
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	32.28	288.50	136.57	0.00	0.00	12.94	12.94	0.00	11.90	11.90	25,197.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.22	0.41	6.88	0.01	0.03	0.02	0.06	0.01	0.02	0.03	713.21
Time Slice 7/1/2009-9/30/2009 Active	53.15	361.47	342.86	0.22	860.48	16.80	877.28	179.85	15.41	195.26	50,711.85
Building 06/01/2009-08/31/2015	12.79	72.53	198.98	0.22	0.94	3.84	4.78	0.34	3.49	3.83	24,757.15
Building Off Road Diesel	5.47	37.09	18.48	0.00	0.00	2.27	2.27	0.00	2.09	2.09	3,719.82
Building Vendor Trips	2.12	25.78	19.74	0.04	0.15	1.06	1.21	0.05	0.97	1.02	4,382.61
Building Worker Trips	5.21	9.66	160.76	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,654.72
Coating 07/01/2009-08/31/2015	7.86	0.03	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.64
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.64

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Mass Grading 01/01/2009-	32.50	288.92	143.45	0.01	859.53	12.96	872.49	179.51	11.92	191.43	25,911.05
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	32.28	288.50	136.57	0.00	0.00	12.94	12.94	0.00	11.90	11.90	25,197.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.22	0.41	6.88	0.01	0.03	0.02	0.06	0.01	0.02	0.03	713.21
Time Slice 10/1/2009-12/31/2009	**55.79**	**376.63**	**351.93**	**0.23**	860.49	**18.08**	878.56	179.85	**16.58**	196.44	**51,945.55**
Asphalt 10/01/2009-08/31/2015	2.64	15.15	9.07	0.00	0.01	1.27	1.28	0.00	1.17	1.17	1,233.71
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.43	14.47	7.65	0.00	0.00	1.24	1.24	0.00	1.14	1.14	1,033.53
Paving On Road Diesel	0.04	0.61	0.22	0.00	0.00	0.02	0.03	0.00	0.02	0.02	76.14
Paving Worker Trips	0.04	0.07	1.20	0.00	0.01	0.00	0.01	0.00	0.00	0.01	124.04
Building 06/01/2009-08/31/2015	12.79	72.53	198.98	0.22	0.94	3.84	4.78	0.34	3.49	3.83	24,757.15
Building Off Road Diesel	5.47	37.09	18.48	0.00	0.00	2.27	2.27	0.00	2.09	2.09	3,719.82
Building Vendor Trips	2.12	25.78	19.74	0.04	0.15	1.06	1.21	0.05	0.97	1.02	4,382.61
Building Worker Trips	5.21	9.66	160.76	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,654.72
Coating 07/01/2009-08/31/2015	7.86	0.03	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.64
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.64
Mass Grading 01/01/2009-	32.50	288.92	143.45	0.01	859.53	12.96	872.49	179.51	11.92	191.43	25,911.05
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	32.28	288.50	136.57	0.00	0.00	12.94	12.94	0.00	11.90	11.90	25,197.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.22	0.41	6.88	0.01	0.03	0.02	0.06	0.01	0.02	0.03	713.21
Time Slice 1/1/2010-7/30/2010 Active	53.15	355.10	327.69	**0.23**	860.49	17.03	877.51	179.85	15.62	195.47	51,928.94
Asphalt 10/01/2009-08/31/2015	2.50	14.39	8.87	0.00	0.01	1.24	1.24	0.00	1.14	1.14	1,233.59
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.29	13.77	7.57	0.00	0.00	1.21	1.21	0.00	1.11	1.11	1,033.53
Paving On Road Diesel	0.04	0.55	0.20	0.00	0.00	0.02	0.02	0.00	0.02	0.02	76.14
Paving Worker Trips	0.04	0.07	1.10	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.92
Building 06/01/2009-08/31/2015	11.81	67.16	184.28	0.22	0.94	3.56	4.50	0.34	3.23	3.56	24,741.39
Building Off Road Diesel	5.14	34.93	17.86	0.00	0.00	2.09	2.09	0.00	1.92	1.92	3,719.82
Building Vendor Trips	1.97	23.48	18.35	0.04	0.15	0.95	1.10	0.05	0.87	0.92	4,382.83
Building Worker Trips	4.71	8.75	148.07	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,638.74
Coating 07/01/2009-08/31/2015	7.86	0.02	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.60
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.60
Mass Grading 01/01/2009-	30.98	273.53	134.15	0.01	859.53	12.23	871.77	179.51	11.25	190.76	25,910.37
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Mass Grading Off Road Diesel	30.78	273.16	127.81	0.00	0.00	12.21	12.21	0.00	11.23	11.23	25,197.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.20	0.37	6.34	0.01	0.03	0.02	0.06	0.01	0.02	0.03	712.53
Time Slice 8/2/2010-12/31/2010 Active	22.17	81.57	193.54	0.22	0.95	4.79	5.75	0.34	4.37	4.71	26,018.57
Asphalt 10/01/2009-08/31/2015	2.50	14.39	8.87	0.00	0.01	1.24	1.24	0.00	1.14	1.14	1,233.59
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.29	13.77	7.57	0.00	0.00	1.21	1.21	0.00	1.11	1.11	1,033.53
Paving On Road Diesel	0.04	0.55	0.20	0.00	0.00	0.02	0.02	0.00	0.02	0.02	76.14
Paving Worker Trips	0.04	0.07	1.10	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.92
Building 06/01/2009-08/31/2015	11.81	67.16	184.28	0.22	0.94	3.56	4.50	0.34	3.23	3.56	24,741.39
Building Off Road Diesel	5.14	34.93	17.86	0.00	0.00	2.09	2.09	0.00	1.92	1.92	3,719.82
Building Vendor Trips	1.97	23.48	18.35	0.04	0.15	0.95	1.10	0.05	0.87	0.92	4,382.83
Building Worker Trips	4.71	8.75	148.07	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,638.74
Coating 07/01/2009-08/31/2015	7.86	0.02	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.60
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.60
Time Slice 1/3/2011-12/30/2011 Active	21.05	75.27	180.08	0.22	0.95	4.50	5.46	0.34	4.10	4.44	26,005.77
Asphalt 10/01/2009-08/31/2015	2.36	13.66	8.67	0.00	0.01	1.19	1.19	0.00	1.09	1.09	1,233.49
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.16	13.10	7.47	0.00	0.00	1.16	1.16	0.00	1.07	1.07	1,033.53
Paving On Road Diesel	0.04	0.50	0.18	0.00	0.00	0.02	0.02	0.00	0.02	0.02	76.14
Paving Worker Trips	0.03	0.06	1.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.82
Building 06/01/2009-08/31/2015	10.83	61.59	171.05	0.22	0.94	3.32	4.26	0.34	3.01	3.34	24,728.71
Building Off Road Diesel	4.73	32.50	17.29	0.00	0.00	1.95	1.95	0.00	1.79	1.79	3,719.82
Building Vendor Trips	1.81	21.14	16.96	0.04	0.15	0.85	1.00	0.05	0.78	0.83	4,383.13
Building Worker Trips	4.28	7.95	136.81	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,625.76
Coating 07/01/2009-08/31/2015	7.86	0.02	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.56
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.56
Time Slice 1/2/2012-3/30/2012 Active	20.03	69.26	167.57	0.22	0.95	4.19	5.14	0.34	3.81	4.15	25,987.84
Asphalt 10/01/2009-08/31/2015	2.24	12.94	8.50	0.00	0.01	1.12	1.13	0.00	1.03	1.03	1,233.36
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.04	12.44	7.40	0.00	0.00	1.10	1.10	0.00	1.01	1.01	1,033.53
Paving On Road Diesel	0.03	0.44	0.16	0.00	0.00	0.02	0.02	0.00	0.02	0.02	76.14
Paving Worker Trips	0.03	0.05	0.94	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.69
Building 06/01/2009-08/31/2015	9.94	56.30	158.74	0.22	0.94	3.07	4.01	0.34	2.78	3.12	24,710.97
Building Off Road Diesel	4.40	30.22	16.79	0.00	0.00	1.80	1.80	0.00	1.66	1.66	3,719.82
Building Vendor Trips	1.66	18.85	15.60	0.04	0.15	0.75	0.90	0.05	0.69	0.74	4,383.47
Building Worker Trips	3.87	7.24	126.34	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,607.68

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Coating 07/01/2009-08/31/2015	7.86	0.02	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.52
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.52
Time Slice 4/2/2012-10/31/2012 Active	47.74	310.15	286.40	**0.23**	280.20	14.52	294.73	58.66	13.32	71.98	51,896.88
Asphalt 10/01/2009-08/31/2015	2.24	12.94	8.50	0.00	0.01	1.12	1.13	0.00	1.03	1.03	1,233.36
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.04	12.44	7.40	0.00	0.00	1.10	1.10	0.00	1.01	1.01	1,033.53
Paving On Road Diesel	0.03	0.44	0.16	0.00	0.00	0.02	0.02	0.00	0.02	0.02	76.14
Paving Worker Trips	0.03	0.05	0.94	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.69
Building 06/01/2009-08/31/2015	9.94	56.30	158.74	0.22	0.94	3.07	4.01	0.34	2.78	3.12	24,710.97
Building Off Road Diesel	4.40	30.22	16.79	0.00	0.00	1.80	1.80	0.00	1.66	1.66	3,719.82
Building Vendor Trips	1.66	18.85	15.60	0.04	0.15	0.75	0.90	0.05	0.69	0.74	4,383.47
Building Worker Trips	3.87	7.24	126.34	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,607.68
Coating 07/01/2009-08/31/2015	7.86	0.02	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.52
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.52
Mass Grading 04/01/2012-	27.71	240.89	118.83	0.01	279.25	10.34	289.59	58.32	9.51	67.83	25,909.04
Mass Grading Dust	0.00	0.00	0.00	0.00	279.22	0.00	279.22	58.31	0.00	58.31	0.00
Mass Grading Off Road Diesel	27.54	240.58	113.42	0.00	0.00	10.31	10.31	0.00	9.49	9.49	25,197.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.17	0.31	5.41	0.01	0.03	0.02	0.06	0.01	0.02	0.03	711.20
Time Slice 11/1/2012-12/31/2012	20.03	69.26	167.57	0.22	0.95	4.19	5.14	0.34	3.81	4.15	25,987.84
Asphalt 10/01/2009-08/31/2015	2.24	12.94	8.50	0.00	0.01	1.12	1.13	0.00	1.03	1.03	1,233.36
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.04	12.44	7.40	0.00	0.00	1.10	1.10	0.00	1.01	1.01	1,033.53
Paving On Road Diesel	0.03	0.44	0.16	0.00	0.00	0.02	0.02	0.00	0.02	0.02	76.14
Paving Worker Trips	0.03	0.05	0.94	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.69
Building 06/01/2009-08/31/2015	9.94	56.30	158.74	0.22	0.94	3.07	4.01	0.34	2.78	3.12	24,710.97
Building Off Road Diesel	4.40	30.22	16.79	0.00	0.00	1.80	1.80	0.00	1.66	1.66	3,719.82
Building Vendor Trips	1.66	18.85	15.60	0.04	0.15	0.75	0.90	0.05	0.69	0.74	4,383.47
Building Worker Trips	3.87	7.24	126.34	0.17	0.79	0.52	1.31	0.28	0.44	0.72	16,607.68
Coating 07/01/2009-08/31/2015	7.86	0.02	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.52
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.52
Time Slice 1/1/2013-12/31/2013 Active	19.03	63.55	155.84	0.22	0.95	3.85	4.80	0.34	3.49	3.83	25,972.19
Asphalt 10/01/2009-08/31/2015	2.10	12.24	8.35	0.00	0.01	1.05	1.06	0.00	0.96	0.97	1,233.24
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.91	11.80	7.33	0.00	0.00	1.03	1.03	0.00	0.95	0.95	1,033.53
Paving On Road Diesel	0.03	0.39	0.14	0.00	0.00	0.01	0.02	0.00	0.01	0.01	76.14

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Paving Worker Trips	0.03	0.05	0.87	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.57
Building 06/01/2009-08/31/2015	9.08	51.29	147.19	0.22	0.94	2.80	3.74	0.34	2.53	2.86	24,695.48
Building Off Road Diesel	4.07	28.05	16.40	0.00	0.00	1.60	1.60	0.00	1.47	1.47	3,719.82
Building Vendor Trips	1.51	16.65	14.30	0.04	0.15	0.66	0.81	0.05	0.60	0.66	4,383.84
Building Worker Trips	3.49	6.60	116.48	0.17	0.79	0.54	1.33	0.28	0.45	0.74	16,591.82
Coating 07/01/2009-08/31/2015	7.86	0.02	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.47
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.47
Time Slice 1/1/2014-12/31/2014 Active	18.14	57.88	145.08	0.22	0.95	3.50	4.45	0.34	3.17	3.51	25,958.42
Asphalt 10/01/2009-08/31/2015	1.99	11.57	8.21	0.00	0.01	0.98	0.99	0.00	0.90	0.90	1,233.14
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.81	11.19	7.28	0.00	0.00	0.96	0.96	0.00	0.89	0.89	1,033.53
Paving On Road Diesel	0.03	0.34	0.13	0.00	0.00	0.01	0.02	0.00	0.01	0.01	76.14
Paving Worker Trips	0.02	0.04	0.80	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.47
Building 06/01/2009-08/31/2015	8.29	46.29	136.59	0.22	0.94	2.52	3.46	0.34	2.27	2.60	24,681.85
Building Off Road Diesel	3.76	25.68	16.00	0.00	0.00	1.40	1.40	0.00	1.29	1.29	3,719.82
Building Vendor Trips	1.37	14.59	13.12	0.04	0.15	0.58	0.73	0.05	0.53	0.58	4,384.10
Building Worker Trips	3.16	6.01	107.47	0.17	0.79	0.54	1.33	0.28	0.45	0.74	16,577.93
Coating 07/01/2009-08/31/2015	7.86	0.02	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.44
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.44
Time Slice 1/1/2015-8/31/2015 Active	17.29	52.36	135.15	0.22	0.95	3.22	4.18	0.34	2.92	3.26	25,937.26
Asphalt 10/01/2009-08/31/2015	1.87	10.83	8.06	0.00	0.01	0.91	0.92	0.00	0.84	0.84	1,232.98
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.70	10.49	7.21	0.00	0.00	0.90	0.90	0.00	0.82	0.82	1,033.53
Paving On Road Diesel	0.03	0.30	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	76.14
Paving Worker Trips	0.02	0.04	0.74	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.31
Building 06/01/2009-08/31/2015	7.56	41.52	126.83	0.22	0.94	2.31	3.25	0.34	2.08	2.42	24,660.90
Building Off Road Diesel	3.47	23.31	15.68	0.00	0.00	1.27	1.27	0.00	1.17	1.17	3,719.82
Building Vendor Trips	1.24	12.75	12.04	0.04	0.15	0.50	0.66	0.05	0.46	0.51	4,384.37
Building Worker Trips	2.85	5.47	99.10	0.17	0.79	0.54	1.33	0.28	0.45	0.74	16,556.71
Coating 07/01/2009-08/31/2015	7.85	0.01	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.38
Architectural Coating	7.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.01	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.38

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Mass Grading 1/1/2009 - 7/31/2010 - Site Grading Phase 1A

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:
PM10: 55% PM25: 55%
The following mitigation measures apply to Phase: Mass Grading 4/1/2012 - 10/31/2012 - Site Grading Phase 1B
For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:
PM10: 55% PM25: 55%
For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:
PM10: 55% PM25: 55%

Phase Assumptions

Phase: Mass Grading 1/1/2009 - 7/31/2010 - Site Grading Phase 1A
Total Acres Disturbed: 271
Maximum Daily Acreage Disturbed: 50
Fugitive Dust Level of Detail: Default
38.2 lbs per acre-day
On Road Truck Travel (VMT): 0
Off-Road Equipment:
4 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day
3 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day
10 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day
3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day
3 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Mass Grading 4/1/2012 - 10/31/2012 - Site Grading Phase 1B
Total Acres Disturbed: 100
Maximum Daily Acreage Disturbed: 50
Fugitive Dust Level of Detail: Low
Onsite Cut/Fill: 1021 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day
On Road Truck Travel (VMT): 0
Off-Road Equipment:
4 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day
3 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day
10 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day
3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day
3 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 10/1/2009 - 8/31/2015 - Asphalt Paving

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2

Acres to be Paved: 77.22

Off-Road Equipment:

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 6/1/2009 - 8/31/2015 - Building Construction

Off-Road Equipment:

1 Aerial Lifts (60 hp) operating at a 0.46 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

2 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 7/1/2009 - 8/31/2015 - Arch Coatings

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Page: 1

3/31/2008 06:15:51 PM

Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Mitigated Emissions (Pounds/Day)

File Name: V:\AQNOISE DIVISION\Active Projects\Rialto Specific Plan\Construction\URBEMIS\Phase II.urb924

Project Name: Lytle Creek Phase 2

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Mitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 5/1/2009-5/29/2009 Active	4.52	41.97	21.14	0.02	10.98	2.11	13.08	2.29	1.94	4.23	4,287.52
Demolition 05/01/2009-05/31/2009	4.52	41.97	21.14	0.02	10.98	2.11	13.08	2.29	1.94	4.23	4,287.52
Fugitive Dust	0.00	0.00	0.00	0.00	10.92	0.00	10.92	2.27	0.00	2.27	0.00
Demo Off Road Diesel	3.56	29.56	15.27	0.00	0.00	1.59	1.59	0.00	1.46	1.46	2,632.55
Demo On Road Diesel	0.93	12.35	4.74	0.01	0.05	0.52	0.57	0.02	0.47	0.49	1,530.53
Demo Worker Trips	0.04	0.07	1.13	0.00	0.01	0.00	0.01	0.00	0.00	0.00	124.43
Time Slice 6/1/2009-12/31/2009 Active	45.86	403.89	202.22	0.01	859.55	18.36	877.92	179.52	16.89	196.41	36,173.57
Fine Grading 06/01/2009-	45.86	403.89	202.22	0.01	859.55	18.36	877.92	179.52	16.89	196.41	36,173.57
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	45.54	403.30	192.36	0.00	0.00	18.33	18.33	0.00	16.87	16.87	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.32	0.59	9.86	0.01	0.05	0.03	0.08	0.02	0.02	0.04	1,088.77
Time Slice 1/1/2010-3/31/2010 Active	43.70	382.28	190.11	0.01	859.55	17.33	876.89	179.52	15.95	195.46	36,173.25
Fine Grading 06/01/2009-	43.70	382.28	190.11	0.01	859.55	17.33	876.89	179.52	15.95	195.46	36,173.25
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	43.41	381.74	180.94	0.00	0.00	17.30	17.30	0.00	15.92	15.92	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.29	0.54	9.17	0.01	0.05	0.03	0.08	0.02	0.02	0.04	1,088.45
Time Slice 4/1/2010-4/30/2010 Active	83.22	542.50	1,022.56	1.05	864.15	26.62	890.78	181.17	24.30	205.47	141,641.03
Building 04/01/2010-05/31/2018	39.52	160.22	832.44	1.04	4.60	9.29	13.89	1.65	8.35	10.01	105,467.78
Building Off Road Diesel	10.56	53.72	35.18	0.00	0.00	4.27	4.27	0.00	3.93	3.93	5,057.89
Building Vendor Trips	5.40	62.31	48.11	0.11	0.40	2.60	3.00	0.14	2.38	2.52	11,505.87
Building Worker Trips	23.56	44.19	749.15	0.93	4.20	2.42	6.62	1.51	2.04	3.56	88,904.01
Fine Grading 06/01/2009-	43.70	382.28	190.11	0.01	859.55	17.33	876.89	179.52	15.95	195.46	36,173.25
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Fine Grading Off Road Diesel	43.41	381.74	180.94	0.00	0.00	17.30	17.30	0.00	15.92	15.92	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.29	0.54	9.17	0.01	0.05	0.03	0.08	0.02	0.02	0.04	1,088.45
Time Slice 5/3/2010-12/31/2010 Active	**102.55**	**563.15**	**1,036.11**	**1.06**	864.17	**28.37**	892.54	181.18	**25.90**	207.08	**143,546.85**
Asphalt 05/01/2010-05/31/2018	3.67	20.61	12.82	0.00	0.02	1.74	1.76	0.01	1.60	1.61	1,818.21
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	3.20	19.17	10.47	0.00	0.00	1.68	1.68	0.00	1.55	1.55	1,418.81
Paving On Road Diesel	0.10	1.34	0.51	0.00	0.01	0.05	0.06	0.00	0.05	0.05	181.71
Paving Worker Trips	0.06	0.11	1.83	0.00	0.01	0.01	0.02	0.00	0.00	0.01	217.69
Building 04/01/2010-05/31/2018	39.52	160.22	832.44	1.04	4.60	9.29	13.89	1.65	8.35	10.01	105,467.78
Building Off Road Diesel	10.56	53.72	35.18	0.00	0.00	4.27	4.27	0.00	3.93	3.93	5,057.89
Building Vendor Trips	5.40	62.31	48.11	0.11	0.40	2.60	3.00	0.14	2.38	2.52	11,505.87
Building Worker Trips	23.56	44.19	749.15	0.93	4.20	2.42	6.62	1.51	2.04	3.56	88,904.01
Coating 05/01/2010-05/31/2018	15.65	0.04	0.74	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.61
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.04	0.74	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.61
Fine Grading 06/01/2009-	43.70	382.28	190.11	0.01	859.55	17.33	876.89	179.52	15.95	195.46	36,173.25
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	43.41	381.74	180.94	0.00	0.00	17.30	17.30	0.00	15.92	15.92	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.29	0.54	9.17	0.01	0.05	0.03	0.08	0.02	0.02	0.04	1,088.45
Time Slice 1/3/2011-12/30/2011 Active	96.44	526.22	969.09	**1.06**	864.17	26.32	890.49	181.18	24.02	205.19	143,527.42
Asphalt 05/01/2010-05/31/2018	3.48	19.55	12.51	0.00	0.02	1.68	1.69	0.01	1.54	1.55	1,818.16
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	3.02	18.25	10.34	0.00	0.00	1.62	1.62	0.00	1.49	1.49	1,418.81
Paving On Road Diesel	0.09	1.20	0.46	0.00	0.01	0.05	0.05	0.00	0.04	0.05	181.71
Paving Worker Trips	0.05	0.10	1.71	0.00	0.01	0.01	0.02	0.00	0.00	0.01	217.64
Building 04/01/2010-05/31/2018	36.28	147.38	776.33	1.04	4.60	8.77	13.37	1.65	7.88	9.53	105,448.65
Building Off Road Diesel	9.82	50.82	34.48	0.00	0.00	4.03	4.03	0.00	3.71	3.71	5,057.89
Building Vendor Trips	4.97	56.15	44.59	0.11	0.40	2.32	2.72	0.14	2.13	2.26	11,506.05
Building Worker Trips	21.49	40.41	697.26	0.93	4.20	2.42	6.62	1.51	2.04	3.56	88,884.70
Coating 05/01/2010-05/31/2018	15.65	0.04	0.69	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.59
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.04	0.69	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.59
Fine Grading 06/01/2009-	41.02	359.25	179.56	0.01	859.55	15.87	875.42	179.52	14.60	194.11	36,173.01
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	40.76	358.76	171.02	0.00	0.00	15.84	15.84	0.00	14.57	14.57	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.26	0.49	8.54	0.01	0.05	0.03	0.08	0.02	0.02	0.04	1,088.22
Time Slice 1/2/2012-12/31/2012 Active	91.27	490.30	906.49	**1.06**	864.17	24.49	888.67	181.18	22.33	203.50	143,511.96

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Asphalt 05/01/2010-05/31/2018	3.31	18.50	12.24	0.00	0.02	1.58	1.60	0.01	1.45	1.46	1,818.13
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.86	17.34	10.24	0.00	0.00	1.53	1.53	0.00	1.41	1.41	1,418.81
Paving On Road Diesel	0.09	1.07	0.41	0.00	0.01	0.04	0.05	0.00	0.04	0.04	181.71
Paving Worker Trips	0.05	0.09	1.59	0.00	0.01	0.01	0.02	0.00	0.00	0.01	217.61
Building 04/01/2010-05/31/2018	33.21	135.06	723.70	1.04	4.60	8.18	12.78	1.65	7.33	8.98	105,433.43
Building Off Road Diesel	9.08	47.91	33.83	0.00	0.00	3.70	3.70	0.00	3.40	3.40	5,057.89
Building Vendor Trips	4.56	50.11	41.23	0.11	0.40	2.05	2.46	0.14	1.88	2.02	11,506.25
Building Worker Trips	19.57	37.04	648.64	0.93	4.20	2.43	6.63	1.51	2.04	3.56	88,869.29
Coating 05/01/2010-05/31/2018	15.65	0.04	0.64	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.58
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.04	0.64	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.58
Fine Grading 06/01/2009-	39.11	336.71	169.91	0.01	859.55	14.73	874.28	179.52	13.55	193.06	36,172.82
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	38.87	336.25	161.97	0.00	0.00	14.70	14.70	0.00	13.52	13.52	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.24	0.45	7.94	0.01	0.05	0.03	0.08	0.02	0.02	0.04	1,088.03
Time Slice 1/1/2013-12/31/2013 Active	86.73	456.37	847.50	**1.06**	864.17	22.71	886.88	181.18	20.67	201.85	143,501.63
Asphalt 05/01/2010-05/31/2018	3.12	17.49	11.99	0.00	0.02	1.48	1.49	0.01	1.36	1.36	1,818.10
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.69	16.46	10.15	0.00	0.00	1.43	1.43	0.00	1.32	1.32	1,418.81
Paving On Road Diesel	0.08	0.94	0.37	0.00	0.01	0.04	0.04	0.00	0.03	0.04	181.71
Paving Worker Trips	0.04	0.08	1.48	0.00	0.01	0.01	0.02	0.00	0.00	0.01	217.58
Building 04/01/2010-05/31/2018	30.30	123.06	673.99	1.04	4.60	7.58	12.18	1.65	6.76	8.41	105,423.26
Building Off Road Diesel	8.33	44.95	33.22	0.00	0.00	3.34	3.34	0.00	3.07	3.07	5,057.89
Building Vendor Trips	4.14	44.30	37.94	0.11	0.40	1.80	2.20	0.14	1.65	1.78	11,506.67
Building Worker Trips	17.83	33.80	602.84	0.93	4.20	2.44	6.64	1.51	2.04	3.56	88,858.71
Coating 05/01/2010-05/31/2018	15.65	0.03	0.59	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.57
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.03	0.59	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.57
Fine Grading 06/01/2009-	37.66	315.79	160.92	0.01	859.55	13.65	873.20	179.52	12.56	192.07	36,172.69
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	37.44	315.38	153.54	0.00	0.00	13.62	13.62	0.00	12.53	12.53	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.22	0.41	7.38	0.01	0.05	0.03	0.08	0.02	0.02	0.04	1,087.90
Time Slice 1/1/2014-12/31/2014 Active	81.99	421.58	795.19	**1.06**	864.17	21.09	885.27	181.18	19.19	200.36	143,493.01
Asphalt 05/01/2010-05/31/2018	2.97	16.51	11.76	0.00	0.02	1.38	1.40	0.01	1.27	1.28	1,818.08
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.54	15.61	10.07	0.00	0.00	1.34	1.34	0.00	1.24	1.24	1,418.81
Paving On Road Diesel	0.07	0.83	0.32	0.00	0.01	0.03	0.04	0.00	0.03	0.03	181.71

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Paving Worker Trips	0.04	0.08	1.38	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.56
Building 04/01/2010-05/31/2018	27.64	112.11	629.10	1.04	4.60	7.20	11.80	1.65	6.41	8.06	105,414.79
Building Off Road Diesel	7.62	42.12	32.62	0.00	0.00	2.98	2.98	0.00	2.74	2.74	5,057.89
Building Vendor Trips	3.75	38.90	34.92	0.11	0.40	1.57	1.98	0.14	1.44	1.57	11,506.98
Building Worker Trips	16.26	31.09	561.57	0.93	4.20	2.64	6.84	1.51	2.23	3.74	88,849.92
Coating 05/01/2010-05/31/2018	15.65	0.03	0.55	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.56
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.03	0.55	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.56
Fine Grading 06/01/2009-	35.75	292.92	153.77	0.01	859.55	12.51	872.06	179.52	11.51	191.02	36,172.59
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	35.55	292.54	146.89	0.00	0.00	12.48	12.48	0.00	11.48	11.48	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.20	0.38	6.88	0.01	0.05	0.03	0.08	0.02	0.03	0.05	1,087.79
Time Slice 1/1/2015-8/31/2015 Active	77.33	386.52	745.93	**1.06**	864.17	19.54	883.71	181.18	17.76	198.93	143,485.76
Asphalt 05/01/2010-05/31/2018	2.80	15.44	11.54	0.00	0.02	1.28	1.29	0.01	1.18	1.18	1,818.06
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.38	14.65	9.98	0.00	0.00	1.25	1.25	0.00	1.15	1.15	1,418.81
Paving On Road Diesel	0.06	0.72	0.28	0.00	0.01	0.03	0.03	0.00	0.02	0.03	181.71
Paving Worker Trips	0.04	0.07	1.28	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.54
Building 04/01/2010-05/31/2018	25.21	101.60	587.08	1.04	4.60	6.73	11.34	1.65	5.98	7.63	105,407.66
Building Off Road Diesel	6.98	39.07	32.08	0.00	0.00	2.72	2.72	0.00	2.50	2.50	5,057.89
Building Vendor Trips	3.39	34.04	32.13	0.11	0.40	1.37	1.77	0.14	1.25	1.39	11,507.42
Building Worker Trips	14.84	28.50	522.87	0.93	4.20	2.64	6.84	1.51	2.23	3.74	88,842.34
Coating 05/01/2010-05/31/2018	15.65	0.03	0.52	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.55
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.52	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.55
Fine Grading 06/01/2009-	33.68	269.44	146.80	0.01	859.55	11.52	871.07	179.52	10.60	190.11	36,172.49
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	33.50	269.10	140.39	0.00	0.00	11.49	11.49	0.00	10.57	10.57	35,084.80
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.18	0.35	6.40	0.01	0.05	0.03	0.08	0.02	0.03	0.05	1,087.70
Time Slice 9/1/2015-12/31/2015 Active	43.65	117.08	599.13	1.05	4.62	8.01	12.64	1.66	7.16	8.82	107,313.27
Asphalt 05/01/2010-05/31/2018	2.80	15.44	11.54	0.00	0.02	1.28	1.29	0.01	1.18	1.18	1,818.06
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.38	14.65	9.98	0.00	0.00	1.25	1.25	0.00	1.15	1.15	1,418.81
Paving On Road Diesel	0.06	0.72	0.28	0.00	0.01	0.03	0.03	0.00	0.02	0.03	181.71
Paving Worker Trips	0.04	0.07	1.28	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.54
Building 04/01/2010-05/31/2018	25.21	101.60	587.08	1.04	4.60	6.73	11.34	1.65	5.98	7.63	105,407.66
Building Off Road Diesel	6.98	39.07	32.08	0.00	0.00	2.72	2.72	0.00	2.50	2.50	5,057.89
Building Vendor Trips	3.39	34.04	32.13	0.11	0.40	1.37	1.77	0.14	1.25	1.39	11,507.42

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Building Worker Trips	14.84	28.50	522.87	0.93	4.20	2.64	6.84	1.51	2.23	3.74	88,842.34
Coating 05/01/2010-05/31/2018	15.65	0.03	0.52	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.55
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.52	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.55
Time Slice 1/1/2016-12/30/2016 Active	41.36	107.11	561.70	1.05	4.62	7.42	12.04	1.66	6.61	8.27	107,302.95
Asphalt 05/01/2010-05/31/2018	2.62	14.42	11.36	0.00	0.02	1.17	1.19	0.01	1.08	1.08	1,818.04
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.22	13.72	9.91	0.00	0.00	1.14	1.14	0.00	1.05	1.05	1,418.81
Paving On Road Diesel	0.06	0.63	0.25	0.00	0.01	0.02	0.03	0.00	0.02	0.02	181.71
Paving Worker Trips	0.03	0.06	1.20	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.51
Building 04/01/2010-05/31/2018	23.09	92.66	549.86	1.04	4.60	6.25	10.85	1.65	5.53	7.19	105,397.37
Building Off Road Diesel	6.39	36.26	31.63	0.00	0.00	2.39	2.39	0.00	2.20	2.20	5,057.89
Building Vendor Trips	3.09	30.06	29.79	0.11	0.40	1.21	1.62	0.14	1.11	1.24	11,507.68
Building Worker Trips	13.61	26.34	488.44	0.93	4.20	2.64	6.84	1.51	2.23	3.74	88,831.81
Coating 05/01/2010-05/31/2018	15.64	0.03	0.48	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.54
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.48	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.54
Time Slice 1/2/2017-12/29/2017 Active	39.25	98.27	525.95	1.05	4.62	6.91	11.54	1.66	6.15	7.80	107,295.97
Asphalt 05/01/2010-05/31/2018	2.48	13.48	11.17	0.00	0.02	1.08	1.10	0.01	0.99	1.00	1,818.02
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.09	12.86	9.83	0.00	0.00	1.05	1.05	0.00	0.97	0.97	1,418.81
Paving On Road Diesel	0.05	0.56	0.22	0.00	0.01	0.02	0.03	0.00	0.02	0.02	181.71
Paving Worker Trips	0.03	0.06	1.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.50
Building 04/01/2010-05/31/2018	21.13	84.76	514.33	1.04	4.60	5.83	10.43	1.65	5.15	6.80	105,390.41
Building Off Road Diesel	5.78	33.70	31.21	0.00	0.00	2.11	2.11	0.00	1.94	1.94	5,057.89
Building Vendor Trips	2.83	26.75	27.72	0.11	0.40	1.08	1.48	0.14	0.98	1.12	11,508.04
Building Worker Trips	12.52	24.31	455.39	0.93	4.20	2.64	6.84	1.51	2.23	3.74	88,824.48
Coating 05/01/2010-05/31/2018	15.64	0.02	0.45	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.53
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.45	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.53
Time Slice 1/1/2018-5/31/2018 Active	37.30	90.24	492.72	1.05	4.62	6.47	11.09	1.66	5.73	7.39	107,291.16
Asphalt 05/01/2010-05/31/2018	2.36	12.58	11.03	0.00	0.02	0.99	1.00	0.01	0.91	0.91	1,818.00
Paving Off-Gas	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.97	12.02	9.79	0.00	0.00	0.96	0.96	0.00	0.89	0.89	1,418.81
Paving On Road Diesel	0.05	0.50	0.20	0.00	0.01	0.02	0.02	0.00	0.02	0.02	181.71
Paving Worker Trips	0.03	0.05	1.04	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.48
Building 04/01/2010-05/31/2018	19.30	77.63	481.28	1.04	4.60	5.48	10.08	1.65	4.82	6.47	105,385.63
Building Off Road Diesel	5.22	31.25	30.82	0.00	0.00	1.86	1.86	0.00	1.71	1.71	5,057.89
Building Vendor Trips	2.60	23.98	25.89	0.11	0.40	0.97	1.37	0.14	0.88	1.02	11,508.46
Building Worker Trips	11.47	22.41	424.57	0.93	4.20	2.65	6.85	1.51	2.23	3.74	88,819.27

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Coating 05/01/2010-05/31/2018	15.64	0.02	0.42	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.53
Architectural Coating	15.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.42	0.00	0.00	0.00	0.01	0.00	0.00	0.00	87.53

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/1/2009 - 8/31/2015 - Default Fine Site Grading/Excavation Description

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

Phase Assumptions

Phase: Demolition 5/1/2009 - 5/31/2009 - Type Your Description Here

Building Volume Total (cubic feet): 320000

Building Volume Daily (cubic feet): 26000

On Road Truck Travel (VMT): 361.11

Off-Road Equipment:

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Fine Grading 6/1/2009 - 8/31/2015 - Default Fine Site Grading/Excavation Description

Total Acres Disturbed: 761

Maximum Daily Acreage Disturbed: 50

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

6 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

5 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

3 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day

12 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day

4 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

5 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 5/1/2010 - 5/31/2018 - Default Paving Description

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2

Acres to be Paved: 252
Off-Road Equipment:
2 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 0 hours per day
1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day
2 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day
2 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 4/1/2010 - 5/31/2018 - Default Building Construction Description
Off-Road Equipment:
2 Aerial Lifts (60 hp) operating at a 0.46 load factor for 8 hours per day
3 Air Compressors (106 hp) operating at a 0.48 load factor for 8 hours per day
3 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 8 hours per day
3 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day
1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day
5 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day
3 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day
5 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day
3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 5/1/2010 - 5/31/2018 - Default Architectural Coating Description
Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100
Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50
Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250
Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100
Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250
Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Page: 1

4/2/2008 03:27:19 PM

Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Mitigated Emissions (Pounds/Day)

File Name: V:\AQNOISE DIVISION\Active Projects\Rialto Specific Plan\Construction\URBEMIS\Phase IIIa.urb924

Project Name: Lytle Creek Rialto - Construction - Phase IIIa

Project Location: San Bernadino County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Mitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 6/1/2011-12/30/2011 Active	35.79	308.21	159.43	0.01	859.55	14.36	873.91	179.52	13.21	192.73	31,854.28
Mass Grading 06/01/2011-	35.79	308.21	159.43	0.01	859.55	14.36	873.91	179.52	13.21	192.73	31,854.28
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	35.51	307.69	150.51	0.00	0.00	14.33	14.33	0.00	13.18	13.18	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.28	0.52	8.92	0.01	0.05	0.03	0.09	0.02	0.03	0.05	1,083.44
Time Slice 1/2/2012-2/29/2012 Active	34.13	288.57	152.48	0.01	859.55	13.29	872.85	179.52	12.23	191.74	31,853.10
Mass Grading 06/01/2011-	34.13	288.57	152.48	0.01	859.55	13.29	872.85	179.52	12.23	191.74	31,853.10
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	33.87	288.10	144.25	0.00	0.00	13.26	13.26	0.00	12.20	12.20	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.25	0.47	8.23	0.01	0.05	0.03	0.09	0.02	0.03	0.05	1,082.26
Time Slice 3/1/2012-3/30/2012 Active	56.08	392.50	598.86	0.66	862.38	19.11	881.49	180.53	17.44	197.97	97,636.03
Building 03/01/2012-02/28/2020	21.96	103.93	446.38	0.65	2.83	5.81	8.64	1.01	5.22	6.23	65,782.93
Building Off Road Diesel	5.36	25.96	19.91	0.00	0.00	2.02	2.02	0.00	1.86	1.86	2,771.15
Building Vendor Trips	4.97	56.23	46.99	0.13	0.46	2.24	2.70	0.16	2.05	2.21	13,130.56
Building Worker Trips	11.63	21.74	379.48	0.53	2.37	1.56	3.93	0.85	1.31	2.16	49,881.22
Mass Grading 06/01/2011-	34.13	288.57	152.48	0.01	859.55	13.29	872.85	179.52	12.23	191.74	31,853.10
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	33.87	288.10	144.25	0.00	0.00	13.26	13.26	0.00	12.20	12.20	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.25	0.47	8.23	0.01	0.05	0.03	0.09	0.02	0.03	0.05	1,082.26
Time Slice 4/2/2012-12/31/2012 Active	**83.36**	**405.93**	**608.30**	**0.67**	862.40	**20.25**	882.64	180.53	**18.49**	199.02	**99,048.56**
Asphalt 04/01/2012-02/28/2020	2.41	13.39	8.67	0.00	0.01	1.13	1.15	0.00	1.04	1.05	1,311.78
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Paving Off Road Diesel	2.04	12.44	7.40	0.00	0.00	1.10	1.10	0.00	1.01	1.01	1,033.53
Paving On Road Diesel	0.07	0.90	0.33	0.00	0.01	0.03	0.04	0.00	0.03	0.03	154.56
Paving Worker Trips	0.03	0.05	0.94	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.69
Building 03/01/2012-02/28/2020	21.96	103.93	446.38	0.65	2.83	5.81	8.64	1.01	5.22	6.23	65,782.93
Building Off Road Diesel	5.36	25.96	19.91	0.00	0.00	2.02	2.02	0.00	1.86	1.86	2,771.15
Building Vendor Trips	4.97	56.23	46.99	0.13	0.46	2.24	2.70	0.16	2.05	2.21	13,130.56
Building Worker Trips	11.63	21.74	379.48	0.53	2.37	1.56	3.93	0.85	1.31	2.16	49,881.22
Coating 04/01/2012-02/28/2020	24.87	0.04	0.77	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.76
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.04	0.77	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.76
Mass Grading 06/01/2011-	34.13	288.57	152.48	0.01	859.55	13.29	872.85	179.52	12.23	191.74	31,853.10
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	33.87	288.10	144.25	0.00	0.00	13.26	13.26	0.00	12.20	12.20	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.25	0.47	8.23	0.01	0.05	0.03	0.09	0.02	0.03	0.05	1,082.26
Time Slice 1/1/2013-12/31/2013 Active	79.62	376.83	567.87	**0.67**	862.40	18.80	881.20	180.53	17.15	197.69	99,000.80
Asphalt 04/01/2012-02/28/2020	2.27	12.64	8.49	0.00	0.01	1.06	1.07	0.00	0.98	0.98	1,311.66
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.91	11.80	7.33	0.00	0.00	1.03	1.03	0.00	0.95	0.95	1,033.53
Paving On Road Diesel	0.06	0.79	0.29	0.00	0.01	0.03	0.03	0.00	0.03	0.03	154.56
Paving Worker Trips	0.03	0.05	0.87	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.57
Building 03/01/2012-02/28/2020	19.87	93.85	412.43	0.65	2.83	5.39	8.22	1.01	4.82	5.83	65,736.42
Building Off Road Diesel	4.86	24.36	19.49	0.00	0.00	1.80	1.80	0.00	1.66	1.66	2,771.15
Building Vendor Trips	4.52	49.67	43.08	0.13	0.46	1.97	2.43	0.16	1.80	1.96	13,131.68
Building Worker Trips	10.49	19.83	349.85	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,833.59
Coating 04/01/2012-02/28/2020	24.86	0.04	0.71	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.66
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.04	0.71	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.66
Mass Grading 06/01/2011-	32.62	270.29	146.25	0.01	859.55	12.34	871.89	179.52	11.35	190.87	31,852.07
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	32.39	269.86	138.66	0.00	0.00	12.31	12.31	0.00	11.32	11.32	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.23	0.43	7.59	0.01	0.05	0.04	0.09	0.02	0.03	0.05	1,081.23
Time Slice 1/1/2014-12/31/2014 Active	75.97	347.16	531.44	**0.67**	862.40	17.14	879.54	180.53	15.63	196.16	98,958.80
Asphalt 04/01/2012-02/28/2020	2.16	11.92	8.34	0.00	0.01	0.99	1.00	0.00	0.91	0.92	1,311.55
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.81	11.19	7.28	0.00	0.00	0.96	0.96	0.00	0.89	0.89	1,033.53
Paving On Road Diesel	0.06	0.69	0.26	0.00	0.01	0.03	0.03	0.00	0.02	0.03	154.56
Paving Worker Trips	0.02	0.04	0.80	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.47
Building 03/01/2012-02/28/2020	17.99	84.43	381.42	0.65	2.83	4.94	7.77	1.01	4.40	5.41	65,695.51

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Building Off Road Diesel	4.40	22.83	19.09	0.00	0.00	1.59	1.59	0.00	1.46	1.46	2,771.15
Building Vendor Trips	4.09	43.54	39.54	0.13	0.46	1.73	2.19	0.16	1.58	1.74	13,132.48
Building Worker Trips	9.50	18.06	322.79	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,791.87
Coating 04/01/2012-02/28/2020	24.86	0.04	0.65	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.58
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.04	0.65	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.58
Mass Grading 06/01/2011-	30.96	250.78	141.03	0.01	859.55	11.21	870.76	179.52	10.31	189.83	31,851.16
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	30.75	250.38	134.03	0.00	0.00	11.18	11.18	0.00	10.28	10.28	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.21	0.39	7.00	0.01	0.05	0.04	0.09	0.02	0.03	0.05	1,080.32
Time Slice 1/1/2015-12/31/2015 Active	72.18	316.43	497.66	**0.67**	862.40	15.84	878.23	180.53	14.43	194.96	98,894.23
Asphalt 04/01/2012-02/28/2020	2.03	11.13	8.18	0.00	0.01	0.92	0.93	0.00	0.85	0.85	1,311.40
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.70	10.49	7.21	0.00	0.00	0.90	0.90	0.00	0.82	0.82	1,033.53
Paving On Road Diesel	0.05	0.60	0.23	0.00	0.01	0.02	0.03	0.00	0.02	0.02	154.56
Paving Worker Trips	0.02	0.04	0.74	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.31
Building 03/01/2012-02/28/2020	16.23	75.64	352.65	0.65	2.83	4.58	7.41	1.01	4.07	5.09	65,632.61
Building Off Road Diesel	3.98	21.19	18.71	0.00	0.00	1.45	1.45	0.00	1.34	1.34	2,771.15
Building Vendor Trips	3.69	38.04	36.28	0.13	0.46	1.51	1.97	0.16	1.38	1.53	13,133.31
Building Worker Trips	8.55	16.41	297.66	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,728.15
Coating 04/01/2012-02/28/2020	24.86	0.03	0.60	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.45
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.03	0.60	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.45
Mass Grading 06/01/2011-	29.06	229.62	136.23	0.01	859.55	10.33	869.89	179.52	9.51	189.02	31,849.78
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	28.87	229.27	129.77	0.00	0.00	10.30	10.30	0.00	9.48	9.48	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.19	0.36	6.46	0.01	0.05	0.04	0.09	0.02	0.03	0.05	1,078.94
Time Slice 1/1/2016-12/30/2016 Active	68.98	288.73	467.73	**0.67**	862.40	14.49	876.88	180.53	13.19	193.72	98,835.88
Asphalt 04/01/2012-02/28/2020	1.91	10.37	8.05	0.00	0.01	0.84	0.85	0.00	0.77	0.77	1,311.25
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.58	9.81	7.17	0.00	0.00	0.81	0.81	0.00	0.75	0.75	1,033.53
Paving On Road Diesel	0.05	0.53	0.20	0.00	0.01	0.02	0.02	0.00	0.02	0.02	154.56
Paving Worker Trips	0.02	0.04	0.68	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.16
Building 03/01/2012-02/28/2020	14.78	68.18	326.92	0.65	2.83	4.22	7.05	1.01	3.75	4.76	65,575.77
Building Off Road Diesel	3.60	19.67	18.42	0.00	0.00	1.27	1.27	0.00	1.17	1.17	2,771.15
Building Vendor Trips	3.36	33.55	33.53	0.13	0.46	1.34	1.80	0.16	1.22	1.37	13,133.93
Building Worker Trips	7.81	14.96	274.98	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,670.69
Coating 04/01/2012-02/28/2020	24.86	0.03	0.56	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.33

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.02	0.03	0.56	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.33
Mass Grading 06/01/2011-	27.43	210.14	132.21	0.01	859.55	9.43	868.98	179.52	8.67	188.19	31,848.53
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	27.26	209.82	126.24	0.00	0.00	9.39	9.39	0.00	8.64	8.64	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.17	0.32	5.97	0.01	0.05	0.04	0.09	0.02	0.03	0.05	1,077.69
Time Slice 1/2/2017-5/31/2017 Active	65.95	263.19	439.82	**0.67**	862.40	13.19	875.58	180.53	11.99	192.53	98,783.07
Asphalt 04/01/2012-02/28/2020	1.80	9.68	7.92	0.00	0.01	0.77	0.78	0.00	0.71	0.71	1,311.12
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.48	9.17	7.11	0.00	0.00	0.75	0.75	0.00	0.69	0.69	1,033.53
Paving On Road Diesel	0.04	0.47	0.18	0.00	0.01	0.02	0.02	0.00	0.02	0.02	154.56
Paving Worker Trips	0.02	0.03	0.63	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.04
Building 03/01/2012-02/28/2020	13.37	61.83	303.23	0.65	2.83	3.91	6.74	1.01	3.46	4.47	65,524.32
Building Off Road Diesel	3.23	18.32	18.15	0.00	0.00	1.10	1.10	0.00	1.01	1.01	2,771.15
Building Vendor Trips	3.08	29.77	31.09	0.13	0.46	1.19	1.65	0.16	1.09	1.24	13,134.55
Building Worker Trips	7.06	13.74	253.99	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,618.62
Coating 04/01/2012-02/28/2020	24.86	0.03	0.51	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.23
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.51	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.23
Mass Grading 06/01/2011-	25.92	191.65	128.16	0.01	859.55	8.51	868.06	179.52	7.82	187.34	31,847.40
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	25.77	191.35	122.65	0.00	0.00	8.47	8.47	0.00	7.79	7.79	30,770.84
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.15	0.30	5.51	0.01	0.05	0.04	0.09	0.02	0.03	0.05	1,076.56
Time Slice 6/1/2017-12/29/2017 Active	40.03	71.54	311.66	0.66	2.85	4.68	7.53	1.02	4.17	5.19	66,935.67
Asphalt 04/01/2012-02/28/2020	1.80	9.68	7.92	0.00	0.01	0.77	0.78	0.00	0.71	0.71	1,311.12
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.48	9.17	7.11	0.00	0.00	0.75	0.75	0.00	0.69	0.69	1,033.53
Paving On Road Diesel	0.04	0.47	0.18	0.00	0.01	0.02	0.02	0.00	0.02	0.02	154.56
Paving Worker Trips	0.02	0.03	0.63	0.00	0.01	0.00	0.01	0.00	0.00	0.01	123.04
Building 03/01/2012-02/28/2020	13.37	61.83	303.23	0.65	2.83	3.91	6.74	1.01	3.46	4.47	65,524.32
Building Off Road Diesel	3.23	18.32	18.15	0.00	0.00	1.10	1.10	0.00	1.01	1.01	2,771.15
Building Vendor Trips	3.08	29.77	31.09	0.13	0.46	1.19	1.65	0.16	1.09	1.24	13,134.55
Building Worker Trips	7.06	13.74	253.99	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,618.62
Coating 04/01/2012-02/28/2020	24.86	0.03	0.51	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.23
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.51	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.23
Time Slice 1/1/2018-12/31/2018 Active	38.70	65.21	290.01	0.66	2.85	4.35	7.19	1.02	3.86	4.88	66,862.56
Asphalt 04/01/2012-02/28/2020	1.72	9.02	7.83	0.00	0.01	0.70	0.71	0.00	0.64	0.65	1,310.94

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.39	8.57	7.08	0.00	0.00	0.68	0.68	0.00	0.63	0.63	1,033.53
Paving On Road Diesel	0.04	0.42	0.16	0.00	0.01	0.01	0.02	0.00	0.01	0.01	154.56
Paving Worker Trips	0.02	0.03	0.58	0.00	0.01	0.00	0.01	0.00	0.00	0.01	122.85
Building 03/01/2012-02/28/2020	12.13	56.16	281.71	0.65	2.83	3.64	6.47	1.01	3.22	4.23	65,451.54
Building Off Road Diesel	2.89	17.02	17.90	0.00	0.00	0.96	0.96	0.00	0.88	0.88	2,771.15
Building Vendor Trips	2.84	26.59	28.94	0.13	0.46	1.07	1.53	0.16	0.97	1.13	13,135.11
Building Worker Trips	6.39	12.54	234.87	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,545.28
Coating 04/01/2012-02/28/2020	24.86	0.03	0.47	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.08
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.47	0.00	0.00	0.00	0.01	0.00	0.00	0.00	100.08
Time Slice 1/1/2019-12/31/2019 Active	37.53	59.72	270.40	0.66	2.85	4.03	6.87	1.02	3.57	4.58	66,797.81
Asphalt 04/01/2012-02/28/2020	1.61	8.43	7.70	0.00	0.01	0.63	0.64	0.00	0.58	0.58	1,310.78
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.29	8.02	7.01	0.00	0.00	0.61	0.61	0.00	0.56	0.56	1,033.53
Paving On Road Diesel	0.04	0.38	0.15	0.00	0.01	0.01	0.02	0.00	0.01	0.01	154.56
Paving Worker Trips	0.01	0.03	0.54	0.00	0.01	0.00	0.01	0.00	0.00	0.01	122.69
Building 03/01/2012-02/28/2020	11.06	51.27	262.26	0.65	2.83	3.40	6.22	1.01	2.99	4.00	65,387.09
Building Off Road Diesel	2.62	15.83	17.69	0.00	0.00	0.81	0.81	0.00	0.74	0.74	2,771.15
Building Vendor Trips	2.62	23.91	27.03	0.13	0.46	0.97	1.43	0.16	0.88	1.04	13,135.62
Building Worker Trips	5.82	11.53	217.54	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,480.32
Coating 04/01/2012-02/28/2020	24.86	0.02	0.44	0.00	0.00	0.00	0.01	0.00	0.00	0.00	99.95
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.44	0.00	0.00	0.00	0.01	0.00	0.00	0.00	99.95
Time Slice 1/1/2020-2/28/2020 Active	36.42	54.90	252.00	0.66	2.85	3.81	6.65	1.02	3.37	4.38	66,739.47
Asphalt 04/01/2012-02/28/2020	1.51	7.85	7.61	0.00	0.01	0.60	0.61	0.00	0.55	0.55	1,310.64
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.19	7.49	6.98	0.00	0.00	0.58	0.58	0.00	0.53	0.53	1,033.53
Paving On Road Diesel	0.03	0.34	0.14	0.00	0.01	0.01	0.02	0.00	0.01	0.01	154.56
Paving Worker Trips	0.01	0.03	0.50	0.00	0.01	0.00	0.01	0.00	0.00	0.01	122.55
Building 03/01/2012-02/28/2020	10.06	47.03	243.98	0.65	2.83	3.21	6.04	1.01	2.82	3.83	65,329.01
Building Off Road Diesel	2.36	14.83	17.54	0.00	0.00	0.71	0.71	0.00	0.65	0.65	2,771.15
Building Vendor Trips	2.44	21.66	25.32	0.13	0.46	0.88	1.34	0.16	0.80	0.96	13,136.09
Building Worker Trips	5.27	10.54	201.12	0.53	2.37	1.62	3.99	0.85	1.36	2.22	49,421.76
Coating 04/01/2012-02/28/2020	24.85	0.02	0.41	0.00	0.00	0.00	0.01	0.00	0.00	0.00	99.83
Architectural Coating	24.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.41	0.00	0.00	0.00	0.01	0.00	0.00	0.00	99.83

Construction Related Mitigation Measures

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
2 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day											

Phase: Architectural Coating 4/1/2012 - 2/28/2020 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2

The following mitigation measures apply to Phase: Mass Grading 6/1/2011 - 5/31/2017 - Default Mass Site Grading/Excavation Description

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

Phase Assumptions

Phase: Mass Grading 6/1/2011 - 5/31/2017 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 816

Maximum Daily Acreage Disturbed: 50

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

12 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

3 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

3 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

3 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day

8 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day

3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 4/1/2012 - 2/28/2020 - Default Paving Description

Acres to be Paved: 209.88

Off-Road Equipment:

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 3/1/2012 - 2/28/2020 - Default Building Construction Description

Off-Road Equipment:

2 Aerial Lifts (60 hp) operating at a 0.46 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 3 hours per day

3 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

2 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

2 Skid Steer Loaders (44 hp) operating at a 0.55 load factor for 8 hours per day

3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Page: 1

4/2/2008 03:01:05 PM

Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Mitigated Emissions (Pounds/Day)

File Name: V:\AQNOISE DIVISION\Active Projects\Rialto Specific Plan\Construction\URBEMIS\Phase IIIb.urb9

Project Name: Lytle Creek Rialto Construction - Phase IIIb

Project Location: San Bernadino County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Mitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 4/1/2024-8/30/2024 Active	20.65	138.37	114.34	0.01	859.55	5.78	865.33	179.51	5.32	184.83	29,550.75
Mass Grading 04/01/2024-	20.65	138.37	114.34	0.01	859.55	5.78	865.33	179.51	5.32	184.83	29,550.75
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	20.58	138.23	111.53	0.00	0.00	5.75	5.75	0.00	5.29	5.29	28,574.71
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.07	0.14	2.81	0.01	0.05	0.03	0.08	0.02	0.03	0.04	976.03
Time Slice 9/2/2024-9/30/2024 Active	23.67	156.35	149.97	0.08	859.85	6.88	866.73	179.62	6.31	185.93	39,111.85
Building 09/01/2024-08/31/2025	3.02	17.98	35.63	0.07	0.30	1.09	1.40	0.11	0.99	1.10	9,561.10
Building Off Road Diesel	2.48	15.66	18.43	0.00	0.00	0.85	0.85	0.00	0.79	0.79	2,901.48
Building Vendor Trips	0.19	1.57	2.07	0.01	0.05	0.07	0.12	0.02	0.06	0.08	1,406.62
Building Worker Trips	0.35	0.76	15.13	0.06	0.25	0.17	0.43	0.09	0.15	0.24	5,253.01
Mass Grading 04/01/2024-	20.65	138.37	114.34	0.01	859.55	5.78	865.33	179.51	5.32	184.83	29,550.75
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	20.58	138.23	111.53	0.00	0.00	5.75	5.75	0.00	5.29	5.29	28,574.71
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.07	0.14	2.81	0.01	0.05	0.03	0.08	0.02	0.03	0.04	976.03
Time Slice 10/1/2024-12/31/2024	**41.53**	**162.95**	**156.66**	**0.08**	859.86	**7.38**	867.24	179.63	**6.77**	186.40	**40,372.34**
Asphalt 10/01/2024-08/31/2025	1.31	6.59	6.42	0.00	0.01	0.50	0.51	0.00	0.46	0.46	1,167.76
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.00	6.34	5.97	0.00	0.00	0.49	0.49	0.00	0.45	0.45	887.12
Paving On Road Diesel	0.03	0.23	0.10	0.00	0.01	0.01	0.01	0.00	0.01	0.01	158.64
Paving Worker Trips	0.01	0.02	0.35	0.00	0.01	0.00	0.01	0.00	0.00	0.01	122.00
Building 09/01/2024-08/31/2025	3.02	17.98	35.63	0.07	0.30	1.09	1.40	0.11	0.99	1.10	9,561.10
Building Off Road Diesel	2.48	15.66	18.43	0.00	0.00	0.85	0.85	0.00	0.79	0.79	2,901.48
Building Vendor Trips	0.19	1.57	2.07	0.01	0.05	0.07	0.12	0.02	0.06	0.08	1,406.62

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Building Worker Trips	0.35	0.76	15.13	0.06	0.25	0.17	0.43	0.09	0.15	0.24	5,253.01
Coating 10/01/2024-08/31/2025	16.55	0.01	0.27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	92.72
Architectural Coating	16.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.01	0.27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	92.72
Mass Grading 04/01/2024-	20.65	138.37	114.34	0.01	859.55	5.78	865.33	179.51	5.32	184.83	29,550.75
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	20.58	138.23	111.53	0.00	0.00	5.75	5.75	0.00	5.29	5.29	28,574.71
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.07	0.14	2.81	0.01	0.05	0.03	0.08	0.02	0.03	0.04	976.03
Time Slice 1/1/2025-1/31/2025 Active	41.53	**162.95**	**156.66**	**0.08**	859.86	**7.38**	867.24	179.63	**6.77**	186.40	**40,372.34**
Asphalt 10/01/2024-08/31/2025	1.31	6.59	6.42	0.00	0.01	0.50	0.51	0.00	0.46	0.46	1,167.76
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.00	6.34	5.97	0.00	0.00	0.49	0.49	0.00	0.45	0.45	887.12
Paving On Road Diesel	0.03	0.23	0.10	0.00	0.01	0.01	0.01	0.00	0.01	0.01	158.64
Paving Worker Trips	0.01	0.02	0.35	0.00	0.01	0.00	0.01	0.00	0.00	0.01	122.00
Building 09/01/2024-08/31/2025	3.02	17.98	35.63	0.07	0.30	1.09	1.40	0.11	0.99	1.10	9,561.10
Building Off Road Diesel	2.48	15.66	18.43	0.00	0.00	0.85	0.85	0.00	0.79	0.79	2,901.48
Building Vendor Trips	0.19	1.57	2.07	0.01	0.05	0.07	0.12	0.02	0.06	0.08	1,406.62
Building Worker Trips	0.35	0.76	15.13	0.06	0.25	0.17	0.43	0.09	0.15	0.24	5,253.01
Coating 10/01/2024-08/31/2025	16.55	0.01	0.27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	92.72
Architectural Coating	16.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.01	0.27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	92.72
Mass Grading 04/01/2024-	20.65	138.37	114.34	0.01	859.55	5.78	865.33	179.51	5.32	184.83	29,550.75
Mass Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Mass Grading Off Road Diesel	20.58	138.23	111.53	0.00	0.00	5.75	5.75	0.00	5.29	5.29	28,574.71
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.07	0.14	2.81	0.01	0.05	0.03	0.08	0.02	0.03	0.04	976.03
Time Slice 2/3/2025-8/29/2025 Active	20.89	24.58	42.32	0.07	0.32	1.60	1.91	0.11	1.45	1.57	10,821.59
Asphalt 10/01/2024-08/31/2025	1.31	6.59	6.42	0.00	0.01	0.50	0.51	0.00	0.46	0.46	1,167.76
Paving Off-Gas	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.00	6.34	5.97	0.00	0.00	0.49	0.49	0.00	0.45	0.45	887.12
Paving On Road Diesel	0.03	0.23	0.10	0.00	0.01	0.01	0.01	0.00	0.01	0.01	158.64
Paving Worker Trips	0.01	0.02	0.35	0.00	0.01	0.00	0.01	0.00	0.00	0.01	122.00
Building 09/01/2024-08/31/2025	3.02	17.98	35.63	0.07	0.30	1.09	1.40	0.11	0.99	1.10	9,561.10
Building Off Road Diesel	2.48	15.66	18.43	0.00	0.00	0.85	0.85	0.00	0.79	0.79	2,901.48
Building Vendor Trips	0.19	1.57	2.07	0.01	0.05	0.07	0.12	0.02	0.06	0.08	1,406.62
Building Worker Trips	0.35	0.76	15.13	0.06	0.25	0.17	0.43	0.09	0.15	0.24	5,253.01
Coating 10/01/2024-08/31/2025	16.55	0.01	0.27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	92.72
Architectural Coating	16.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.01	0.27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	92.72

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Mass Grading 4/1/2024 - 1/31/2025 - Default Mass Site Grading/Excavation Description

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

Phase Assumptions

Phase: Mass Grading 4/1/2024 - 1/31/2025 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 113

Maximum Daily Acreage Disturbed: 50

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

12 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

3 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

3 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day

8 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day

3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 10/1/2024 - 8/31/2025 - Default Paving Description

Acres to be Paved: 24.92

Off-Road Equipment:

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 6 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 9/1/2024 - 8/31/2025 - Default Building Construction Description

Off-Road Equipment:

2 Aerial Lifts (60 hp) operating at a 0.46 load factor for 8 hours per day

2 Air Compressors (106 hp) operating at a 0.48 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 2 hours per day

3 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

2 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day											
2 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day											

Phase: Architectural Coating 10/1/2024 - 8/31/2025 - Default Architectural Coating Description
Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100
Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50
Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250
Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100
Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250
Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Page: 1

4/2/2008 03:08:24 PM

Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Mitigated Emissions (Pounds/Day)

File Name: V:\AQNOISE DIVISION\Active Projects\Rialto Specific Plan\Construction\URBEMIS\Phase IV.urb9

Project Name: Lytle Creek Phase 4

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Mitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 7/3/2017-12/29/2017 Active	24.75	186.74	112.08	0.01	859.54	7.95	867.49	179.51	7.31	186.82	29,569.96
Fine Grading 07/01/2017-	24.75	186.74	112.08	0.01	859.54	7.95	867.49	179.51	7.31	186.82	29,569.96
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	24.63	186.50	107.62	0.00	0.00	7.92	7.92	0.00	7.29	7.29	28,699.98
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.12	0.24	4.46	0.01	0.04	0.03	0.07	0.01	0.02	0.04	869.98
Time Slice 1/1/2018-3/30/2018 Active	23.17	170.82	108.58	0.01	859.54	7.15	866.69	179.51	6.57	186.08	29,569.91
Fine Grading 07/01/2017-	23.17	170.82	108.58	0.01	859.54	7.15	866.69	179.51	6.57	186.08	29,569.91
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	23.05	170.60	104.42	0.00	0.00	7.12	7.12	0.00	6.55	6.55	28,699.98
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.11	0.22	4.16	0.01	0.04	0.03	0.07	0.01	0.02	0.04	869.93
Time Slice 4/2/2018-4/30/2018 Active	31.93	220.34	255.62	0.34	860.94	9.94	870.88	180.01	9.08	189.09	65,487.70
Building 04/01/2018-06/30/2021	8.76	49.52	147.04	0.33	1.40	2.79	4.19	0.50	2.51	3.01	35,917.79
Building Off Road Diesel	3.48	20.88	19.88	0.00	0.00	1.21	1.21	0.00	1.12	1.12	3,406.08
Building Vendor Trips	2.52	23.26	25.11	0.11	0.39	0.94	1.33	0.13	0.86	0.99	11,162.86
Building Worker Trips	2.76	5.39	102.05	0.22	1.01	0.64	1.65	0.36	0.54	0.90	21,348.85
Fine Grading 07/01/2017-	23.17	170.82	108.58	0.01	859.54	7.15	866.69	179.51	6.57	186.08	29,569.91
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	23.05	170.60	104.42	0.00	0.00	7.12	7.12	0.00	6.55	6.55	28,699.98
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.11	0.22	4.16	0.01	0.04	0.03	0.07	0.01	0.02	0.04	869.93
Time Slice 5/1/2018-12/31/2018 Active	**52.35**	**231.26**	**265.97**	**0.34**	860.96	**10.81**	871.77	180.02	**9.88**	189.90	**67,126.42**
Asphalt 05/01/2018-06/30/2021	1.87	10.90	9.86	0.00	0.01	0.87	0.88	0.00	0.80	0.80	1,535.88
Paving Off-Gas	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Paving Off Road Diesel	1.75	10.72	8.76	0.00	0.00	0.86	0.86	0.00	0.79	0.79	1,272.41
Paving On Road Diesel	0.01	0.13	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	45.99
Paving Worker Trips	0.03	0.05	1.04	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.48
Building 04/01/2018-06/30/2021	8.76	49.52	147.04	0.33	1.40	2.79	4.19	0.50	2.51	3.01	35,917.79
Building Off Road Diesel	3.48	20.88	19.88	0.00	0.00	1.21	1.21	0.00	1.12	1.12	3,406.08
Building Vendor Trips	2.52	23.26	25.11	0.11	0.39	0.94	1.33	0.13	0.86	0.99	11,162.86
Building Worker Trips	2.76	5.39	102.05	0.22	1.01	0.64	1.65	0.36	0.54	0.90	21,348.85
Coating 05/01/2018-06/30/2021	18.55	0.03	0.49	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.84
Architectural Coating	18.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.03	0.49	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.84
Fine Grading 07/01/2017-	23.17	170.82	108.58	0.01	859.54	7.15	866.69	179.51	6.57	186.08	29,569.91
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	23.05	170.60	104.42	0.00	0.00	7.12	7.12	0.00	6.55	6.55	28,699.98
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.11	0.22	4.16	0.01	0.04	0.03	0.07	0.01	0.02	0.04	869.93
Time Slice 1/1/2019-12/31/2019 Active	50.41	211.69	253.67	**0.34**	860.96	9.72	870.67	180.02	8.88	188.89	67,125.92
Asphalt 05/01/2018-06/30/2021	1.74	10.20	9.70	0.00	0.01	0.79	0.80	0.00	0.73	0.73	1,535.88
Paving Off-Gas	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.63	10.04	8.69	0.00	0.00	0.78	0.78	0.00	0.72	0.72	1,272.41
Paving On Road Diesel	0.01	0.11	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	45.99
Paving Worker Trips	0.03	0.05	0.97	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.47
Building 04/01/2018-06/30/2021	8.06	45.29	138.33	0.33	1.40	2.53	3.93	0.50	2.27	2.76	35,917.34
Building Off Road Diesel	3.18	19.34	19.66	0.00	0.00	1.04	1.04	0.00	0.96	0.96	3,406.08
Building Vendor Trips	2.34	20.99	23.51	0.11	0.39	0.85	1.24	0.13	0.77	0.91	11,163.29
Building Worker Trips	2.54	4.96	95.15	0.22	1.01	0.64	1.65	0.36	0.54	0.90	21,347.97
Coating 05/01/2018-06/30/2021	18.55	0.02	0.46	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.83
Architectural Coating	18.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.46	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.83
Fine Grading 07/01/2017-	22.06	156.18	105.19	0.01	859.54	6.39	865.93	179.51	5.88	185.39	29,569.88
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	21.96	155.97	101.31	0.00	0.00	6.37	6.37	0.00	5.86	5.86	28,699.98
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.10	0.20	3.88	0.01	0.04	0.03	0.07	0.01	0.02	0.04	869.90
Time Slice 1/1/2020-9/30/2020 Active	48.24	193.67	242.59	**0.34**	860.96	8.73	869.69	180.02	7.97	187.98	67,125.64
Asphalt 05/01/2018-06/30/2021	1.62	9.53	9.59	0.00	0.01	0.74	0.75	0.00	0.68	0.68	1,535.87
Paving Off-Gas	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.51	9.38	8.65	0.00	0.00	0.73	0.73	0.00	0.67	0.67	1,272.41
Paving On Road Diesel	0.01	0.10	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.99
Paving Worker Trips	0.02	0.05	0.90	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.47
Building 04/01/2018-06/30/2021	7.36	41.70	130.18	0.33	1.40	2.33	3.73	0.50	2.08	2.58	35,917.09

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Building Off Road Diesel	2.88	18.03	19.47	0.00	0.00	0.92	0.92	0.00	0.84	0.84	3,406.08
Building Vendor Trips	2.17	19.09	22.08	0.11	0.39	0.78	1.17	0.13	0.71	0.84	11,163.73
Building Worker Trips	2.31	4.58	88.62	0.22	1.01	0.64	1.65	0.36	0.54	0.90	21,347.29
Coating 05/01/2018-06/30/2021	18.54	0.02	0.43	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.83
Architectural Coating	18.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.43	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.83
Fine Grading 07/01/2017-	20.71	142.42	102.39	0.01	859.54	5.66	865.20	179.51	5.20	184.72	29,569.85
Fine Grading Dust	0.00	0.00	0.00	0.00	859.50	0.00	859.50	179.50	0.00	179.50	0.00
Fine Grading Off Road Diesel	20.62	142.23	98.78	0.00	0.00	5.63	5.63	0.00	5.18	5.18	28,699.98
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.09	0.19	3.61	0.01	0.04	0.03	0.07	0.01	0.02	0.04	869.87
Time Slice 10/1/2020-12/31/2020	27.53	51.25	140.19	0.33	1.42	3.07	4.49	0.50	2.76	3.27	37,555.79
Asphalt 05/01/2018-06/30/2021	1.62	9.53	9.59	0.00	0.01	0.74	0.75	0.00	0.68	0.68	1,535.87
Paving Off-Gas	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.51	9.38	8.65	0.00	0.00	0.73	0.73	0.00	0.67	0.67	1,272.41
Paving On Road Diesel	0.01	0.10	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.99
Paving Worker Trips	0.02	0.05	0.90	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.47
Building 04/01/2018-06/30/2021	7.36	41.70	130.18	0.33	1.40	2.33	3.73	0.50	2.08	2.58	35,917.09
Building Off Road Diesel	2.88	18.03	19.47	0.00	0.00	0.92	0.92	0.00	0.84	0.84	3,406.08
Building Vendor Trips	2.17	19.09	22.08	0.11	0.39	0.78	1.17	0.13	0.71	0.84	11,163.73
Building Worker Trips	2.31	4.58	88.62	0.22	1.01	0.64	1.65	0.36	0.54	0.90	21,347.29
Coating 05/01/2018-06/30/2021	18.54	0.02	0.43	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.83
Architectural Coating	18.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.43	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.83
Time Slice 1/1/2021-6/30/2021 Active	26.18	44.00	109.90	0.33	1.42	2.86	4.27	0.50	2.57	3.07	37,555.95
Asphalt 05/01/2018-06/30/2021	1.61	9.49	9.33	0.00	0.01	0.74	0.75	0.00	0.68	0.68	1,535.85
Paving Off-Gas	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.51	9.38	8.65	0.00	0.00	0.73	0.73	0.00	0.67	0.67	1,272.41
Paving On Road Diesel	0.01	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.99
Paving Worker Trips	0.02	0.03	0.65	0.00	0.01	0.01	0.02	0.00	0.01	0.01	217.45
Building 04/01/2018-06/30/2021	6.03	34.49	100.27	0.33	1.40	2.12	3.52	0.50	1.89	2.39	35,917.28
Building Off Road Diesel	2.88	18.03	19.47	0.00	0.00	0.92	0.92	0.00	0.84	0.84	3,406.08
Building Vendor Trips	1.64	13.31	17.05	0.11	0.39	0.57	0.96	0.13	0.51	0.64	11,165.69
Building Worker Trips	1.52	3.16	63.74	0.22	1.01	0.64	1.65	0.36	0.54	0.90	21,345.52
Coating 05/01/2018-06/30/2021	18.54	0.02	0.31	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.82
Architectural Coating	18.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.02	0.31	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.82

Construction Related Mitigation Measures

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2

The following mitigation measures apply to Phase: Fine Grading 7/1/2017 - 9/30/2020 - Default Fine Site Grading/Excavation Description

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

Phase Assumptions

Phase: Fine Grading 7/1/2017 - 9/30/2020 - Default Fine Site Grading/Excavation Description

Total Acres Disturbed: 252

Maximum Daily Acreage Disturbed: 50

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

6 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

4 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

2 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day

10 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day

3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 5/1/2018 - 6/30/2021 - Default Paving Description

Acres to be Paved: 25

Off-Road Equipment:

2 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 0 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 6 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 4/1/2018 - 6/30/2021 - Default Building Construction Description

Off-Road Equipment:

1 Aerial Lifts (60 hp) operating at a 0.46 load factor for 8 hours per day

2 Air Compressors (106 hp) operating at a 0.48 load factor for 8 hours per day

2 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 8 hours per day

2 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
3 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day											
2 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day											
3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day											
2 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day											

Phase: Architectural Coating 5/1/2018 - 6/30/2021 - Default Architectural Coating Description
Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100
Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50
Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250
Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100
Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250
Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Table A-1
Start-up Emission Factors
Lytle Creek Ranch
Rialto, California

Variable Start Times (URBEMIS defaults)[1]						
Time	**Home-Work**	**Home-Shop**	**Home-Other**	**Combined Weight[2]**	**CO_2 Emissions (g/start)**	**Weighted CO_2 Emissions (g/start)**
5	0.7	3.3	6.1	0.038	13.35	0.510
10	1	9.5	7.6	0.058	14.99	0.865
20	1.4	14.4	7.8	0.069	18.81	1.295
30	2.2	18.3	7.2	0.076	23.35	1.763
40	2.6	12.2	7	0.065	28.60	1.856
50	2.8	7.5	7.9	0.062	34.57	2.126
60	2.2	4.2	6.2	0.045	41.25	1.866
120	2.6	3.6	6.6	0.047	95.67	4.538
180	6.2	3.7	7.2	0.062	108.53	6.774
240	8.9	2.1	4.9	0.057	121.38	6.933
300	8.6	2.6	4	0.053	134.20	7.061
360	8.6	2.6	4	0.053	147.00	7.734
420	8.7	2.6	4	0.053	159.77	8.459
480	8.7	2.6	3.9	0.052	172.53	9.049
540	8.7	2.7	3.9	0.053	185.25	9.750
600	8.7	2.7	3.9	0.053	197.96	10.419
660	8.7	2.7	3.9	0.053	210.64	11.087
720	8.7	2.7	3.9	0.053	223.30	11.753
						103.838

Notes:
1. The percentage breakdown by time since last start and trip type is based on URBEMIS defaults.
2. The trip type distribution is based on URBEMIS defaults:

Trip Type	Trip Type
Home-Work	32.90%
Home-Shop	18.00%
Home-Other	49.10%

Sources
Software User's Guide: URBEMIS2007 for Windows. Version 9.2
http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Main%20Body.pdf

Appendix B:

Crain and Associates Memorandum
Mobile Emissions Analysis Input

EMAIL TRANSMITTED

September 15, 2009

Mr. Peter Lewandowski
Principal
Environmental Impact Sciences
26051 Via Concha
Mission Viejo, California 92691-5614

RE: Lytle Creek Development Mobile Emissions Analysis Input

Dear Peter,

As requested, we have estimated the number of daily (weekend days, as well as weekdays) project vehicle trips (VT) and vehicle miles of travel (VMT) for use in the Greenhouse Gas Emissions analysis for the Lytle Creek Ranch Specific Plan Environmental Impact Report (EIR). Specifically, this is an estimate of the amount of VT and VMT which would be added by the project. It should be noted that this analysis is consistent with, but measures somewhat different variables than those used in the traffic impact analysis. Specifically, this analysis considers how many VT and how much VMT would be added on a global basis by this project. The traffic impact analysis (and associated studies) looks at how many trips would be added to specific locations such as study intersections.

As a first step, we estimated the number of trips added by the project. This analysis was taken from and is consistent with the traffic analysis conducted for the project. The site generation values were taken directly from the computerized East Valley Transportation Model (EVTM) used for the traffic analysis. The weekend trip generation value was compared to the weekday trip generation value based on ITE trip estimates. The ITE rates are less specific to this project, but were less than 10 percent different from the model estimate for this site assuming the proposed project. The ITE projection for the weekend trip ends was slightly lower, but within five percent of the weekday trip end generation value. The EVTM model was run by the Southern California Association of Government (SCAG) Inland Empire office and was an appropriate modification of their RivSan Model used in order to reflect the proposed project.

2007 Sawtelle Blvd., Suite #4
Los Angeles, CA 90025
310 473 6508 (main)
310 444 9771 (fax)

www.crainandassociates.com

The RivSan Model was the model developed for this area and used to project traffic volumes for the San Bernardino County CMP. This model was developed from the regional model which SCAG uses for regional analyses. The regional model is the standard tool in use for air quality and other regional analyses, and that model utilizes the federally issued Urban Transportation Planning Software (UTPS) package.

A very important distinction should be made for the EVTM model's generation analysis. The model, as well as Institute of Transportation Engineers (ITE) "trip" generation rates within the Trip Generation Manual, estimates trip ends (the word "ends" was dropped from the ITE Trip Generation Manual between the 3rd and 4th editions). For most smaller land use projects where one trip end is at the proposed project site, but the other end is outside the study area, this distinction is not important. However, for the Greenhouse Gas Emissions analysis, the study area is the entire SCAG region. The vast majority of trips will have both ends of the trip within the study area. Thus, unlike the limited areas used in the traffic analysis for which a single trip end is included for each trip, both trip ends are included for each trip in this Greenhouse Gas Emissions analysis. The number of trip ends within the Specific Plan area matches the traffic study and other localized analyses, but due to trips which stop at the site and are already on the street network (such as people diverted to a newly built store nearer their home), the adopted method in the UTPS package is to set the number of trips equal to the number of production trip ends. (Each trip is a connection between a production end and an attraction end.) The federally set UTPS methodology was used for this Greenhouse Gas Emissions analysis.

The analysis below shows a summary of the number of productions (added regional trips) for each of the five project zones as well as for the Specific Plan as a total. It should be noted that productions are used for the person trip generation analysis prior to the trip distribution and mode split step. The calculated factor for each zone in the Specific Plan area (with a weighted average of 52%) was applied to the vehicle trip ends. In addition, the vehicle trips assigned by the model to the network were augmented to also include the vehicle trips which stayed within a zone (e.g. a car run to the grocery store which is three blocks away). Therefore, the estimate below is of the total vehicle trips which will be added to the Southern California basin by the Lytle Creek Ranch Specific Plan.

Zone	Neighborhood	Total Trip Ends	Percent Productions	Productions (Added Trips)
80	I	7,533	68.1%	5,130
81	I	2,697	72.1%	1,945
82	II	24,225	54.6%	13,227
83	III	46,614	46.3%	21,582
84	IV	10,444	54.2%	5,661
Specific Plan Total		***91,513***		***47,545***

Once the number of added trips (as opposed to trip ends) was determined, the trip length could then be multiplied by the trips for each project traffic model zone in order to determine the amount of vehicle miles of travel (VMT) which would be added to the region by the Specific Plan. Again, the project computer model utilized by SCAG was used for the average trip length calculation step. The trip length for each project zone was determined from the model output data. This result was then applied to the added vehicle trips as determined above. The following tables show the resulting analysis:

Zone	Neighborhood	Vehicle Trips	Average Trip Length	Added Vehicle Miles of Travel (VMT)
80	I	5,130	14.5	74,385
81	I	1,945	14.4	28,008
82	II	13,227	9.2	121,688
83	III	21,582	9.3	200,713
84	IV	5,661	13.0	73,593
Specific Plan Total		***47,545***		***498,387***

In summary, prior to mitigation, the land uses proposed to be built within the Lytle Creek Ranch Specific Plan area would be expected to add about 47,545 vehicle trips (VT) which add about 498,387 vehicles miles of travel (VMT) to the region.

Please contact me with any questions.

Sincerely,

George Rhyner
Senior Transportation Engineer

GR:cw
C19689B
JA79256
enclosures

Appendix C:

URBEMIS Files for Mobile Emissions

9/21/2009 5:06:10 PM

Urbemis 2007 Version 9.2.4

Detail Report for Annual Operational Mitigated Emissions (Tons/Year)

File Name: U:\Lytle Creek Ranch\Calculations\Traffic\URBEMIS\ENVIRON OPS bike_ped 091709.urb924

Project Name: Lytle Creek Ranch Final Buildout

Project Location: San Bernadino County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

OPERATIONAL EMISSION ESTIMATES (Annual Tons Per Year, Mitigated)

Source	CO2
Single family housing	41,225.98
Condo/townhouse general	46,794.59
Elementary school	1,949.10
City park	618.96
Strip mall	21,939.81
TOTALS (tons/year, mitigated)	112,528.44

Includes correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Operational Mitigation Options Selected

Residential Mitigation Measures

Residential Mix of Uses Mitigation

9/21/2009 5:06:10 PM

Operational Mitigation Options Selected

Residential Mitigation Measures

Percent Reduction in Trips is 1.07% (calculated as a % of 9.57 trips/day))

Note that the above percent is applied to a baseline of 9.57 and that product is

subtracted from the Unmitigated Trips

Inputs Selected:

The number of housing units within a 1/2 mile radius of the project, plus the

number of residential units included in the project are 11723.

The employment for the study area (within a 1/2 mile radius of the project) is 3596.

Residential Local-Serving Retail Mitigation

Percent Reduction in Trips is 2% (calculated as a % of 9.57 trips/day)))

Note that the above percent is applied to a baseline of 9.57 and that product is

subtracted from the Unmitigated Trips

Inputs Selected:

The Presence of Local-Serving Retail checkbox was selected.

Residential Transit Service Mitigation

Percent Reduction in Trips is 1.04% (calculated as a % of 9.57 trips/day)

Note that the above percent is applied to a baseline of 9.57 and that product is

subtracted from the Unmitigated Trips

Inputs Selected:

9/21/2009 5:06:10 PM

Operational Mitigation Options Selected

Residential Mitigation Measures

The Number of Daily Weekday Buses Stopping Within 1/4 Mile of Site is 34

The Number of Daily Rail or Bus Rapid Transit Stops Within 1/2 Mile of Site is 19

The Number of Dedicated Daily Shuttle Trips is 0

Residential Pedestrian/Bicycle Friendliness Mitigation

Percent Reduction in Trips is 6.6% (calculated as a % of 9.57 trips/day)

Note that the above percent is applied to a baseline of 9.57 and that product is

subtracted from the Unmitigated Trips

Inputs Selected:

The Number of Intersections per Square Mile is 0

The Percent of Streets with Sidewalks on One Side is 100%

The Percent of Streets with Sidewalks on Both Sides is 70%

The Percent of Arterials/Collectors with Bike Lanes or where Suitable,

Direct Parallel Routes Exist is 100%

Nonresidential Mitigation Measures

Non-Residential Mix of Uses Mitigation

Percent Reduction in Trips is 1.07%

Inputs Selected:

The number of housing units within a 1/2 mile radius of the project, plus the

number of residential units included in the project are 11723.

9/21/2009 5:06:10 PM

Nonresidential Mitigation Measures

The employment for the study area (within a 1/2 mile radius of the project) is 3596.

Non-Residential Local-Serving Retail Mitigation

Percent Reduction in Trips is 2%

Inputs Selected:

The Presence of Local-Serving Retail checkbox was selected.

Non-Residential Transit Service Mitigation

Percent Reduction in Trips is 1.04%

Inputs Selected:

The Number of Daily Weekday Buses Stopping Within 1/4 Mile of Site is 34

The Number of Daily Rail or Bus Rapid Transit Stops Within 1/2 Mile of Site is 19

The Number of Dedicated Daily Shuttle Trips is 0

Non-Residential Pedestrian/Bicycle Friendliness Mitigation

Percent Reduction in Trips is 6.6%

Inputs Selected:

The Number of Intersections per Square Mile is 0

The Percent of Streets with Sidewalks on One Side is 100%

The Percent of Streets with Sidewalks on Both Sides is 70%

9/21/2009 5:06:10 PM

Nonresidential Mitigation Measures

The Percent of Arterials/Collectors with Bike Lanes or where Suitable,

Direct Parallel Routes Exist is 100%

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	396.00	6.86	dwelling units	3,409.00	23,401.43	206,985.72
Condo/townhouse general	211.20	5.31	dwelling units	4,998.00	26,562.39	234,944.39
Elementary school		0.79	students	1,950.00	1,532.14	9,796.97
City park		1.42	acres	318.00	451.44	3,128.49
Strip mall		26.21	1000 sq ft	849.42	22,266.84	110,189.88
					74,214.24	565,045.45

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.2	0.0	100.0	0.0
Light Truck < 3750 lbs	9.9	0.0	99.0	1.0
Light Truck 3751-5750 lbs	21.8	0.0	100.0	0.0
Med Truck 5751-8500 lbs	12.1	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	2.3	0.0	82.6	17.4
Lite-Heavy Truck 10,001-14,000 lbs	0.7	0.0	57.1	42.9
Med-Heavy Truck 14,001-33,000 lbs	1.1	0.0	18.2	81.8
Heavy-Heavy Truck 33,001-60,000 lbs	2.1	0.0	0.0	100.0
Other Bus	0.0	0.0	0.0	0.0

9/21/2009 5:06:10 PM

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.0	0.0	0.0	0.0
Motorcycle	4.0	32.5	67.5	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.7	0.0	88.2	11.8

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	12.7	7.0	9.5	13.3	7.4	8.9
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Elementary school				20.0	10.0	70.0
City park				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0

Operational Changes to Defaults

Ambient summer temperature changed from 80 degrees F to 85 degrees F

9/21/2009 5:05:29 PM

Urbemis 2007 Version 9.2.4

Detail Report for Annual Operational Unmitigated Emissions (Tons/Year)

File Name: U:\Lytle Creek Ranch\Calculations\Traffic\URBEMIS\ENVIRON OPS bike_ped 091709.urb924

Project Name: Lytle Creek Ranch Final Buildout

Project Location: San Bernadino County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

OPERATIONAL EMISSION ESTIMATES (Annual Tons Per Year, Unmitigated)

Source	CO2
Single family housing	47,384.08
Condo/townhouse general	55,823.11
Elementary school	2,183.01
City park	693.24
Strip mall	24,572.70
TOTALS (tons/year, unmitigated)	130,656.14

Includes correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	396.00	7.89	dwelling units	3,409.00	26,897.01	237,904.09

9/21/2009 5:05:29 PM

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Condo/townhouse general	211.20	6.34	dwelling units	4,998.00	31,687.32	280,274.40
Elementary school		0.88	students	1,950.00	1,716.00	10,972.65
City park		1.59	acres	318.00	505.62	3,503.92
Strip mall		29.36	1000 sq ft	849.42	24,938.97	123,413.22
					85,744.92	656,068.28

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.2	0.0	100.0	0.0
Light Truck < 3750 lbs	9.9	0.0	99.0	1.0
Light Truck 3751-5750 lbs	21.8	0.0	100.0	0.0
Med Truck 5751-8500 lbs	12.1	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	2.3	0.0	82.6	17.4
Lite-Heavy Truck 10,001-14,000 lbs	0.7	0.0	57.1	42.9
Med-Heavy Truck 14,001-33,000 lbs	1.1	0.0	18.2	81.8
Heavy-Heavy Truck 33,001-60,000 lbs	2.1	0.0	0.0	100.0
Other Bus	0.0	0.0	0.0	0.0
Urban Bus	0.0	0.0	0.0	0.0
Motorcycle	4.0	32.5	67.5	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.7	0.0	88.2	11.8

9/21/2009 5:05:29 PM

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	12.7	7.0	9.5	13.3	7.4	8.9
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Elementary school				20.0	10.0	70.0
City park				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0

Operational Changes to Defaults

Ambient summer temperature changed from 80 degrees F to 85 degrees F

9/21/2009 5:10:00 PM

Urbemis 2007 Version 9.2.4

Detail Report for Annual Operational Unmitigated Emissions (Tons/Year)

File Name: U:\Lytle Creek Ranch\Calculations\Traffic\URBEMIS\ENVIRON OPS BAU unit no highrise.urb924

Project Name: Lytle Creek Ranch Final Buildout

Project Location: San Bernadino County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

OPERATIONAL EMISSION ESTIMATES (Annual Tons Per Year, Unmitigated)

Source	CO2
Single family housing	103,950.16
Condo/townhouse general	20,032.48
Elementary school	2,183.01
City park	693.24
Strip mall	24,572.70
TOTALS (tons/year, unmitigated)	151,431.59

Includes correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	1,303.40	8.73	dwelling units	6,759.00	59,006.07	521,908.74

9/21/2009 5:10:00 PM

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Condo/townhouse general	103.00	6.90	dwelling units	1,648.00	11,371.20	100,578.28
Elementary school		0.88	students	1,950.00	1,716.00	10,972.65
City park		1.59	acres	318.00	505.62	3,503.92
Strip mall		29.36	1000 sq ft	849.42	24,938.97	123,413.22
					97,537.86	760,376.81

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.2	0.0	100.0	0.0
Light Truck < 3750 lbs	9.9	0.0	99.0	1.0
Light Truck 3751-5750 lbs	21.8	0.0	100.0	0.0
Med Truck 5751-8500 lbs	12.1	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	2.3	0.0	82.6	17.4
Lite-Heavy Truck 10,001-14,000 lbs	0.7	0.0	57.1	42.9
Med-Heavy Truck 14,001-33,000 lbs	1.1	0.0	18.2	81.8
Heavy-Heavy Truck 33,001-60,000 lbs	2.1	0.0	0.0	100.0
Other Bus	0.0	0.0	0.0	0.0
Urban Bus	0.0	0.0	0.0	0.0
Motorcycle	4.0	32.5	67.5	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.7	0.0	88.2	11.8

9/21/2009 5:10:00 PM

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	12.7	7.0	9.5	13.3	7.4	8.9
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Elementary school				20.0	10.0	70.0
City park				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0

Operational Changes to Defaults

Ambient summer temperature changed from 80 degrees F to 85 degrees F

Appendix D:
EMFAC File Output

```
Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
*****************************************************************************
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table  1:  Running Exhaust Emissions (grams/mile)

Pollutant Name: Total Organic Gases,,,,Temperature: 64F,,Relative Humidity:
43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000,   0.024,   0.108,   0.024,   0.000,   0.030,   0.103,   0.031,
   0.000,   0.050,   0.112,   0.050,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   3.532,   2.127,   0.000,   2.591,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   3.532,   0.051,   0.104,   0.065,
   25,   0.000,   0.018,   0.090,   0.018,   0.000,   0.023,   0.087,   0.023,
   0.000,   0.038,   0.094,   0.038,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   3.198,   1.832,   0.000,   2.283,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   3.198,   0.040,   0.087,   0.054,
   30,   0.000,   0.015,   0.077,   0.015,   0.000,   0.019,   0.074,   0.019,
   0.000,   0.030,   0.080,   0.030,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   3.029,   1.663,   0.000,   2.114,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   3.029,   0.034,   0.075,   0.047,
   35,   0.000,   0.013,   0.068,   0.013,   0.000,   0.016,   0.065,   0.016,
   0.000,   0.026,   0.070,   0.026,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   3.002,   1.592,   0.000,   2.058,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   3.002,   0.030,   0.065,   0.043,


Pollutant Name: Carbon Monoxide,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
```

```
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000,   0.703,   0.785,   0.703,   0.000,   0.900,   0.771,   0.900,
   0.000,   1.321,   0.799,   1.321,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   27.311,  10.355,   0.000,  15.956,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,  27.311,   0.991,   0.772,   1.103,
   25,   0.000,   0.646,   0.621,   0.646,   0.000,   0.825,   0.609,   0.824,
   0.000,   1.211,   0.632,   1.211,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   26.161,   9.628,   0.000,  15.089,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,  26.161,   0.911,   0.610,   1.018,
   30,   0.000,   0.595,   0.513,   0.595,   0.000,   0.759,   0.504,   0.758,
   0.000,   1.115,   0.523,   1.115,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   26.390,   9.045,   0.000,  14.775,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,  26.390,   0.840,   0.505,   0.949,
   35,   0.000,   0.549,   0.444,   0.549,   0.000,   0.701,   0.436,   0.700,
   0.000,   1.030,   0.452,   1.030,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   28.035,   8.602,   0.000,  15.021,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,  28.035,   0.778,   0.437,   0.894,


Pollutant Name: Oxides of Nitrogen,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000,   0.051,   1.372,   0.051,   0.000,   0.067,   1.378,   0.072,
   0.000,   0.114,   1.367,   0.114,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   1.237,   1.080,   0.000,   1.132,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   1.237,   0.080,   1.378,   0.086,
   25,   0.000,   0.047,   1.267,   0.047,   0.000,   0.061,   1.272,   0.066,
   0.000,   0.105,   1.261,   0.105,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   1.292,   1.039,   0.000,   1.122,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   1.292,   0.074,   1.271,   0.080,
   30,   0.000,   0.044,   1.211,   0.044,   0.000,   0.057,   1.216,   0.061,
   0.000,   0.098,   1.206,   0.098,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
```

```
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   1.347,   1.014,   0.000,   1.124,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   1.347,   0.070,   1.216,   0.076,
   35,   0.000,   0.042,   1.200,   0.042,   0.000,   0.054,   1.205,   0.058,
   0.000,   0.093,   1.195,   0.093,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   1.402,   1.005,   0.000,   1.136,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   1.402,   0.066,   1.204,   0.073,


Pollutant Name: Carbon Dioxide,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000, 445.582, 345.720, 445.578,   0.000, 562.497, 345.720, 561.717,
   0.000, 574.266, 345.720, 574.250,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   152.598, 176.615,   0.000, 168.681,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000, 152.598, 496.315, 345.720, 494.771,
   25,   0.000, 376.459, 345.720, 376.458,   0.000, 475.237, 345.720, 474.771,
   0.000, 485.181, 345.720, 485.171,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   136.747, 162.134,   0.000, 153.748,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000, 136.747, 419.434, 345.720, 418.191,
   30,   0.000, 330.114, 345.720, 330.115,   0.000, 416.732, 345.720, 416.477,
   0.000, 425.452, 345.720, 425.446,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   124.450, 154.266,   0.000, 144.417,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000, 124.450, 367.903, 345.720, 366.855,
   35,   0.000, 300.446, 345.720, 300.448,   0.000, 379.279, 345.720, 379.158,
   0.000, 387.215, 345.720, 387.212,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   115.023, 152.160,   0.000, 139.892,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000, 115.023, 334.941, 345.720, 334.011,


Pollutant Name: Sulfur Dioxide,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
```

```
 AT,DSL,ALL,

   20,   0.000,   0.004,   0.003,   0.004,   0.000,   0.005,   0.003,   0.005,
   0.000,   0.006,   0.003,   0.006,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.002,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.002,   0.005,   0.003,   0.005,
   25,   0.000,   0.004,   0.003,   0.004,   0.000,   0.005,   0.003,   0.005,
   0.000,   0.005,   0.003,   0.005,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.002,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.002,   0.004,   0.003,   0.004,
   30,   0.000,   0.003,   0.003,   0.003,   0.000,   0.004,   0.003,   0.004,
   0.000,   0.004,   0.003,   0.004,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.002,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.002,   0.004,   0.003,   0.004,
   35,   0.000,   0.003,   0.003,   0.003,   0.000,   0.004,   0.003,   0.004,
   0.000,   0.004,   0.003,   0.004,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.002,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.002,   0.003,   0.003,   0.003,


Pollutant Name: PM10,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000,   0.020,   0.059,   0.020,   0.000,   0.023,   0.056,   0.023,
   0.000,   0.048,   0.061,   0.048,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.045,   0.003,   0.000,   0.017,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.045,   0.028,   0.057,   0.028,
   25,   0.000,   0.015,   0.049,   0.015,   0.000,   0.017,   0.047,   0.018,
   0.000,   0.037,   0.052,   0.037,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.041,   0.002,   0.000,   0.015,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.041,   0.021,   0.048,   0.022,
   30,   0.000,   0.012,   0.042,   0.012,   0.000,   0.014,   0.041,   0.014,
   0.000,   0.029,   0.044,   0.029,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.039,   0.002,   0.000,   0.014,   0.000,   0.000,   0.000,   0.000,
```

```
   0.000,   0.000,   0.000,   0.000,   0.039,   0.017,   0.041,   0.017,
   35,   0.000,   0.010,   0.037,   0.010,   0.000,   0.012,   0.036,   0.012,
   0.000,   0.025,   0.039,   0.025,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.038,   0.002,   0.000,   0.014,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.038,   0.014,   0.036,   0.015,


Pollutant Name: PM10  - Tire Wear,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000,   0.008,   0.008,   0.008,   0.000,   0.008,   0.008,   0.008,
   0.000,   0.008,   0.008,   0.008,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.004,   0.004,   0.000,   0.004,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.004,   0.008,   0.008,   0.008,
   25,   0.000,   0.008,   0.008,   0.008,   0.000,   0.008,   0.008,   0.008,
   0.000,   0.008,   0.008,   0.008,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.004,   0.004,   0.000,   0.004,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.004,   0.008,   0.008,   0.008,
   30,   0.000,   0.008,   0.008,   0.008,   0.000,   0.008,   0.008,   0.008,
   0.000,   0.008,   0.008,   0.008,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.004,   0.004,   0.000,   0.004,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.004,   0.008,   0.008,   0.008,
   35,   0.000,   0.008,   0.008,   0.008,   0.000,   0.008,   0.008,   0.008,
   0.000,   0.008,   0.008,   0.008,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.004,   0.004,   0.000,   0.004,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.004,   0.008,   0.008,   0.008,


Pollutant Name: PM10  - Brake Wear,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000,   0.013,   0.013,   0.013,   0.000,   0.013,   0.013,   0.013,
```

```
   0.000,   0.013,   0.013,   0.013,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.006,   0.006,   0.000,   0.006,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.006,   0.012,   0.013,   0.012,
   25,   0.000,   0.013,   0.013,   0.013,   0.000,   0.013,   0.013,   0.013,
   0.000,   0.013,   0.013,   0.013,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.006,   0.006,   0.000,   0.006,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.006,   0.012,   0.013,   0.012,
   30,   0.000,   0.013,   0.013,   0.013,   0.000,   0.013,   0.013,   0.013,
   0.000,   0.013,   0.013,   0.013,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.006,   0.006,   0.000,   0.006,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.006,   0.012,   0.013,   0.012,
   35,   0.000,   0.013,   0.013,   0.013,   0.000,   0.013,   0.013,   0.013,
   0.000,   0.013,   0.013,   0.013,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.006,   0.006,   0.000,   0.006,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.006,   0.012,   0.013,   0.012,


Pollutant Name: Gasoline - mi/gal,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000,  19.835,   0.000,  19.835,   0.000,  15.712,   0.000,  15.712,
   0.000,  15.371,   0.000,  15.371,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   43.003,  44.479,   0.000,  43.991,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,  43.003,  18.199,   0.000,  18.304,
   25,   0.000,  23.472,   0.000,  23.472,   0.000,  18.593,   0.000,  18.593,
   0.000,  18.189,   0.000,  18.189,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   47.285,  48.497,   0.000,  48.097,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,  47.285,  21.499,   0.000,  21.609,
   30,   0.000,  26.764,   0.000,  26.764,   0.000,  21.200,   0.000,  21.200,
   0.000,  20.738,   0.000,  20.738,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   50.648,  51.095,   0.000,  50.947,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,  50.648,  24.478,   0.000,  24.589,
   35,   0.000,  29.406,   0.000,  29.406,   0.000,  23.293,   0.000,  23.293,
   0.000,  22.785,   0.000,  22.785,   0.000,   0.000,   0.000,   0.000,
```

```
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   52.734,  51.999,   0.000,  52.242,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,  52.734,  26.858,   0.000,  26.968,


Pollutant Name: Diesel - mi/gal,,,,Temperature: 64F,,Relative Humidity: 43%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,
LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,O
BUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH
,MH,ALL,ALL,ALL,ALL,
 MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

   20,   0.000,   0.000,  29.156,  29.156,   0.000,   0.000,  29.156,  29.156,
   0.000,   0.000,  29.156,  29.156,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,  29.156,  29.156,
   25,   0.000,   0.000,  29.156,  29.156,   0.000,   0.000,  29.156,  29.156,
   0.000,   0.000,  29.156,  29.156,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,  29.156,  29.156,
   30,   0.000,   0.000,  29.156,  29.156,   0.000,   0.000,  29.156,  29.156,
   0.000,   0.000,  29.156,  29.156,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,  29.156,  29.156,
   35,   0.000,   0.000,  29.156,  29.156,   0.000,   0.000,  29.156,  29.156,
   0.000,   0.000,  29.156,  29.156,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,  29.156,  29.156,




Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
*****************************************************************************
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006
```

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table 2: Starting Emissions (grams/trip)

Pollutant Name: Total Organic Gases,,,,Temperature: 64F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,
min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

5, 0.000, 0.006, 0.000, 0.006, 0.000, 0.008, 0.000, 0.008,
0.000, 0.013, 0.000, 0.013, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
1.876, 0.304, 0.000, 0.833, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 1.876, 0.012, 0.000, 0.022,
10, 0.000, 0.013, 0.000, 0.013, 0.000, 0.016, 0.000, 0.016,
0.000, 0.026, 0.000, 0.026, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
1.860, 0.592, 0.000, 1.018, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 1.860, 0.023, 0.000, 0.033,
20, 0.000, 0.024, 0.000, 0.024, 0.000, 0.030, 0.000, 0.030,
0.000, 0.050, 0.000, 0.050, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
1.878, 1.122, 0.000, 1.376, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 1.878, 0.045, 0.000, 0.055,
30, 0.000, 0.036, 0.000, 0.036, 0.000, 0.044, 0.000, 0.044,
0.000, 0.073, 0.000, 0.073, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
1.963, 1.590, 0.000, 1.715, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 1.963, 0.064, 0.000, 0.075,
40, 0.000, 0.046, 0.000, 0.046, 0.000, 0.057, 0.000, 0.056,
0.000, 0.095, 0.000, 0.095, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
2.114, 1.997, 0.000, 2.036, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 2.114, 0.083, 0.000, 0.094,
50, 0.000, 0.055, 0.000, 0.055, 0.000, 0.068, 0.000, 0.068,
0.000, 0.115, 0.000, 0.115, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
2.331, 2.342, 0.000, 2.338, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 2.331, 0.099, 0.000, 0.112,
60, 0.000, 0.064, 0.000, 0.064, 0.000, 0.079, 0.000, 0.079,
0.000, 0.134, 0.000, 0.134, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,

```
 2.424,   2.625,   0.000,   2.557,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   2.424,   0.114,   0.000,   0.127,
120,   0.000,   0.100,   0.000,   0.100,   0.000,   0.121,   0.000,   0.120,
0.000,   0.215,   0.000,   0.215,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
2.116,   3.043,   0.000,   2.731,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   2.116,   0.168,   0.000,   0.179,
180,   0.000,   0.085,   0.000,   0.085,   0.000,   0.104,   0.000,   0.103,
0.000,   0.183,   0.000,   0.183,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
2.303,   2.732,   0.000,   2.588,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   2.303,   0.144,   0.000,   0.156,
240,   0.000,   0.090,   0.000,   0.090,   0.000,   0.110,   0.000,   0.110,
0.000,   0.195,   0.000,   0.195,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
2.491,   2.884,   0.000,   2.752,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   2.491,   0.153,   0.000,   0.166,
300,   0.000,   0.095,   0.000,   0.095,   0.000,   0.116,   0.000,   0.116,
0.000,   0.206,   0.000,   0.206,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
2.678,   3.031,   0.000,   2.912,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   2.678,   0.162,   0.000,   0.176,
360,   0.000,   0.100,   0.000,   0.100,   0.000,   0.123,   0.000,   0.122,
0.000,   0.218,   0.000,   0.218,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
2.866,   3.173,   0.000,   3.070,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   2.866,   0.170,   0.000,   0.185,
420,   0.000,   0.105,   0.000,   0.105,   0.000,   0.129,   0.000,   0.128,
0.000,   0.229,   0.000,   0.229,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
3.053,   3.311,   0.000,   3.224,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   3.053,   0.179,   0.000,   0.195,
480,   0.000,   0.110,   0.000,   0.110,   0.000,   0.135,   0.000,   0.134,
0.000,   0.240,   0.000,   0.240,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
3.240,   3.443,   0.000,   3.375,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   3.240,   0.187,   0.000,   0.204,
540,   0.000,   0.115,   0.000,   0.115,   0.000,   0.141,   0.000,   0.141,
0.000,   0.251,   0.000,   0.251,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
3.428,   3.570,   0.000,   3.522,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   3.428,   0.195,   0.000,   0.213,
600,   0.000,   0.120,   0.000,   0.120,   0.000,   0.147,   0.000,   0.147,
0.000,   0.262,   0.000,   0.262,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
```

```
  3.615,   3.692,   0.000,   3.666,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   3.615,   0.203,   0.000,   0.222,
  660,   0.000,   0.125,   0.000,   0.125,   0.000,   0.153,   0.000,   0.152,
  0.000,   0.273,   0.000,   0.273,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  3.803,   3.810,   0.000,   3.807,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   3.803,   0.211,   0.000,   0.231,
  720,   0.000,   0.130,   0.000,   0.130,   0.000,   0.159,   0.000,   0.158,
  0.000,   0.284,   0.000,   0.284,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  3.990,   3.922,   0.000,   3.945,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   3.990,   0.219,   0.000,   0.240,


Pollutant Name: Carbon Monoxide,,,,Temperature: 64F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
 min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

    5,   0.000,   0.104,   0.000,   0.104,   0.000,   0.137,   0.000,   0.137,
    0.000,   0.205,   0.000,   0.205,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    6.230,   1.664,   0.000,   3.199,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   6.230,   0.154,   0.000,   0.188,
   10,   0.000,   0.206,   0.000,   0.206,   0.000,   0.271,   0.000,   0.270,
   0.000,   0.406,   0.000,   0.406,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   5.517,   3.260,   0.000,   4.019,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   5.517,   0.305,   0.000,   0.334,
   20,   0.000,   0.401,   0.000,   0.401,   0.000,   0.528,   0.000,   0.525,
   0.000,   0.792,   0.000,   0.792,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   4.258,   6.249,   0.000,   5.580,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   4.258,   0.593,   0.000,   0.613,
   30,   0.000,   0.587,   0.000,   0.587,   0.000,   0.770,   0.000,   0.767,
   0.000,   1.158,   0.000,   1.158,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   3.225,   8.968,   0.000,   7.037,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   3.225,   0.865,   0.000,   0.878,
   40,   0.000,   0.762,   0.000,   0.762,   0.000,   0.999,   0.000,   0.995,
   0.000,   1.504,   0.000,   1.504,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   2.415,  11.417,   0.000,   8.389,   0.000,   0.000,   0.000,   0.000,
```

```
 0.000,   0.000,   0.000,   0.000,   2.415,   1.120,   0.000,   1.127,
 50,   0.000,   0.927,   0.000,   0.927,   0.000,   1.214,   0.000,   1.208,
 0.000,   1.831,   0.000,   1.831,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 1.830,  13.595,   0.000,   9.638,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   1.830,   1.360,   0.000,   1.362,
 60,   0.000,   1.081,   0.000,   1.081,   0.000,   1.414,   0.000,   1.408,
 0.000,   2.137,   0.000,   2.137,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 1.469,  15.503,   0.000,  10.783,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   1.469,   1.583,   0.000,   1.581,
120,   0.000,   1.701,   0.000,   1.701,   0.000,   2.178,   0.000,   2.169,
0.000,   3.357,   0.000,   3.356,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
4.488,  19.938,   0.000,  14.742,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   4.488,   2.433,   0.000,   2.443,
180,   0.000,   1.338,   0.000,   1.338,   0.000,   1.729,   0.000,   1.722,
0.000,   2.657,   0.000,   2.657,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
7.092,  14.868,   0.000,  12.253,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   7.092,   1.911,   0.000,   1.939,
240,   0.000,   1.450,   0.000,   1.450,   0.000,   1.869,   0.000,   1.861,
0.000,   2.882,   0.000,   2.882,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
9.419,  15.304,   0.000,  13.325,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   9.419,   2.062,   0.000,   2.102,
300,   0.000,   1.549,   0.000,   1.549,   0.000,   1.994,   0.000,   1.985,
0.000,   3.081,   0.000,   3.081,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
11.471,  15.755,   0.000,  14.314,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  11.471,   2.197,   0.000,   2.247,
360,   0.000,   1.635,   0.000,   1.635,   0.000,   2.102,   0.000,   2.093,
0.000,   3.254,   0.000,   3.253,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
13.247,  16.219,   0.000,  15.219,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  13.247,   2.314,   0.000,   2.374,
420,   0.000,   1.708,   0.000,   1.708,   0.000,   2.195,   0.000,   2.185,
0.000,   3.400,   0.000,   3.400,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
14.747,  16.697,   0.000,  16.041,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  14.747,   2.415,   0.000,   2.482,
480,   0.000,   1.768,   0.000,   1.768,   0.000,   2.271,   0.000,   2.261,
0.000,   3.520,   0.000,   3.519,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
15.970,  17.188,   0.000,  16.779,   0.000,   0.000,   0.000,   0.000,
```

```
  0.000,   0.000,   0.000,   0.000,  15.970,   2.499,   0.000,   2.572,
  540,   0.000,   1.815,   0.000,   1.815,   0.000,   2.332,   0.000,   2.322,
  0.000,   3.613,   0.000,   3.613,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  16.918,  17.694,   0.000,  17.433,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,  16.918,   2.566,   0.000,   2.644,
  600,   0.000,   1.849,   0.000,   1.849,   0.000,   2.377,   0.000,   2.366,
  0.000,   3.680,   0.000,   3.680,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  17.590,  18.214,   0.000,  18.004,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,  17.590,   2.616,   0.000,   2.698,
  660,   0.000,   1.870,   0.000,   1.870,   0.000,   2.406,   0.000,   2.395,
  0.000,   3.721,   0.000,   3.721,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  17.986,  18.748,   0.000,  18.492,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,  17.986,   2.649,   0.000,   2.733,
  720,   0.000,   1.878,   0.000,   1.878,   0.000,   2.419,   0.000,   2.408,
  0.000,   3.736,   0.000,   3.735,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  18.107,  19.295,   0.000,  18.895,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,  18.107,   2.666,   0.000,   2.750,


Pollutant Name: Oxides of Nitrogen,,,,Temperature: 64F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
 min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

    5,   0.000,   0.040,   0.000,   0.040,   0.000,   0.053,   0.000,   0.053,
    0.000,   0.108,   0.000,   0.108,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.287,   0.097,   0.000,   0.161,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.287,   0.062,   0.000,   0.063,
   10,   0.000,   0.043,   0.000,   0.043,   0.000,   0.057,   0.000,   0.057,
   0.000,   0.114,   0.000,   0.114,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.312,   0.147,   0.000,   0.202,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.312,   0.066,   0.000,   0.067,
   20,   0.000,   0.048,   0.000,   0.048,   0.000,   0.063,   0.000,   0.063,
   0.000,   0.126,   0.000,   0.126,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.357,   0.233,   0.000,   0.275,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.357,   0.074,   0.000,   0.075,
```

```
 30,   0.000,   0.052,   0.000,   0.052,   0.000,   0.069,   0.000,   0.068,
 0.000,   0.136,   0.000,   0.136,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.397,   0.304,   0.000,   0.335,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.397,   0.081,   0.000,   0.082,
 40,   0.000,   0.055,   0.000,   0.055,   0.000,   0.073,   0.000,   0.073,
 0.000,   0.144,   0.000,   0.144,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.430,   0.358,   0.000,   0.382,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.430,   0.086,   0.000,   0.088,
 50,   0.000,   0.058,   0.000,   0.058,   0.000,   0.077,   0.000,   0.076,
 0.000,   0.151,   0.000,   0.151,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.457,   0.397,   0.000,   0.417,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.457,   0.091,   0.000,   0.092,
 60,   0.000,   0.060,   0.000,   0.060,   0.000,   0.079,   0.000,   0.079,
 0.000,   0.156,   0.000,   0.156,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.478,   0.419,   0.000,   0.439,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.478,   0.094,   0.000,   0.096,
120,   0.000,   0.065,   0.000,   0.065,   0.000,   0.086,   0.000,   0.085,
0.000,   0.169,   0.000,   0.169,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.487,   0.421,   0.000,   0.443,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.487,   0.101,   0.000,   0.103,
180,   0.000,   0.066,   0.000,   0.066,   0.000,   0.088,   0.000,   0.087,
0.000,   0.173,   0.000,   0.173,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.475,   0.423,   0.000,   0.440,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.475,   0.103,   0.000,   0.105,
240,   0.000,   0.066,   0.000,   0.066,   0.000,   0.087,   0.000,   0.087,
0.000,   0.172,   0.000,   0.172,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.460,   0.420,   0.000,   0.434,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.460,   0.103,   0.000,   0.104,
300,   0.000,   0.065,   0.000,   0.065,   0.000,   0.086,   0.000,   0.086,
0.000,   0.170,   0.000,   0.170,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.441,   0.417,   0.000,   0.425,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.441,   0.101,   0.000,   0.103,
360,   0.000,   0.064,   0.000,   0.064,   0.000,   0.084,   0.000,   0.084,
0.000,   0.167,   0.000,   0.167,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.418,   0.413,   0.000,   0.415,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.418,   0.100,   0.000,   0.101,
```

```
  420,   0.000,   0.063,   0.000,   0.063,   0.000,   0.083,   0.000,   0.082,
  0.000,   0.163,   0.000,   0.163,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.391,   0.408,   0.000,   0.402,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.391,   0.097,   0.000,   0.099,
  480,   0.000,   0.061,   0.000,   0.061,   0.000,   0.080,   0.000,   0.080,
  0.000,   0.158,   0.000,   0.158,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.361,   0.403,   0.000,   0.388,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.361,   0.095,   0.000,   0.096,
  540,   0.000,   0.059,   0.000,   0.059,   0.000,   0.078,   0.000,   0.077,
  0.000,   0.153,   0.000,   0.153,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.326,   0.396,   0.000,   0.373,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.326,   0.092,   0.000,   0.093,
  600,   0.000,   0.057,   0.000,   0.057,   0.000,   0.074,   0.000,   0.074,
  0.000,   0.147,   0.000,   0.147,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.288,   0.389,   0.000,   0.355,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.288,   0.088,   0.000,   0.089,
  660,   0.000,   0.054,   0.000,   0.054,   0.000,   0.071,   0.000,   0.071,
  0.000,   0.140,   0.000,   0.140,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.247,   0.381,   0.000,   0.336,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.247,   0.084,   0.000,   0.085,
  720,   0.000,   0.051,   0.000,   0.051,   0.000,   0.067,   0.000,   0.067,
  0.000,   0.132,   0.000,   0.132,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.201,   0.372,   0.000,   0.314,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.201,   0.079,   0.000,   0.080,


Pollutant Name: Carbon Dioxide,,,,Temperature: 64F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
 min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

    5,   0.000,  11.989,   0.000,  11.988,   0.000,  15.093,   0.000,  15.027,
    0.000,  15.389,   0.000,  15.388,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    35.953,   1.769,   0.000,  13.265,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,  35.953,  13.234,   0.000,  13.353,
   10,   0.000,  13.446,   0.000,  13.445,   0.000,  16.947,   0.000,  16.874,
```

```
 0.000,  17.282,   0.000,  17.280,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 39.014,   3.528,   0.000,  15.462,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,  39.014,  14.868,   0.000,  14.994,
 20,   0.000,  16.852,   0.000,  16.851,   0.000,  21.273,   0.000,  21.181,
 0.000,  21.696,   0.000,  21.695,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 44.957,   7.017,   0.000,  19.776,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,  44.957,  18.677,   0.000,  18.813,
 30,   0.000,  20.913,   0.000,  20.912,   0.000,  26.424,   0.000,  26.309,
 0.000,  26.951,   0.000,  26.949,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 50.657,  10.466,   0.000,  23.983,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,  50.657,  23.209,   0.000,  23.348,
 40,   0.000,  25.631,   0.000,  25.630,   0.000,  32.398,   0.000,  32.258,
 0.000,  33.046,   0.000,  33.043,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 56.117,  13.876,   0.000,  28.082,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,  56.117,  28.462,   0.000,  28.600,
 50,   0.000,  31.005,   0.000,  31.003,   0.000,  39.196,   0.000,  39.027,
 0.000,  39.981,   0.000,  39.978,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 61.335,  17.248,   0.000,  32.075,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,  61.335,  34.437,   0.000,  34.567,
 60,   0.000,  37.035,   0.000,  37.033,   0.000,  46.819,   0.000,  46.616,
 0.000,  47.756,   0.000,  47.752,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 66.311,  20.580,   0.000,  35.960,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,  66.311,  41.134,   0.000,  41.250,
120,   0.000,  86.412,   0.000,  86.407,   0.000, 109.071,   0.000, 108.600,
0.000, 111.240,   0.000, 111.231,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
89.732,  35.003,   0.000,  53.409,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  89.732,  95.757,   0.000,  95.665,
180,   0.000,  98.071,   0.000,  98.065,   0.000, 123.809,   0.000, 123.274,
0.000, 126.273,   0.000, 126.262,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
89.802,  41.353,   0.000,  57.647,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  89.802, 108.705,   0.000, 108.533,
240,   0.000, 109.715,   0.000, 109.709,   0.000, 138.523,   0.000, 137.924,
0.000, 141.280,   0.000, 141.269,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
89.873,  47.329,   0.000,  61.637,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  89.873, 121.629,   0.000, 121.378,
300,   0.000, 121.343,   0.000, 121.337,   0.000, 153.213,   0.000, 152.550,
```

```
0.000, 156.263,   0.000, 156.250,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
89.943,  52.929,   0.000,  65.378,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  89.943, 134.531,   0.000, 134.199,
360,   0.000, 132.956,   0.000, 132.949,   0.000, 167.878,   0.000, 167.152,
0.000, 171.220,   0.000, 171.206,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
90.014,  58.155,   0.000,  68.870,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  90.014, 147.408,   0.000, 146.998,
420,   0.000, 144.554,   0.000, 144.546,   0.000, 182.519,   0.000, 181.729,
0.000, 186.153,   0.000, 186.137,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
90.084,  63.006,   0.000,  72.113,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  90.084, 160.263,   0.000, 159.773,
480,   0.000, 156.136,   0.000, 156.128,   0.000, 197.135,   0.000, 196.283,
0.000, 201.060,   0.000, 201.043,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
90.155,  67.483,   0.000,  75.108,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  90.155, 173.094,   0.000, 172.525,
540,   0.000, 167.703,   0.000, 167.694,   0.000, 211.728,   0.000, 210.812,
0.000, 215.941,   0.000, 215.923,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
90.225,  71.584,   0.000,  77.853,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  90.225, 185.902,   0.000, 185.254,
600,   0.000, 179.254,   0.000, 179.245,   0.000, 226.296,   0.000, 225.317,
0.000, 230.798,   0.000, 230.779,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
90.296,  75.311,   0.000,  80.350,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  90.296, 198.687,   0.000, 197.960,
660,   0.000, 190.790,   0.000, 190.780,   0.000, 240.840,   0.000, 239.798,
0.000, 245.630,   0.000, 245.609,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
90.366,  78.663,   0.000,  82.599,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  90.366, 211.448,   0.000, 210.642,
720,   0.000, 202.311,   0.000, 202.300,   0.000, 255.359,   0.000, 254.255,
0.000, 260.436,   0.000, 260.414,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
90.437,  81.640,   0.000,  84.598,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,  90.437, 224.186,   0.000, 223.302,


Pollutant Name: Sulfur Dioxide,,,,Temperature: 64F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
```

```
min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
AT,DSL,ALL,

   5,   0.000,   0.000,   0.000,   0.000,   0.116,   0.000,   0.000,   0.000,
   0.116,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.057,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  10,   0.000,   0.000,   0.000,   0.000,   0.116,   0.000,   0.000,   0.000,
  0.116,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.001,   0.000,   0.057,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,
  20,   0.000,   0.000,   0.000,   0.000,   0.116,   0.000,   0.000,   0.000,
  0.116,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.001,   0.000,   0.057,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,
  30,   0.000,   0.000,   0.000,   0.000,   0.116,   0.000,   0.000,   0.000,
  0.116,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.001,   0.000,   0.057,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,
  40,   0.000,   0.000,   0.000,   0.000,   0.116,   0.000,   0.000,   0.000,
  0.116,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.001,   0.000,   0.057,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,
  50,   0.000,   0.000,   0.000,   0.000,   0.116,   0.000,   0.000,   0.000,
  0.116,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.001,   0.000,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,
  60,   0.000,   0.000,   0.000,   0.000,   0.116,   0.000,   0.000,   0.000,
  0.116,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,
 120,   0.000,   0.001,   0.000,   0.001,   0.116,   0.001,   0.000,   0.001,
 0.116,   0.001,   0.000,   0.001,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.001,   0.001,   0.000,   0.001,
 180,   0.000,   0.001,   0.000,   0.001,   0.116,   0.001,   0.000,   0.001,
 0.116,   0.001,   0.000,   0.001,   0.000,   0.000,   0.000,   0.000,
```

```
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.001,   0.000,   0.001,
240,   0.000,   0.001,   0.000,   0.001,   0.116,   0.001,   0.000,   0.001,
0.116,   0.001,   0.000,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.001,   0.000,   0.001,
300,   0.000,   0.001,   0.000,   0.001,   0.116,   0.002,   0.000,   0.001,
0.116,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.001,   0.000,   0.001,
360,   0.000,   0.001,   0.000,   0.001,   0.116,   0.002,   0.000,   0.002,
0.116,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.001,   0.000,   0.001,
420,   0.000,   0.001,   0.000,   0.001,   0.116,   0.002,   0.000,   0.002,
0.116,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.002,   0.000,   0.002,
480,   0.000,   0.002,   0.000,   0.002,   0.116,   0.002,   0.000,   0.002,
0.116,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.002,   0.000,   0.002,
540,   0.000,   0.002,   0.000,   0.002,   0.116,   0.002,   0.000,   0.002,
0.116,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.002,   0.000,   0.002,
600,   0.000,   0.002,   0.000,   0.002,   0.116,   0.002,   0.000,   0.002,
0.116,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.002,   0.000,   0.002,
660,   0.000,   0.002,   0.000,   0.002,   0.116,   0.002,   0.000,   0.002,
0.116,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.002,   0.000,   0.002,
720,   0.000,   0.002,   0.000,   0.002,   0.116,   0.002,   0.000,   0.002,
0.116,   0.003,   0.000,   0.003,   0.000,   0.000,   0.000,   0.000,
```

```
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.001,   0.001,   0.057,   0.001,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.001,   0.002,   0.000,   0.002,


Pollutant Name: PM10,,,,Temperature: 64F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
 min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

    5,   0.000,   0.001,   0.000,   0.001,   0.000,   0.001,   0.000,   0.001,
    0.000,   0.001,   0.000,   0.001,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.020,   0.000,   0.000,   0.007,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.020,   0.001,   0.000,   0.001,
   10,   0.000,   0.001,   0.000,   0.001,   0.000,   0.001,   0.000,   0.001,
   0.000,   0.003,   0.000,   0.003,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.017,   0.000,   0.000,   0.006,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.017,   0.002,   0.000,   0.002,
   20,   0.000,   0.002,   0.000,   0.002,   0.000,   0.003,   0.000,   0.003,
   0.000,   0.005,   0.000,   0.005,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.013,   0.001,   0.000,   0.005,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.013,   0.003,   0.000,   0.003,
   30,   0.000,   0.003,   0.000,   0.003,   0.000,   0.004,   0.000,   0.004,
   0.000,   0.008,   0.000,   0.008,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.010,   0.001,   0.000,   0.004,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.010,   0.005,   0.000,   0.005,
   40,   0.000,   0.004,   0.000,   0.004,   0.000,   0.005,   0.000,   0.005,
   0.000,   0.010,   0.000,   0.010,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.008,   0.001,   0.000,   0.003,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.008,   0.006,   0.000,   0.006,
   50,   0.000,   0.005,   0.000,   0.005,   0.000,   0.006,   0.000,   0.006,
   0.000,   0.013,   0.000,   0.013,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.006,   0.002,   0.000,   0.003,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.006,   0.008,   0.000,   0.008,
   60,   0.000,   0.006,   0.000,   0.006,   0.000,   0.007,   0.000,   0.007,
   0.000,   0.015,   0.000,   0.015,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
```

```
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
 0.005,   0.002,   0.000,   0.003,   0.000,   0.000,   0.000,   0.000,
 0.000,   0.000,   0.000,   0.000,   0.005,   0.009,   0.000,   0.009,
120,   0.000,   0.010,   0.000,   0.010,   0.000,   0.012,   0.000,   0.012,
0.000,   0.025,   0.000,   0.025,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.013,   0.002,   0.000,   0.006,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.013,   0.015,   0.000,   0.015,
180,   0.000,   0.012,   0.000,   0.012,   0.000,   0.013,   0.000,   0.013,
0.000,   0.028,   0.000,   0.028,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.020,   0.002,   0.000,   0.008,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.020,   0.016,   0.000,   0.016,
240,   0.000,   0.013,   0.000,   0.013,   0.000,   0.014,   0.000,   0.014,
0.000,   0.030,   0.000,   0.030,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.026,   0.002,   0.000,   0.011,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.026,   0.018,   0.000,   0.018,
300,   0.000,   0.014,   0.000,   0.014,   0.000,   0.015,   0.000,   0.015,
0.000,   0.032,   0.000,   0.032,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.032,   0.003,   0.000,   0.012,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.032,   0.019,   0.000,   0.019,
360,   0.000,   0.015,   0.000,   0.015,   0.000,   0.016,   0.000,   0.016,
0.000,   0.034,   0.000,   0.034,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.037,   0.003,   0.000,   0.014,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.037,   0.020,   0.000,   0.020,
420,   0.000,   0.015,   0.000,   0.015,   0.000,   0.017,   0.000,   0.017,
0.000,   0.036,   0.000,   0.036,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.041,   0.003,   0.000,   0.016,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.041,   0.021,   0.000,   0.021,
480,   0.000,   0.016,   0.000,   0.016,   0.000,   0.018,   0.000,   0.018,
0.000,   0.037,   0.000,   0.037,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.045,   0.003,   0.000,   0.017,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.045,   0.022,   0.000,   0.022,
540,   0.000,   0.016,   0.000,   0.016,   0.000,   0.018,   0.000,   0.018,
0.000,   0.038,   0.000,   0.038,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.047,   0.003,   0.000,   0.018,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.047,   0.023,   0.000,   0.023,
600,   0.000,   0.016,   0.000,   0.016,   0.000,   0.019,   0.000,   0.018,
0.000,   0.039,   0.000,   0.039,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
```

```
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.049,   0.003,   0.000,   0.019,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.049,   0.023,   0.000,   0.023,
  660,   0.000,   0.017,   0.000,   0.017,   0.000,   0.019,   0.000,   0.019,
  0.000,   0.039,   0.000,   0.039,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.050,   0.003,   0.000,   0.019,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.050,   0.023,   0.000,   0.023,
  720,   0.000,   0.017,   0.000,   0.017,   0.000,   0.019,   0.000,   0.019,
  0.000,   0.039,   0.000,   0.039,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
  0.051,   0.003,   0.000,   0.019,   0.000,   0.000,   0.000,   0.000,
  0.000,   0.000,   0.000,   0.000,   0.051,   0.023,   0.000,   0.023,
```

```
Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
*****************************************************************************
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table  4:  Hot Soak Emissions (grams/trip)

Pollutant Name: Total Organic Gases,,,,Temperature: 64F,,Relative Humidity:
ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
 min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

    5,   0.000,   0.023,   0.000,   0.023,   0.000,   0.028,   0.000,   0.028,
    0.000,   0.038,   0.000,   0.038,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.128,   0.000,   0.085,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.029,   0.000,   0.029,
   10,   0.000,   0.042,   0.000,   0.042,   0.000,   0.052,   0.000,   0.052,
   0.000,   0.070,   0.000,   0.070,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
```

```
   0.001,   0.238,   0.000,   0.158,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.001,   0.054,   0.000,   0.053,
   20,   0.000,   0.072,   0.000,   0.072,   0.000,   0.089,   0.000,   0.089,
   0.000,   0.119,   0.000,   0.119,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.001,   0.409,   0.000,   0.272,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.001,   0.091,   0.000,   0.091,
   30,   0.000,   0.092,   0.000,   0.092,   0.000,   0.114,   0.000,   0.113,
   0.000,   0.153,   0.000,   0.153,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.001,   0.531,   0.000,   0.353,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.001,   0.117,   0.000,   0.116,
   40,   0.000,   0.100,   0.000,   0.100,   0.000,   0.123,   0.000,   0.123,
   0.000,   0.165,   0.000,   0.165,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.002,   0.578,   0.000,   0.384,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.002,   0.127,   0.000,   0.126,
```

Hot soak results are scaled to reflect zero emissions for trip lengths of less than 5 minutes (about 25% of in-use trips).

```
Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
******************************************************************************
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table 5a:  Partial Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity:
ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,

   64,   0.000,   0.025,   0.000,   0.025,   0.000,   0.034,   0.000,   0.033,
   0.000,   0.051,   0.000,   0.051,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
```

```
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.312,   0.000,   0.207,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.043,   0.000,   0.042,
```

```
Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
******************************************************************************
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table 5b:  Multi-Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity:
ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,

   64,   0.000,   0.002,   0.000,   0.002,   0.000,   0.002,   0.000,   0.002,
   0.000,   0.004,   0.000,   0.004,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.029,   0.000,   0.020,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.003,   0.000,   0.003,
```

```
Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
******************************************************************************
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table 6a:  Partial Day Resting Loss Emissions (grams/hour)
```

```
Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity:
ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,

   64,   0.000,   0.015,   0.000,   0.015,   0.000,   0.020,   0.000,   0.020,
   0.000,   0.033,   0.000,   0.033,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.111,   0.000,   0.074,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.024,   0.000,   0.023,
```

```
Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
*****************************************************************************
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table 6b:  Multi-Day Resting Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity:
ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,

   64,   0.000,   0.001,   0.000,   0.001,   0.000,   0.001,   0.000,   0.001,
   0.000,   0.002,   0.000,   0.002,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.011,   0.000,   0.007,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.002,   0.000,   0.002,
```

```
Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
******************************************************************************
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table  7:  Estimated Travel Fractions

Pollutant Name: ,,,,Temperature: ALL,,Relative Humidity: ALL

,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,
LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,A
LL,ALL,ALL,ALL,
,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,
DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NC
AT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL
,ALL,

%VMT,   0.000,   0.564,   0.000,   0.564,   0.000,   0.137,   0.000,   0.138,
0.000,   0.286,   0.000,   0.286,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.004,   0.009,   0.000,   0.013,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.004,
0.995,   0.001,   1.000,
%TRIP,   0.000,   0.575,   0.000,   0.575,   0.000,   0.127,   0.001,   0.128,
0.000,   0.281,   0.000,   0.281,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.006,   0.011,   0.000,   0.017,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.006,
0.994,   0.001,   1.000,
%VEH,   0.000,   0.553,   0.000,   0.553,   0.000,   0.124,   0.001,   0.125,
0.000,   0.273,   0.000,   0.273,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.017,   0.033,   0.000,   0.050,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.017,
0.983,   0.001,   1.000,
```


```
Title    : Traffic - 2030 Annual Avg San Bernardino
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/25 12:12:07
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area     : San Bernardino
******************************************************************************
```

```
***********
Year:,2030,, -- Model Years,,1986, to ,2030, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Bernardino,,,,,,County Average

,,,,Table  8:  Evaporative Running Loss Emissions (grams/minute)

Pollutant Name: Total Organic Gases,,,,Temperature: 64F,,Relative Humidity:
ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,L
HD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OB
US,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,
MH,ALL,ALL,ALL,ALL,
 min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,
 CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
 LL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,C
 AT,DSL,ALL,

    1,   0.000,   0.009,   0.000,   0.009,   0.000,   0.148,   0.000,   0.148,
    0.000,   0.220,   0.000,   0.220,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.005,   0.000,   0.004,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.089,   0.000,   0.088,
    2,   0.000,   0.007,   0.000,   0.007,   0.000,   0.076,   0.000,   0.076,
    0.000,   0.113,   0.000,   0.113,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.054,   0.000,   0.036,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.047,   0.000,   0.047,
    3,   0.000,   0.008,   0.000,   0.008,   0.000,   0.054,   0.000,   0.054,
    0.000,   0.079,   0.000,   0.079,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.079,   0.000,   0.053,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.036,   0.000,   0.035,
    4,   0.000,   0.010,   0.000,   0.010,   0.000,   0.045,   0.000,   0.044,
    0.000,   0.064,   0.000,   0.064,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.094,   0.000,   0.063,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.031,   0.000,   0.031,
    5,   0.000,   0.011,   0.000,   0.011,   0.000,   0.039,   0.000,   0.039,
    0.000,   0.054,   0.000,   0.054,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.103,   0.000,   0.069,   0.000,   0.000,   0.000,   0.000,
    0.000,   0.000,   0.000,   0.000,   0.000,   0.028,   0.000,   0.028,
   10,   0.000,   0.014,   0.000,   0.014,   0.000,   0.028,   0.000,   0.028,
   0.000,   0.037,   0.000,   0.037,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.121,   0.000,   0.081,   0.000,   0.000,   0.000,   0.000,
   0.000,   0.000,   0.000,   0.000,   0.000,   0.024,   0.000,   0.023,
   15,   0.000,   0.015,   0.000,   0.015,   0.000,   0.025,   0.000,   0.025,
```

```
0.000,   0.032,   0.000,   0.032,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.125,   0.000,   0.084,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.022,   0.000,   0.022,
20,   0.000,   0.015,   0.000,   0.015,   0.000,   0.024,   0.000,   0.024,
0.000,   0.031,   0.000,   0.031,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.127,   0.000,   0.085,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.022,   0.000,   0.022,
25,   0.000,   0.015,   0.000,   0.015,   0.000,   0.023,   0.000,   0.023,
0.000,   0.030,   0.000,   0.030,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.127,   0.000,   0.085,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.022,   0.000,   0.021,
30,   0.000,   0.015,   0.000,   0.015,   0.000,   0.023,   0.000,   0.023,
0.000,   0.030,   0.000,   0.030,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.125,   0.000,   0.084,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.021,   0.000,   0.021,
35,   0.000,   0.015,   0.000,   0.015,   0.000,   0.023,   0.000,   0.023,
0.000,   0.029,   0.000,   0.029,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.123,   0.000,   0.083,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.021,   0.000,   0.021,
40,   0.000,   0.015,   0.000,   0.015,   0.000,   0.023,   0.000,   0.022,
0.000,   0.029,   0.000,   0.029,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.122,   0.000,   0.082,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.021,   0.000,   0.021,
45,   0.000,   0.015,   0.000,   0.015,   0.000,   0.022,   0.000,   0.022,
0.000,   0.029,   0.000,   0.029,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.121,   0.000,   0.081,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.021,   0.000,   0.021,
50,   0.000,   0.015,   0.000,   0.015,   0.000,   0.022,   0.000,   0.022,
0.000,   0.029,   0.000,   0.029,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.119,   0.000,   0.080,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.021,   0.000,   0.021,
55,   0.000,   0.015,   0.000,   0.015,   0.000,   0.022,   0.000,   0.022,
0.000,   0.028,   0.000,   0.028,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.118,   0.000,   0.079,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.020,   0.000,   0.020,
60,   0.000,   0.014,   0.000,   0.014,   0.000,   0.022,   0.000,   0.022,
```

```
0.000,   0.028,   0.000,   0.028,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.117,   0.000,   0.078,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.001,   0.020,   0.000,   0.020,
```

Appendix E:

Life Cycle Greenhouse Gas Emissions from Building materials

Life Cycle Greenhouse Gas Emissions from Building Materials

Prepared for:
Lytle Development Company
Ontario, California

Prepared by:
ENVIRON International Corporation
San Francisco, California

Date:
September 28, 2009

Project Number:
03-22796A

ENVIRON

Contents

		Page
EXECUTIVE SUMMARY		1
1	Introduction	1
1.1	Background on Life Cycle Analysis	1
2	Emissions Estimates	1
2.1	Life Cycle GHG Emissions from Building Materials	1
2.1.1	LCA Studies for Buildings	2
2.1.2	Energy Efficiency vs. Embodied Energy in Buildings	3
2.2	GHG Emissions from Manufacture of Infrastructure Materials	5
2.2.1	Embodied Energy in Concrete Production	5
2.2.2	Embodied Energy in Asphalt Production	6
2.2.3	Embodied Energy in Infrastructure	6
2.3	Transportation of Materials for Infrastructure	7
2.3.1	Calculation of Emissions from Transportation of Materials for Buildings	7
2.4	Summary of Emissions from Buildings and Infrastructure	7

List of Tables

Table 1 Life Cycle Greenhouse Gas (GHG) Emissions From Materials Used for Buildings
Table 2 Greenhouse Gas (GHG) Emission Factors for the Manufacture of Cement
Table 3 Quantities of Infrastructure Materials
Table 4 Greenhouse Gas (GHG) Emissions from Manufacture of Materials
Table 5 Greenhouse Gas (GHG) Emissions from Transportation of Infrastructure Construction Raw Materials
Table 6 Summary of Life Cycle Greenhouse Gas (GHG) Emissions from Buildings and Infrastructure

Acronyms

AP-42	Compilation of Air Pollutant Emission Factors
$CaCO_3$	limestone
CaO	calcium oxide
CCAR	California Climate Action Registry
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DOE	Department of Energy
EERE	Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
ENVIRON	ENVIRON International Corporation
ft^2	square feet
GHG	greenhouse gas
GRP	General Reporting Protocol
kWh/m^2	kilowatt hour per square meter
LCA	life cycle analyses
LCR	Lytle Creek Ranch
MMBTU	million British thermal units

EXECUTIVE SUMMARY

This report evaluates the life cycle greenhouse gas (GHG) emissions associated with the building materials used in the construction of the Lytle Creek Ranch development. The life cycle GHG emissions include the embodied energy from the materials manufacture and the energy used to transport those materials to the site. This report then compares the life cycle GHG emissions to the overall annual operational emissions of Lytle Creek Ranch. The materials analyzed in this report include materials for 1) residential and non-residential buildings and 2) site infrastructure. This report calculates the overall life cycle emissions from construction materials to be 1,044 – 8,881 tonnes per year, or 1 – 9% of the overall Lytle Creek Ranch project emissions.

ENVIRON estimated the life cycle GHG emissions for buildings by conducting an analysis of available literature on life cycle analyses (LCA) for buildings. According to these studies, approximately 75 - 97% of GHG emissions from buildings are associated with energy usage during the operational phase; the other 3 - 25% of the GHG emissions are due to material manufacture and transport. Using the GHG emissions from the operation of Lytle Creek Ranch buildings, 3% to 25% corresponds to 802 – 8,639 tonnes CO_2 per year or 0.8 – 8.8% of Lytle Creek Ranch project emissions.

ENVIRON calculated the life cycle GHG emissions for infrastructure (roads, storm drains, utilities, gas, electricity, cable) to be equal to a one time emission of 9,688 tonnes CO_2. This analysis considered the manufacture and transport of concrete and asphalt. Based on this analysis, the manufacture of the materials leads to 9,549 tonnes of emissions, and the transport of the materials leads to 140 tonnes of CO_2 emissions. Although Lytle Creek Ranch estimates the need for volume of asphalt approximately three times higher than that of concrete, the majority of the emissions for infrastructure result from the manufacture of concrete because of the higher CO_2 emission factor associated with this process. Because the asphalt and concrete are locally sourced, the transportation emissions are relatively small. If a 40 year lifespan of the infrastructure is assumed, the total annualized emissions are 242 tonnes per year or 0.2% of Lytle Creek Ranch project emissions.

The overall life cycle emissions from embodied energy in Lytle Creek Ranch building materials, annualized by 40 years, are 1,044 – 8,881 tonnes CO_2 per year. This represents 1 – 9% of the annualized GHG emissions from the Lytle Creek Ranch project. The bulk of these emissions (77% – 97% of the LCA emissions) are based on general life cycle analysis studies and do not reflect the design features of Lytle Creek Ranch. Aspects of the project will tend to drive the life cycle emissions towards the lower end of the range; one example is the emphasis on the use of local construction materials.

1 Introduction

This report evaluates the life cycle greenhouse gas (GHG) emissions associated with the building materials used in the construction of the Lytle Creek Ranch development. The life cycle GHG emissions include the embodied energy from the materials manufacture and the energy used to transport those materials to the site. This report then compares the life cycle GHG emissions to the overall annual operational emissions of Lytle Creek Ranch. The materials analyzed in this report include materials for 1) residential and non-residential buildings and 2) site infrastructure.

1.1 Background on Life Cycle Analysis

LCA is a method developed to evaluate the mass balance of inputs and outputs of systems and to organize and convert those inputs and outputs into environmental themes or categories. In this case, the LCA is related to GHG emissions associated with the different stages of a life cycle. The LCA field is still relatively new, and while there are general standards for goals and general practices for LCAs[1] the specific methodologies and, in particular, the boundaries chosen for the LCA makes inter-comparison of various studies difficult. Simple choices such as the useful life of a building or road, for example, can change the LCA outcome substantially. Additionally, the geographic location, climatic zone and building type significantly influence patterns of energy consumption (and energy efficiency) and therefore determine life cycle GHG emissions, which makes comparisons among different studies difficult.

The calculations and results presented in this report are estimates and should be used only for a general comparison to the overall GHG emissions estimated in the Climate Change Section of the Draft EIR for Lytle Creek Ranch. LCA emissions vary based on input assumptions and assessment boundaries (e.g., how far back to trace the origin of a material). Assumptions made in this report are generally conservative. However, due to the open-ended nature of LCAs, the analysis is not exact and may be highly uncertain.

2 Emissions Estimates

2.1 Life Cycle GHG Emissions from Building Materials

ENVIRON estimated the life cycle GHG emissions for building materials by conducting an analysis of available literature on life cycle analyses (LCA) for buildings. According to these studies, approximately 75 - 97% of GHG emissions from buildings are associated with energy usage during the operational phase; the other 3 - 25% of the GHG emissions are due to building material manufacture and transport. Based on the GHG emissions from the operation of Lytle Creek Ranch buildings[2], 3% to 25% corresponds to 802 – 8,639 tonnes CO_2 per year, as shown in Table 1. The specific LCA studies used are discussed in the next section.

---

[1] ISO 14044 and ISO 14040

[2] Climate Change Technical Report: Lytle Creek Ranch. July 2009.

With the current energy generation mix in the US which relies heavily on fossil fuel based sources, focusing on energy efficiency measures (which ultimately reduces lifetime GHG emissions) is more effective in reducing the overall GHG footprint than focusing on materials with low embodied energy. As the energy generation measures reduce their GHG intensity (shift away from fossil fuel to renewable fuels), material selection will be a more critical factor in a building's GHG emissions over its life cycle.

2.1.1 LCA Studies for Buildings

The LCA literature studies tend to compare the energy used to make and transport building materials, or the embodied energy, with the operational energy use. In this manner, the relative importance of the embodied energy can be assessed. ENVIRON discusses several studies that compare the embodied energy and the operational energy.

A life cycle assessment of a 66,000 ft^2 sustainably-designed university building[3] in the US Mid-west[4] estimated that the GHG emissions associated with its energy use over a 100-year time horizon to be 135,000 metric tones of carbon dioxide equivalent (CO_2e), 96.5% of which result from operations phase activities, 3% from material production (of which ⅓ is cement production) and 0.5% from transportation and decommissioning combined. The study also notes that the GHG emissions closely matches the distribution of life cycle energy distributions, indicating that operational energy requirements are the key factor determining overall GHG emissions, especially when considering fossil fuel based energy generation. This building has a longer estimated life than Lytle Creek Ranch buildings, which would lead to a lower comparison of embodied energy to operational energy.

A study of single-family homes in the US Mid-west,[5] one built using standard construction techniques and the second incorporating energy efficiency measures, reached similar conclusions. Over the life cycle of the homes (assumed to be 50 years), the conventional home uses 15,000 MMBTU and the energy efficient configuration uses 6,000 MMBTU of energy, representing a 60% reduction in overall energy. As GHG emissions closely match the distribution of life cycle energy distributions, the energy efficient variant resulted in 63% fewer emissions. Of the total energy use over the structure's life cycle, 91% of the conventional house total energy results from energy consumed in the use stage (e.g., operating energy). This value drops to 74% in the energy efficient home as the energy embodied in the building materials stays the same or is slightly higher than that in the conventional home and operating energy is reduced.

---

[3] Includes 4 floors of classroom and open-plan offices and 3 floors of hotel rooms, in this evaluation used as a surrogate for a generic commercial structure.

[4] Scheuer, C., G.A. Keoleian, and P. Reppe. (2003) Life cycle energy and environmental performance of a new university building: Modeling challenges and design implications. *Energy and Buildings*, **35**(10): p. 1049.

[5] Keoleian, G.A., S. Blanchard, and P. Reppe. (2000) Life-cycle energy, costs, and strategies for improving a single-family house. *Journal of Industrial Ecology*, **4**(2): p. 135.

Similarly, a review of 60 case studies of homes from nine European countries in a variety of climates[6] indicated that operating energy represents the largest part of energy demand by a building during its life cycle. In one evaluation the operating energy is reported as between 92 - 95% for conventional construction and 72 - 90% for low-energy buildings[7] (which are also consistent with other literature references[8]). Sartori and Hestnes[6] also note that buildings constructed with energy efficiency measures may have a higher energy (and concomitant GHG emissions) embodied by the materials used in construction (e.g., more insulation, higher thermal mass), but over the lifespan of the building the overall energy use (operating and embodied energy) is dramatically lower due to the large reductions in operating energy. As an example, the embodied energy was estimated to be 1171 kWh/m^2 for a conventional house and 1391 kWh/m^2 for a passive, energy efficient home, an increase of 220 kWh/m^2 or 19%. Over the lifetime of the building, however, the total energy (operating and embodied) of the conventional house was approximately 22,500 kWh/m^2, while the passive house was roughly 5,500 kWh/m^2, a four-fold decrease in the total energy over an assumed 80 year life cycle.

2.1.2 Energy Efficiency vs. Embodied Energy in Buildings

From our analysis of these assessments, we note the following major conclusions:

- To minimize GHG lifetime emissions, optimization of energy efficiency (both thermal and electrical) for the operational phase of a building should be the primary emphasis for design, especially when the energy supplied is generated from fossil fuel sources.
- Passive design measures such as the orientation of structure to maximize solar heating and daylighting as well as natural ventilation; heavy construction to increase the thermal mass of the structure with materials that have a high capacity for absorbing heat and change temperature slowly; and solar control like window shading[9] should be emphasized[10,11,12] as they have a negligible increase in embodied energy (GHG emissions from material production) and can reduce total energy substantially.[13]
- Active energy efficiency measures (e.g., mechanical ventilation, artificial cooling, free cooling) may as much as double the embodied energy of the structure, but can halve overall energy usage.

---

[6] Sartori, I. and A.G. Hestnes. (2007) Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Buildings*, **39**(3): p. 249.

[7] Winther, B.N. and A.G. Hestnes. (1999) Solar versus green: The analysis of a Norwegian row house. *Solar Energy*, **66**(6): p. 387.

[8] Adalberth, K., A. Almgren, and E.H. Petersen. (2001) Life Cycle Assessment of Four Multi-Family Buildings. *International Journal of Low Energy and Sustainable Buildings*, **2**.

[9] United Nations Environment Program 2007 Buildings and Climate Change report whole-house system measures are recommended for the Mediterranean and desert climate zones.

[10] Browning, W.D. and J.J. Romm. (1998) *Greening the Building and the Bottom Line*. Snowmass, Colorado: Rocky Mountain Institute.

[11] United Nations Environment Program. (2007) *Buildings and Climate Change: Status, Challenges and Opportunities.*

[12] US Department of Energy Building Technologies Program. (2007) www.eere.energy.gov/buildings/. October.

[13] Sartori, I. and A.G. Hestnes. (2007) Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Buildings*, **39**(3): p. 249.

- With the current energy generation mix in the US which relies heavily on fossil fuel based sources, focusing on energy efficiency measures (which ultimately reduces lifetime GHG emissions) is more effective in reducing the overall GHG footprint than focusing on materials with low embodied energy. As the energy generation measures reduce their GHG intensity (shift away from fossil fuel to renewable), material selection will be a more critical factor in a building's GHG emissions over its life cycle.

One cannot evaluate the life cycle emissions of a building product independent of the impact that the building product has on energy use. For example, studies that evaluate the relative embodied energy and GHG emissions associated with the production of structural materials such as steel, concrete or wood generally indicate that the wood products have the lowest GHG emissions as it is produced from a renewable resource that may actually remove CO_2 during its production phase and sequester it during its use phase.[14,15] However, these studies do not account for the effect of the material on overall building energy efficiency, which is often heavily dependent on the climate in which the building is located. In desert climates, the thermal mass of the structure is important for energy savings, as the thermal mass cools at night and keep the house cool during the day during hot weather and conversely heats during the day keeps the house warm during the evening during cool weather. To increase thermal mass, concrete is much more effective than wood. In other types of climates (cooler with less solar heating), wood with insulation has a greater impact at improving overall building efficiency.

For some building products or systems, the net energy savings during the operational portion of the building's life cycle are comparable. If this is the case, then the alternative with the lowest embodied GHG emissions will result in the lowest life cycle GHG emissions.

Building materials with high replacement rates, like carpeting and wiring, can often have a high contribution to the overall GHG emissions as their impact is dependent on renovation schedules. For example, if two building materials have the same embodied energy but one is replaced every 5 years and the second is replaced every 25 years then the first will have five times the embodied energy over the lifetime of the building. As such Scheuer et al.[16] indicate that "[d]esign strategies that maximize the service life of building materials should be maximized." These strategies include designing the structure for minimal material use and choosing materials with low embodied energy, high recycled content, and long life spans.

From our analysis of these product or system specific assessments, we note the following major conclusions:

- Products or systems which have the greatest impact in improving overall building energy efficiency over the building's life cycle should be selected to minimize life cycle GHG

[14] Borjesson, P. and L. Gustavsson. (2000) Greenhouse gas balances in building construction: Wood versus concrete from life-cycle and forest land-use perspectives. *Energy Policy*, **28**(9): p. 575.
[15] Lenzen, M. and G. Treloar. (2002) Embodied energy in buildings: Wood versus concrete - Reply to Borjesson and Gustavsson. *Energy Policy*, **30**(3): p. 249.
[16] Scheuer, C., G.A. Keoleian, and P. Reppe. (2003) Life cycle energy and environmental performance of a new university building: Modeling challenges and design implications. *Energy and Buildings*, **35**(10): p. 1049.

emissions. These alternatives may not necessarily have the lowest embodied GHG emissions.

- When evaluating products or systems that have similar impacts on overall building energy efficiency, alternatives with the lowest embodied GHG emissions should be selected to minimize GHG emissions.
- Materials with high replacement rates (e.g., carpeting, wiring) tend to have higher embodied energy due to their short life cycle, therefore minimizing embodied GHG emissions is most critical for these types of products or systems to minimize overall GHG emissions. Materials with low replacement rates (e.g., piping, air ducts) tend to have lower embodied energy over the life cycle of the building, therefore differences in overall GHG emissions between several alternatives are likely to be small.

2.2 GHG Emissions from Manufacture of Infrastructure Materials

ENVIRON evaluated the embodied energies of materials likely to be found in the infrastructure (roads, storm drains, utilities, gas, electricity, cable) of the Lytle Creek Ranch development. The embodied energies of different materials vary based upon the transportation distance and manufacturing processes. A material that is locally-sourced may require a large amount of energy to be produced and, on the contrary, a material with a relatively low energy intensity may be sourced from farther away. ENVIRON assumed that concrete and asphalt will be among the dominant materials used in the infrastructure and estimated the embodied energies of these two materials. The manufacture of these materials results in overall CO_2 emissions of 9,549 tonnes. Although asphalt is predicted to be used in higher quantities than concrete, 80% of these emissions (7,636 tonnes) result from the manufacture of concrete because the CO_2 emission factor of concrete is over fifty times that of asphalt.

2.2.1 Embodied Energy in Concrete Production

Concrete is composed primarily of cement, water, and aggregate such as sand and gravel, with small amounts of chemical admixtures. A typical concrete mix contains approximately 15% cement by volume.[17] Because the remaining 85% of concrete is composed of water and aggregate, ENVIRON assumed that all of the manufacture-related embodied energy in concrete stems from the production of cement.

There are two main sources of CO_2 emissions from the production of cement: “calcining” emissions and fossil fuel combustion emissions. Calcining emissions result from the chemical conversion of limestone ($CaCO_3$) to calcium oxide (CaO) and carbon dioxide (CO_2). CaO is a precursor to cement and CO_2 is released to the atmosphere. The emissions from fossil fuel combustion vary based on fuel type, but in general slightly more than half of the emissions

[17] Portland Cement Association. Cement and Concrete Basics. http://www.cement.org/basics/concretebasics_concretebasics.asp

associated with cement production are attributed to calcining emissions and the remainder result from fossil fuel combustion.[18]

ENVIRON used three sources to estimate CO_2 emission factors for the production of cement. The Energy Information Administration (EIA)[19] and AP-42[20] estimate that 0.5 tonnes of CO_2 are emitted from the calcining process for every 1 tonne of cement produced. AP-42 also provides a range (0.75 – 1.19 tonnes CO_2 / tonne cement) of total CO_2 emission factors (including calcining emissions and fossil fuel combustion emissions). The consulting group Battelle[21] estimates a total CO_2 emission factor for cement production in North America of 0.99 tonnes CO_2 / tonne cement. These emission factors are presented in Table 2.

2.2.2 Embodied Energy in Asphalt Production

The manufacture of asphalt is less energy intensive than the manufacture of cement. Asphalt is composed of asphalt cement and aggregate; the aggregate typically constitutes 92% by weight of the asphalt mixture.[22] AP-42 estimates CO_2 emission factors for batch mix (37 pounds CO_2 / short ton asphalt) and drum mix (33 pounds CO_2 / short ton asphalt) hot mix asphalt plants based on fuel usage within the plants.[23] ENVIRON used the average of these two values to represent the embodied energy of asphalt for Lytle Creek Ranch infrastructure.

2.2.3 Embodied Energy in Infrastructure

ENVIRON used the CO_2 emission factors from cement and asphalt to estimate the embodied energy of the infrastructure materials in the Lytle Creek Ranch development. ENVIRON used volumes of virgin concrete and asphalt as provided by Lytle Development Company for Lytle Creek Ranch, resulting in the predicted material amounts shown in Table 3. The estimated emissions from the manufacture of the infrastructure materials are presented in Table 4. Because concrete is 15% cement by volume,[24] the total volume of concrete in Table 3 is multiplied by 15% to yield the volume of cement presented in Table 4. The emissions from the cement manufacture are assumed to be equal to the emissions from concrete manufacture. One-time emissions from concrete and asphalt manufacture for infrastructure materials are estimated to be 7,636 and 1,913 tonnes CO_2, respectively.

---

[18] USGS 2005 Minerals Yearbook: Cement. February 2007. pg 16.1-16.2. http://minerals.usgs.gov/minerals/pubs/commodity/cement/cemenmyb05.pdf

[19] EIA Energy Market and Economic Impacts of S.280, the Climate Stewardship and Innovation Act of 2007. August 2007. http://www.eia.doe.gov/oiaf/servicerpt/csia/special_topics.html

[20] EPA AP42 Section 11.6: Portland Cement Manufacturing. http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s06.pdf

[21] Battelle. Humphreys, K. and Mahasenan, M. Climate Change: Toward a Sustainable Cement Industry. March 2002.

[22] EPA AP42 section 11.1: Hot Mix Asphalt Plants. pg 11.1-1. http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s01.pdf

[23] EPA AP42 section 11.1: Hot Mix Asphalt Plants. Tables 11.1-5 and 11.1-7. http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s01.pdf

[24] Portland Cement Association. Cement and Concrete Basics. http://www.cement.org/basics/concretebasics_concretebasics.asp

2.3 Transportation of Materials for Infrastructure

ENVIRON estimated the emissions from the transportation of the infrastructure. ENVIRON selected distances based on an expected trip distance of local manufacturers of cement and asphalt to the Lytle Creek Ranch development,[25] provided by the Lytle Development Company. Using the infrastructure material quantities specified in Table 3, ENVIRON estimated emissions of 140 tonnes CO_2 from the transportation of the concrete and asphalt in the infrastructure.[26] Details of the calculations are outlined in Table 5.

2.3.1 Calculation of Emissions from Transportation of Materials for Buildings

Although each particular shipper operates with greater or lesser efficiencies, ENVIRON assumed an average GHG emission rate per tonne-mile[27] for each mode of transportation. Although it is likely that more dense material has a slightly lower GHG shipping intensity than does less dense material, this analysis developed a single emission factor per tonne-mile of material moved, regardless of density, for each mode of transportation.

2.3.1.1 Emissions associated with transporting the material

Emission factors were calculated from DOE EERE energy intensity indicators.[28] EERE data is presented in terms of energy per mile traveled. These were converted using AP-42 conversion factors[29] for energy in different types of fuel, and California Climate Action Registry (CCAR) General Reporting Protocol (GRP)[30] emission factors for mass of CO_2 emitted per gallon of fuel. Trains and trucks are assumed to run on diesel. These emission factors are listed in Table 5. The emission factors developed above were multiplied by the distances traveled by each type of transportation.

2.4 Summary of Emissions from Buildings and Infrastructure

Table 6 presents the summary of the life cycle greenhouse gas (GHG) emissions associated with the building materials used in the construction of the Lytle Creek Ranch development. The life cycle GHG emissions include the embodied energy from the materials manufacture and the energy used to transport those materials to the site. The materials analyzed include materials for 1) residential and non-residential buildings and 2) site infrastructure. This report calculates the overall life cycle emissions from construction materials to be 1,044 – 8,881 tonnes per year, or 1 – 9% of the overall Lytle Creek Ranch project emissions. Aspects of this project such as the emphasis on the use of local construction materials are expected to drive the life cycle emissions toward the lower end of the range.

---

[25] The distance for concrete and asphalt assumes the use of a local source 3 miles from Lytle Creek Ranch.
[26] For the estimates of emissions from material transportation, ENVIRON conservatively assumed that the entire concrete mix, not just cement, is transported from the source locations to the development site.
[27] A tonne-mile refers to the amount of material (in tonnes) moved a distance of one mile.
[28] Grams CO_2 per tonne-mile. See http://intensityindicators.pnl.gov/trend_data.stm Transportation sector data.
[29] AP-42 conversions available at http://www.epa.gov/ttn/chief/ap42/appendix/appa.pdf
[30] The GRP is available online at http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

Table 1
Life Cycle Greenhouse Gas (GHG) Emissions From Materials[1] Used for Buildings
Lytle Creek Ranch
Rialto, California

GHG Emissions from Energy Usage Associated with Residential and Non-Residential Buildings[2]	Embodied Energy as Percentage of Overall Energy[3]	
	3%	25%
(tonnes CO_2 / year)		
25,916	802	8,639

Notes:
1. All materials were analyzed. See references below for more details.
2. Represents CO2 emissions from electricity and natural gas use. From the Lytle Creek Ranch Climate Change Report.
3. Percentages are based upon LCA studies below. The studies compared energy used in the manufacture and transport of materials to energy use from electricity and natural gas. Varying lifetimes of homes were assumed in each study. As homes become more energy efficient, the portion of GHGs from embodied energy increases.

Abbreviations:
CO_2 = carbon dioxide
GHG = greenhouse gas
LCA = life cycle analysis

Sources:
Scheuer, C., G.A. Keoleian, and P. Reppe. (2003) Life cycle energy and environmental performance of a new university building: Modeling challenges and design implications. *Energy and Buildings* , **35**(10): p. 1049.
Keoleian, G.A., S. Blanchard, and P. Reppe. (2000) Life-cycle energy, costs, and strategies for improving a single-family house. *Journal of Industrial Ecology* , **4**(2): p. 135.
Sartori, I. and A.G. Hestnes. (2007) Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Buildings* , **39**(3): p. 249.

Winther, B.N. and A.G. Hestnes. (1999) Solar versus green: The analysis of a Norwegian row house. *Solar Energy* , **66**(6): p. 387.

Adalberth, K., A. Almgren, and E.H. Petersen. (2001) Life Cycle Assessment of Four Multi-Family Buildings. *International Journal of Low Energy and Sustainable Buildings* , **2**.

Table 2
Greenhouse Gas (GHG) Emission Factors for the Manufacture of Cement
Lytle Creek Ranch
Rialto, California

Data Source	Calcining Emissions[4]	Fossil Fuel Emissions[5]
	(tonnes CO_2/tonne cement)	
EIA[1]	0.5	-
EPA AP-42[2]	0.5	-
	0.75 - 1.19	
	0.92	
Battelle[3]	0.99	

Notes:

1. From the Energy Market and Economic Impacts of S.280, the Climate Stewardship and Innovation Act of 2007. Calculations are detailed in the Documentation for Emissions of Greenhouse Gases in the United States 2004, pg 35 - 38.

2. From AP-42 section 11.6: Portland Cement Manufacturing. Approximately 500 kg of CO_2 are released per Mg of cement produced during the calcining process; total manufacturing emissions depend on energy consumption (pg 11.6-6). Table 11.6-8 specifies 2,100 lbs CO_2 per ton of clinker produced (ENVIRON used the higher value instead of 1,800 lbs / ton to be conservative). Clinker is a precursor to cement. Using a clinker factor of 0.88 lb clinker/lb cement (from the Battelle report) yields an emission factor of 0.92 tonnes CO_2/tonne cement.

3. From Table 1-2 of the Battelle report. The North American average emission factor is 0.99 kg CO_2/kg cement; the global average is 0.87 kg CO_2/kg cement.

4. There are two main sources of CO_2 emissions from the manufacture of cement: the calcining process and fossil fuel combustion. Calcining emissions result from the chemical reaction of converting limestone ($CaCO_3$) to calcium oxide (CaO) and carbon dioxide (CO_2). CaO is a precursor to concrete and CO_2 is released to the atmosphere.

5. Fossil fuel combustion usually provides the energy necessary to manufacture cement. The emissions from the fossil fuel combustion vary depending on the type of fuel used; in general the combustion accounts for slightly less than half of the CO_2 emissions from the manufacture of cement.

Abbreviations:
AP-42 = Compilation of Air Pollutant Emission Factors
CO_2 = carbon dioxide
EIA = Energy Information Administration
EPA = Environmental Protection Agency
kg = kilogram
Mg = megagram = 1,000 kg
NA = not available

Sources:
EIA Energy Market and Economic Impacts of S.280, the Climate Stewardship and Innovation Act of 2007. August 2007. http://www.eia.doe.gov/oiaf/servicerpt/csia/special_topics.html
EPA AP42 Section 11.6: Portland Cement Manufacturing.
http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s06.pdf
Battelle. Humphreys, K. and Mahasenan, M. Climate Change: Toward a Sustainable Cement Industry. March 2002.

Table 3
Quantities of Infrastructure Materials
Lytle Creek Ranch
Rialto, California

CONCRETE			
	Projected Material Needed[1]	**Density[2]**	**Total Weight[3]**
	(cu ft)	**(lb/cu ft)**	**(tonnes)**
New	1,224,307	150	8330042%
Re-used	0	150	0
Total	1,224,307	---	83,300
		Total Concrete (cu yd)	45,345
ASPHALT			
	Projected Material Needed[1]	**Density[4]**	**Total Weight[3]**
	(cu ft)	**(lb/cu ft)**	**(tonnes)**
New	3,759,243	64.11	109,315
Re-used	0	64.11	0
Total	3,759,243	---	109,315
		Total Asphalt (cu yd)	139,231

Notes:
1. Material volumes provided by Lytle Development Company.
2. Density of concrete calculated from mass and volume reported by Lytle Development Company.
3. Total material quantities (tonnes) for concrete and asphalt are calculated by converting cubic feet of material into mass in tonnes using the conversion factor of 0.00045 tonnes/lb.
4. Density of asphalt calculated from mass and volume reported by Lytle Development Company.

Abbreviations:
cu ft = cubic foot
cu yd = cubic yard
DU = dwelling units
ft = foot
in = inch
lb = pound
sq ft = square foot

Table 4
Greenhouse Gas (GHG) Emissions from Manufacture of Infrastructure Materials
Lytle Creek Ranch
Rialto, California

Material	Emission Factor	Volume of Material	Mass of Material	Emissions from Manufacture of Material[3]
	(tonnes CO_2/tonne material)	(cu yd)	(tonnes)	(tonnes CO_2)
Cement (in new concrete)[1]	0.990	6,802	7,713	7,636
Asphalt, new[2]	0.018	139,231	109,315	1,913
TOTAL				**9,549**

Notes:

1. Concrete is composed of cement, water, aggregate, and chemical admixtures; concrete mixtures are approximately 15% cement by volume (Portland Cement Association). Cement accounts for almost all of the CO_2 emissions associated with the manufacture of conrete. The cement emission factors provided by AP-42 cover a wide range of processing technologies and emission factors, so ENVIRON used the cement emission factor provided by the Battelle report.

2. From AP-42 section 11.1: Hot Mix Asphalt Plants. Tables 11.1-5 and 11.1-7. ENVIRON assumed an average emission factor from batch mix hot asphalt plants and drum mix hot asphalt plants.

3. Because the manufacture of cement is the main contributor to CO_2 emissions in the production of concrete, ENVIRON assumed that the emissions from the manufacture of cement are equal to the emissions from the overall manufacture of concrete.

Abbreviations:
CO_2 = carbon dioxide
cu yd = cubic yard

Sources:
Battelle. Humphreys, K. and Mahasenan, M. Climate Change: Toward a Sustainable Cement Industry. March 2002.
EPA AP42 section 11.1: Hot Mix Asphalt Plants. Tables 11.1-5 and 11.1-7.
http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s01.pdf
Intergovernmental Panel on Climate Change, Fourth Assessment Report, 2007. Table 2.14. Available at: http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_Ch02.pdf.
Portland Cement Association. Cement and Concrete Basics. http://www.cement.org/basics/concretebasics_concretebasics.asp

Table 5
Greenhouse Gas (GHG) Emissions from Transportation of Infrastructure Raw Materials
Lytle Creek Ranch
Rialto, California

Material	Total Mass Transported[1]	Distance from Source Location[2]	Mass-Distance[3]	Emission Factor[4]	Emissions to Transport to Construction Site[5]	
		Local Source	Local Source	Truck	Local Source	Total
	(tonnes material)	(miles)	(tonne-miles)	(grams CO_2/ tonne-mile)	(tonnes CO_2)	
Concrete	83,300	3	249,901	253	63	63
Asphalt	109,315	3	301,709		76	76
TOTAL						**140**

Notes:
1. The total mass transported is assumed to contain only virgin materials. For manufacturing emissions, only the amount of cement is considered; however, for transportation emissions, the entire mass of virgin concrete is considered because the concrete mix is transported from the source locations.
2. Distances from source to project location provided by Lytle Development Company
3. Mass distance is the mass of material multipled by the distance traveled. ENVIRON assumed that the concrete and asphalt aggregate come from local sources. The petroleum used in the asphalt comes from the Port of Los Angeles. Asphalt is roughly 92% by weight aggregate, so ENVIRON assumed that the remaining 8% is representative of the mass of petroleum transported from the Port of Los Angeles.
4. Emission factors for truck calculated from DOE EERE energy intensity indicators. EERE data is presented in Btu / ton mile. These were converted using AP-42 conversion factors for energy in different types of fuel, and CCAR GRP emission factors for mass CO_2 emitted per gallon of fuel. Trucks are assumed to run on diesel.
5. Emissions calculated by multiplying the mass-distance by the emission factor. Because of the close proximity of the source locations to Lytle Creek Ranch, ENVIRON conservatively assumed that all infrastructure materials will be transported by truck.

Sources:
DOE EERE energy intensity indicators. http://intensityindicators.pnl.gov/trend_data.stm Transportation sector data.
AP42 conversions available at http://www.epa.gov/ttn/chief/ap42/appendix/appa.pdf

Table 6
Summary of Life Cycle Greenhouse Gas (GHG) Emissions from Buildings, Infrastructure
Lytle Creek Ranch
Rialto, California

Emissions Source[1]		Emissions from Manufacture of Materials[3]	Emissions from Transportation of Materials[4]	Total Emissions	Assumed Lifetime of Emissions Source[5]	Total Annualized Emissions[6]	Total Annual Emissions from LCR[7]	LCA Fraction of Total Emissions[8]
		(tonnes CO_2)			(years)	(tonnes CO_2 / year)	(tonnes CO_2 / year)	(%)
Buildings[2]	Low Estimate	32,061		32,061	40	802	98,059	0.8%
	High Estimate	345,545		345,545		8,639		9%
Infrastructure		9,549	140	9,688		242		0.2%
TOTAL		41749 - 355234		41749 - 355234		1044 - 8881		1.1% - 9%

Notes:
1. ENVIRON estimated LCA emissions from two sources: buildings, and infrastructure.
2. Emissions from buildings are shown as a range from a low to a high estimate based on the range presented in Table 1. The values in Table 1 are multiplied by the assumed lifetime of 40 years to yield total emissions in tonnes CO_2.
3. Emissions from the manufacture of materials for infrastructure are from Table 4.
4. Emissions from the transportation of materials for infrastructure are from Table 5.
5. The assumed lifetime of emissions source may be adjusted; here ENVIRON has assumed a conservatively short lifetime of 40 years.
6. Total emissions are divided by the assumed lifetime of emissions sources to yield the total annualized emissions.
7. From the Lytle Creek Ranch Climate Change Report.
8. The LCA fraction of total emissions is calculated by dividing the total annualized emissions by the total emissions from Lytle Creek Ranch.

Abbreviations:
CO_2 = carbon dioxide
LCA = life cycle assessment
LCR = Lytle Creek Ranch

Sources:
Values are calculated using Tables 1 through 5 and the emissions presented in the Lytle Creek Ranch Climate Change Report.