APPENDIX G

Health Risk Assessment

sierra research

Health Risk Assessment for the Rocklin 60 Project Placer County, California

prepared for:

Rocklin 60, LLC

March 2008

prepared by:

Sierra Research, Inc.
1801 J Street
Sacramento, California 95811
(916) 444-6666

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Submitted to
Rocklin 60, LLC

March 2008

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Summary

The California Air Resource Board's (CARB's) guidance document entitled "Air Quality and Land Use Handbook: A Community Health Perspective,"[1] recommends, among other things, that new residences should not be sited within 500 feet of a freeway. This recommendation was based on analyses suggesting that health risks were increased within 300 feet of a freeway, and that a 70% reduction in ambient particulate levels[2] is seen at 500 feet from the source.

The Sacramento Metropolitan Air Quality Management District (SMAQMD) responded to the ARB guidance document with a more specific methodology in their own separate guidance document titled "draft Recommended Protocol for Evaluating the Location of Sensitive Land Uses Adjacent to Major Roadways"[3]. Based on these guidance documents, the City of Rocklin (i.e., the Lead Agency for the Rocklin 60 Project) was concerned about the proximity of the proposed residences to nearby Interstate 80. In response to that concern, the SMAQMD methodology was applied to the project[4]. The resulting report indicated that the proposed residences would be sufficiently distant from Interstate 80 to not require further health risk assessment (HRA). A HRA was recently completed for the Rocklin Crossings commercial development on the west side of the Project[5], estimating a maximum cancer risk of 5.1 in one million to the nearest planned Rocklin 60 residence. Based on this result, the City of Rocklin requested that an HRA be performed for the Rocklin 60 Project, despite the conclusions drawn from use of the SMAQMD methodology. The site-specific HRA herein was performed for the Rocklin 60 Project in response to the City of Rocklin request.

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[1] Published in April 2005.

[2] Particulate is singled out for this observation because health risk analyses have indicated that the dominant source of cancer risk in an urban area is Diesel exhaust particulate matter (South Coast Air Quality Management District. *Multiple Air Toxics Exposure Study (MATES II),* March 2000.

[3] January 2007, Version 1.0.

[4] HDR|The Hoyt Company. *Rocklin 60 Screening Report,* July 31, 2007.

[5] Michael Brandman Associates. *Health Risk Assessment of the Rocklin Crossings, Rocklin, California,* July 25, 2007. The Rocklin Crossings HRA was concerned with the potential health impacts that commercial development may have on neighboring residential receptors while the HRA herein is concerned with the potential health impacts on the same residences from the relatively close proximity of a major roadway (Interstate 80).

The analysis of potential health impacts associated with freeway emissions on the proposed development was prepared based on CARB and U.S. Environmental Protection Agency (EPA) emission factors, EPA dispersion models, and traffic data provided by Caltrans and the Sacramento Area Council of Governments (SACOG) [6]. This analysis indicates that risks from nearby Interstate 80 on proposed residences in the Rocklin 60 Project are lower than those presented in CARB's land use guidance document. For the residence located closest to the freeway (i.e., Lot 155) [7], the maximum potential health impacts would be the following:

- acute non-cancer health impact would be at the established regulatory significance level (i.e., health hazard index = 1);
- chronic non-cancer health impact would be one-third of the established regulatory significance level (i.e., health hazard index = 0.33); and
- 70 year-average maximum potential cancer risk (mean point estimate = 130 in one million) for a resident moving into the Rocklin 60 lot nearest Interstate 80 in 2007 would be approximately one quarter of the year 2000 risk level attributable to toxic air pollutants in the Sacramento Valley Air Basin (520 in one million).

The impacts identified for this project, in comparison with the values presented in the CARB and SMAQMD Land Use Guidance documents, are the result of a number of site-specific factors, including vehicle traffic volumes, the relative orientation of the freeway vis-à-vis the proposed development, local meteorology, and the decline in vehicle emissions over time. Based on projections of vehicle traffic and emission factors[8], emissions from each vehicle (average) will decline at least twice as rapidly as the increase in traffic volume. If the Lead Agency finds that the potential health impacts of Interstate 80 emissions on the Rocklin 60 Project are significant, then the following mitigation measures should be considered:

- Constructing sound walls to enhance the dispersion of emissions from the freeway;
- Planting dense tiers of trees to enhance the dispersion of emissions from the freeway and intercept (remove) some pollutants; and
- Installing High Efficiency Particulate Air (HEPA) filters in home Heating, Ventilation, and Air Conditioning (HVAC) systems within the Project, and provide homeowners with instructions regarding their use and maintenance. This measure is estimated to reduce indoor risk levels between 25 and 90 percent.[9]

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[6] SACOG. *Draft Metropolitan Transportation Plan for 2035*, SACOG-07-034, October 2007.
[7] The setback distances are from the edge of the mixing zone. The mixing zone is 10 feet wide, beginning at the outer edge of the highway traffic lane nearest the Project.
[8] CARB. EMFAC2007, http://www.arb.ca.gov/msei/onroad/latest_version.htm, run for Sacramento County, which contains identical emission factors to an EMFAC2007 run for Placer County. The project location in Rocklin is only 8 miles northeast of Sacramento County along Interstate 80.
[9] As shown in Appendix A, indoor risk reductions depend on the fraction of time an individual spends in a specified house, the fraction of indoor air that has passed through the HEPA filter, and fraction of total cancer risk attributable to Diesel particulate matter (DPM).

The first and second measures enhance the dispersion of the freeway emissions while the second and third measures remove pollutants. Hence, all three measures reduce the exposure concentrations of pollutants inside project residences.

There are no accepted significance levels set by regulatory agencies for the assessment of cancer risk at residential developments located near transportation facilities such as freeways. While CARB's land use guidelines are intended to provide guidance with respect to siting residential developments near major roadways, the guidelines do not provide significance levels that can be used in the context of the California Environmental Quality Act (CEQA). The analytical approach, potential health impacts and mitigation measures presented in this report are consistent with those that have been accepted in Sacramento County for development projects since the adoption of the CARB guidelines.

Introduction

In April 2005, CARB published a guidance document entitled "Air Quality and Land Use Handbook: A Community Health Perspective," which recommended, among other things, that new residences should not be sited within 500 feet of a freeway. This recommendation was based on analyses suggesting that additional health risks were strongest within 300 feet of a freeway and that a 70% reduction in ambient particulate levels is seen at 500 feet from the source. The CARB recommendation directly affects the proposed Rocklin 60 Project, which proposes construction of residences at distances between 150 and 2,000 feet from Interstate 80.

Figure 1 shows a map of the proposed development site adjacent to Interstate 80, and Figure 2A shows a wind rose for wind direction and speed measured during 1986 at Sacramento Executive Airport, which is 25 miles southwest of the project site, and Figure 2B shows the wind rose during 1996 at McClellan Air Force Base, which is 14 miles southwest of the project site. These two airports provided the nearest sources of meteorological data needed for the air dispersion modeling of the freeway emissions. As shown in both wind rose plots, the prevailing winds blow from the south and southwest. This situates the property upwind of the freeway. Therefore, the prevailing wind conditions have a minimizing to neutral effect on freeway-related emissions. A site-specific HRA was performed to quantify the maximum potential health impacts associated with the combination of meteorology and traffic volumes from the adjacent Interstate 80. Use of additional wind data from Sacramento Executive Airport for years other than 1986 or from McClellan Air Force Base for 1986 or years other than 1996 would not change the conclusions in this analysis.

To assess the potential health impacts associated with exposure to mobile source air toxics (MSATs) emitted from vehicles on a specified section of Interstate 80 adjacent to the development, vehicle emissions on the freeway segment were quantified and the maximum potential exposure was estimated at various distances from the freeway using air dispersion modeling. Although hundreds of organic compounds have been measured in the exhaust of onroad vehicles[10], the MSATs included in this HRA are the 21 inorganic and major organic toxic air contaminants (TACs) and groups of TACs identified by the U.S. EPA[11] to be the most important, and listed in Table 1. Emission factors for the vehicles on Interstate 80 were generated from the EMFAC2007 software system during the following years that would be of potential interest: 2007, 2012, 2017, 2022, 2027, 2032 and 2037. The year 2000 is also of interest because a Caltrans database provides total and truck traffic volumes on segments of Interstate 80 for that year[12]. The year 2007 is listed because it gives the emission factors representing approximately the present time, when the Project is being proposed. The analysis uses the emission factors for each of the seven years listed above to account for the improvements (reductions) in vehicle emissions over the 30-year period. This analysis covers the full project development period (i.e., from date of approval through buildout, the date of which will depend on the housing market) and beyond. This report summarizes the data and methodology used and the results of the assessment.

Table 1
21 Major Mobile Source Air Toxics Identified by EPA

Acetaldehyde	Diesel Particulate Matter (PM) and Diesel Exhaust Organic Gases	MTBE[a]
Acrolein	Formaldehyde	Naphthalene
Arsenic Compounds	n-Hexane	Nickel Compounds
Benzene	Lead Compounds	Polycyclic Organic Matter (POM)
1,3-Butadiene	Manganese Compounds	Styrene
Chromium Compounds	Mercury Compounds	Toluene
Dioxins/Furans		Xylene
Ethylbenzene		

[a] Methyl tert-butyl ether, a gasoline oxygenate and octane-enhancing additive.

Estimating MSAT Emission Levels

Interstate 80 Emissions

To be conservative relative to the development timeline, the analysis uses the most recent (i.e., 2005) SACOG-published traffic data, together with year 2000 Caltrans traffic volume data, to estimate current (2007) traffic volumes for the adjacent Interstate 80 segment, and at five-year increments as far into the future as the emissions modeling would permit (i.e., 2037).[13] CARB's most current version of the EMFAC emissions

[10] USEPA. *Master List of Compounds Emitted by Mobile Sources, http://www.epa.gov/OMSWWW/regs/toxics/420b06002.xls,* updated 2006.
[11] "List of Mobile Source Air Toxics (MSATs)," U.S. Environmental Protection Agency, Mobile Source Air Toxics Website, *http://www.epa.gov/otaq/toxics.htm*, accessed July 26, 2005.
[12] The modeling group of the San Joaquin Valley Air Pollution Control District put a Caltrans traffic volume database for the state of California into Microsoft Access database software, and makes it available to the public upon request.
[13] Appendix B to the report contains the detailed traffic volume tables.

factor and inventory model[14] was used to estimate vehicle emissions for each of the analysis years. For the HRA, EMFAC2007 was used to estimate emissions of hydrocarbons (in the form of total organic gases [TOG] and reactive organic gases [ROG]), and particulate matter with aerodynamic diameter less than or equal to 10 microns (PM_{10}) from gasoline- and Diesel-fueled vehicles specifically for Sacramento County[15], which is the source of most of the commuter traffic passing the project. The Sacramento County traffic distribution data in EMFAC2007 was used in the analysis because of the close proximity of the City of Rocklin to the Sacramento County line (i.e., 8 miles), and the dominance of the Sacramento County population, which is 4.2 times larger than that of Placer County.[16]

EMFAC runs were developed to generate average TOG, ROG, and PM_{10} emission factors in grams per mile for Sacramento County for each of the 13 vehicle classes in the model, by technology group (non-catalyst, catalyst, and Diesel), for a total of 39 combinations. Because the EMFAC model does not directly estimate MSAT emissions, the emission factors generated from the model runs were multiplied by TAC emission ratios (expressed as MSAT/TOG, MSAT/ROG or MSAT/volatile organic compounds [VOC], and MSAT/PM_{10}) from EPA. For example,

MSAT (g/mi) = TOG (g/mi) * MSAT/TOG.

The most current version of EPA's MOBILE model[17] provides TAC emission ratios to estimate emissions for benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, and MTBE from TOG emissions and average fuel properties. For use of this model, the fuel used in Sacramento County for 2007 through 2037 was assumed to fall within the requirements of the California Phase 3 Reformulated Gasoline limits, and the winter fuel Reid vapor pressure (RVP) was estimated to be 13 pounds per square inch based on historical winter gasoline in the area.

In addition to the six above MSAT ratios that are explicitly generated by MOBILE, TAC emission ratios for dioxins, furans, naphthalene, ethylbenzene, n-hexane, styrene, toluene, xylene, a representative group of polycyclic organic matter (POM),[18] chromium (Cr^{6+} and Cr^{3+}), manganese, nickel, mercury, and arsenic were estimated using ratios developed by EPA for use in creating the 2002 National Emissions Inventory (NEI). The TAC emission ratios for naphthalene, ethylbenzene, n-hexane, styrene, toluene, and xylene from the NEI were based on ROG/VOC emissions; the POM ratios were based on the PM_{10} emissions; and emission factors in milligrams per mile were obtained for the

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[14] EMFAC2007, Version 2.3, projects vehicle emissions and emission factors out to the year 2040, November 1, 2006.
[15] EMFAC2007 also estimates the emission factors and emissions for the other criteria pollutants and carbon dioxide, and for each county in California. Placer and Sacramento Counties have the same emission factors, but different traffic volumes.
[16] U.S. Census Bureau, Sacramento and Placer Counties had estimated populations of 1,375,000 and 326,000 in 2006, http://quickfacts.census.gov/qfd/states/06/06067.html, and http://quickfacts.census.gov/qfd/states/06/06061.html, respectively.
[17] MOBILE, Version 6.2, dated September 24, 2003.
[18] A group of seven polynuclear aromatic hydrocarbons (7-PAH)—benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenz(ah)anthracene, and indeno(1,2,3-cd)pyrene)—was used as a surrogate for the larger group of POM compounds.

metals, dioxins, and furans. Because the EMFAC model does not generate hydrocarbon emissions as VOC, the model emissions for ROG were used with the VOC-based ratios.[19]

After MSAT emission factors were developed for each vehicle class from the combination of the TOG, ROG, or PM_{10} emissions from EMFAC2007, and ratios and emission factors from EPA, separate Diesel and gasoline fleet-average MSAT emission factors were estimated using the fraction of vehicle miles traveled (VMT) by vehicle class in EMFAC2007 for Sacramento County for each analysis year. The average gasoline and Diesel MSAT emission factors were then combined with the estimated average annual and peak period total VMT for each fuel type for the adjacent freeway for the study years using the following equation:

MSAT (g/mi) * VMT (mi/s) = MSAT (g/s)

The VMT (the product of roadway length and traffic volume) for vehicles traveling northbound and southbound on the segment of Interstate 80 east of the Highway 193 intersection was estimated from Caltrans traffic volume data for 2000, Sacramento County traffic growth projections obtained from the Sacramento Area Council of Governments (SACOG)[20], and the 0.92-mile freeway segment length estimated to affect Rocklin 60[21]. The SACOG traffic volume data included the annual average and AM and PM peak hour traffic volumes for the northbound and southbound portions of Interstate 80 for the years 2000, 2005, 2018 and 2035. The resulting VMT data for Interstate 80 were interpolated to develop VMT estimates for 2007, 2012, 2017, 2022, 2027, and 2032, and extrapolated for travel estimates for 2037. The annual average and peak VMT per hour and per second for the adjacent segment of Interstate 80 in both directions for each analysis year are shown in Table 2.

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[19] The differences between VOC and ROG are believed to be insignificant in the context of this analysis.

[20] SACOG. *Draft Metropolitan Transportation Plan for 2035*, SACOG-07-034, October 2007.

[21] Includes the 0.55 mile segment of Interstate 80 that is adjacent to the freeway-oriented length of the development (see Attachment 2) plus 1,000 feet at each end. When modeling with line-type sources, there are “end-effects”, which are perturbations in the modeled pollutant concentration field associated with the termination of links. For a continuing line source, adding the extra 1,000 feet to each end avoids these end effects if the link does not, in fact, actually end.

Table 2 Annual Average and Peak VMT on the Interstate 80 Segment (Both Directions) Adjacent to Rocklin 60				
	Annual Average		Peak Period	
Calendar Year	VMT/Hour	VMT/Sec	VMT/Hour	VMT/Sec
2007	9,104	2.53	18,557	5.15
2012	10,016	2.78	20,414	5.67
2017	10,927	3.04	22,271	6.19
2022	11,838	3.29	24,128	6.70
2027	12,749	3.54	25,985	7.22
2032	13,660	3.79	27,842	7.73
2037	14,572	4.05	29,700	8.25

To generate gasoline and Diesel fuel VMT, the VMT shown in Table 2 were multiplied by the VMT fraction for gasoline and Diesel vehicles derived from the EMFAC2007 model. The fuel-specific VMT per second in Table 2 were used along with the gasoline and Diesel fuel average MSAT emission factors in grams per mile in the equation shown above to calculate gasoline and Diesel fuel MSAT emission rates in grams per second. The resulting gram-per-second MSAT emission rates were then combined with the cancer and non-cancer health impact factors (in per microgram/meter^3 [per µg/m^3]) to generate emission-weighted risk per 1 µg/m^3 per gram/second.

Cancer risk factors and acute and chronic health hazard indices (HHIs) were generated using CARB's Hotspots Analysis and Reporting Program (HARP).[22] Risk factors for the MSATs from gasoline-powered vehicles were weighted separately by multiplying the pollutant emission level by the cancer risk factors and HHIs for each individual MSAT. The cancer risk factors and chronic risk HHIs were weighted using the pollutant emission levels generated from the annual average traffic volumes on the Interstate 80 segment, whereas the acute risk HHIs were weighted using the emission levels during the peak traffic hour. The resulting products were then summed for all MSATs to result in the total risk for gasoline-fueled vehicles. For Diesel-fueled vehicles, the DPM risk factor in HARP includes all of the MSATs from Diesel exhaust, so only the DPM emission rate and the DPM cancer risk factor were used to account for all of the cancer risk from Diesel exhaust. As with gasoline-fueled vehicles, the Diesel cancer risk factor and chronic HHI were weighted using the annual average traffic emission levels. No acute non-cancer reference exposure level (REL) or HHI exists for DPM. Risk factors were developed for 70-year (lifetime) exposure of adult receptors[23].

[22] HARP Version 1.3, Build April 23, 2005.
[23] Adult receptors have specific assumptions for breathing rate and body weight in the health risk assessment methodologies.

Dispersion Modeling

The dispersion model used in the analysis is EPA's CAL3QHCR model,[24] which is designed to predict pollutant concentrations near roadways and other line sources. Unit impacts (assuming a total of 1 gram per second is emitted by the Interstate 80 segment) were generated by the model runs for each analysis year at different distances from the freeway. These unit impacts were then combined with the emissions-weighted health impact values discussed above to estimate the potential health impacts of the freeway traffic emissions. The modeling procedure is described in more detail below.

The modeled source was the segment of Interstate 80 adjacent to Rocklin 60. The unit emission rate of 1.0 gram per second from this source was adjusted for each analysis year to the predicted increase in vehicle traffic volumes and the decrease in emissions per vehicle provided by EMFAC2007. The Interstate 80 segment traffic volumes[25] for the analysis years were obtained from SACOG and Caltrans. The freeway dimensions were taken from a TOPO! software map to generate UTM[26] coordinates in NAD83[27]. The freeway segment source was modeled following CAL3QHCR's standard line source/mixing zone approach. Meteorological data collected during 1986 at Sacramento Executive Airport and during 1996 at McClellan Air Force Base were used for the dispersion modeling. Meteorological differences between these two airports and the project site are not likely to significantly affect the reported results.

Exposure was assessed at the edge of the mixing zone, located 17 meters from the center of the Interstate 80 segment, and at a set of points spaced every 10 meters from 20 meters (i.e., just beyond the edge of the mixing zone) out to 650 meters (2,133 feet), the maximum distance of Rocklin 60 property from the center of the highway. The edge of the property nearest Interstate 80 is approximately 60 meters from the center of the highway. Figure 3 contains a line perpendicular to the interstate showing several distances from the edge of the mixing zone out to the maximum. The mixing zone[28] is 10 feet wide and begins at the outside edge of the outer 12-foot wide highway travel lane, making it coincident with the conventional 10-foot wide shoulder next to the outer highway travel lane[29].

[24] CAL3QHCR, Version 04244, dated August 31, 2004

[25] Traffic volumes on each segment are inputs to the model to account for the emissions dispersion attributable to moving vehicles on the roadway.

[26] UTM = Universal Transverse Mercator projection of the Earth's surface

[27] NAD83 = North American Datum of 1983, a coordinate system for locating points on the Earth's surface in North America.

[28] The 10-foot mixing zone is a modeling concept used to account for the dispersion of the exhaust plume generated by the wake of moving vehicles (User's Guide to CAL3QHC Version 2.0, Section 4.2, p.29).

[29] USEPA. User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, EPA-454/R-92-006, Section 3.2.2, p.8, November 1, 1992.

Health Risk Assessment Results

Residential Risks

For each year of the analysis, the cancer risks and non-cancer health hazards associated with the Interstate 80 emissions were estimated from the edge of the mixing zone across the widest part of Rocklin 60, giving impacts over the range of distances from 17 to 650 meters from the center of Interstate 80. The 70-year average health impacts were estimated by time-weighting the impacts for each of the six analysis years of 2007, 2012, 2017, 2022, 2027 and 2032 by the five years that follow each, and the impact for 2037 was time-weighted by the following 40 years.

The 70-year average of the mean point residential cancer risk is summarized in Table 3 and illustrated in Figure 4A using the Sacramento Executive Airport meteorological data and in Figure 4B using the McClellan Air Force Base meteorological data. The ranges presented in Table 3 show the small differences in potential health impacts that arise from use of the two different meteorological data sets, in which the lower impacts are calculated using the data from McClellan Air Force Base. The mean point estimate cancer risk is based on the 65th percentile breathing rate. Table 3 also shows the high-end point estimate, which is based on the 95th percentile breathing rate (ARB guidance[30]). These two methods of calculating lifetime cancer risk provide a range of uncertainty, based on the different exposure assumptions used in the two estimating methods[31]. The maximum potential cancer risk drops off by a factor of ten between the Rocklin 60 lot nearest to Interstate 80 and the most distant location in the southeast corner of the development.

To provide context for the maximum potential cancer risks in Table 3, the overall cancer risk in the Sacramento Valley Air Basin (Basin) attributable to 10 important TACs, including DPM, was 520 in one million in the year 2000, the most recent year analyzed and published[32]. The 10 selected TACs[33] pose the greatest health risk from all sources in the Basin based primarily on ambient air quality data. Therefore, the actual total average basin risk would be higher when all air toxic pollutants are accounted for.

Context for the distance-dependent results plotted in Figures 4A and B is provided by the CARB line showing the decrease of cancer risk from 1,700 in one million at the edge of a freeway to approximately 300 in one million at a distance of 1,000 feet from a freeway[34]. The maximum potential cancer risk for a resident moving in 2007 into a home in the

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[30] ARB. *Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk,* October 9, 2003.

[31] OEHHA. *Air Toxics Hot Spots Program Risk Assessment Guidelines: Part IV Technical Support Document for Exposure Assessment and Stochastic Analysis,* September 2000.

[32] ARB. The California Almanac of Emissions and Air Quality - 2007 Edition, http://www.arb.ca.gov/aqd/almanac/almanac07/excel/tablec_44.xls.

[33] The selected 10 toxic air contaminants are acetaldehyde, benzene, 1,3-butadiene, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, perchloroethylene, and Diesel particulate matter.

[34] The cancer risk decrease from approximately 1,700 to 300 over a distance of approximately 1,000' (~300 m.) is taken from Table 1-2 in the Executive Summary of ARB, *Air Quality and Land Use Handbook: A Community Health Perspective,* April 2005, http://www.arb.ca.gov/ch/landuse.htm.

Rocklin 60 lot nearest Interstate 80 (see the vertical line in Figures 4A and B at a distance of 60 meters from the center of Interstate 80) would be less than the potential cancer risk estimated by the CARB trend line at a distance of 170 meters from the center of Interstate 80 (equivalent to 500 feet from the edge as recommended by CARB guidance).

Table 3
Maximum Potential Health Impacts from Interstate 80 on Rocklin 60

Distance from Middle of I80 (m/ft)	Cancer Risk (70-Year Lifetime)		Non-Cancer Health Hazard Index	
	Mean Point Estimate	High-End Point Estimate	Chronic	Acute
60/197	116-130	174-195	0.29-0.33	0.98-1.0
100/328	75-85	112-127	0.19-0.21	0.67-0.67
150/492	53-60	79-90	0.13-0.15	0.48-0.49
310/1,017	27-31	41-47	0.068-0.078	0.28-0.28
460/1,509	17-21	26-31	0.0440.052	0.20-0.21
610/2,001	12-15	18-23	0.031-0.038	0.16-0.16
650/2,133	11-14	17-21	0.028-0.036	0.16-0.16

The maximum potential chronic non-cancer HHIs would be below the "project significance level"[35] of 1.0 at all distances from the Interstate 80. The maximum potential acute non-cancer HHI would be approximately equal to the significance threshold of 1.0 at the corner of Lot 155 in the northwest corner of the project property.

Because people reside on average approximately 9 years in one residence and 30 years in the same urban area[36], Table 4 presents the maximum potential cancer risks from Interstate 80 on the basis of these time periods for comparison to the 70-year calculated lifetime risk.

[35] The significance thresholds for potential health impacts of TAC exposure have been set for the impacts imposed on residents, workers and sensitive individuals by Projects, but not for the potential health impacts of existing road traffic and other sources on individuals moving into new homes placed within the "impact distance" of such existing sources.

[36] OEHHA. *Air Toxics Hot Spots Program Risk Assessment Guidelines: Part IV Technical Support Document for Exposure Assessment and Stochastic Analysis,* September 2000.

Table 4 Residence Duration Potential Cancer Risks from Interstate 80 on Rocklin 60				
Distance from Middle of I80 (m/ft)	Cancer Risk (9-Year Same Residence Period)		Cancer Risk (30-Year Urban Residence Period)	
	Mean Point Estimate	High-End Point Estimate	Mean Point Estimate	High-End Point Estimate
60/197	15-17	22-25	50-56	75-84
100/328	10-11	14-16	32-36	48-54
150/492	7-8	10-12	23-26	34-39
310/1,017	5-6	5-6	12-20	18-20
460/1,509	2-3	3-4	7-9	11-13
610/2,001	1.5-1.9	2-3	5-6	8-10
650/2,133	1.4-1.8	2-3	5-6	7-9

Conclusions and Recommendations

A site-specific analysis of the potential health risks associated with the impact of freeway emissions on the proposed Rocklin 60 development indicates that potential cancer risk for residents would be lower than suggested by CARB's land use guidance setback of 500 feet from the edge of major roadways. This is the result of a number of factors, including vehicle traffic volumes, the relative orientation of the freeway vis-à-vis the proposed development, local meteorology, and the expected decline in vehicle emissions over time.

At the present time, there are no accepted significance levels for the assessment of cancer risk at residential developments located near transportation corridors such as freeways. While ARB's land use guidelines are intended to provide guidance with respect to siting decisions, the guidelines do not provide significance levels that can be used within the context of CEQA. The analytical approach, project lot setback distances and potential mitigation measures presented in this report are consistent with those that have been accepted in Sacramento County for other development projects since the adoption of the ARB guidelines.

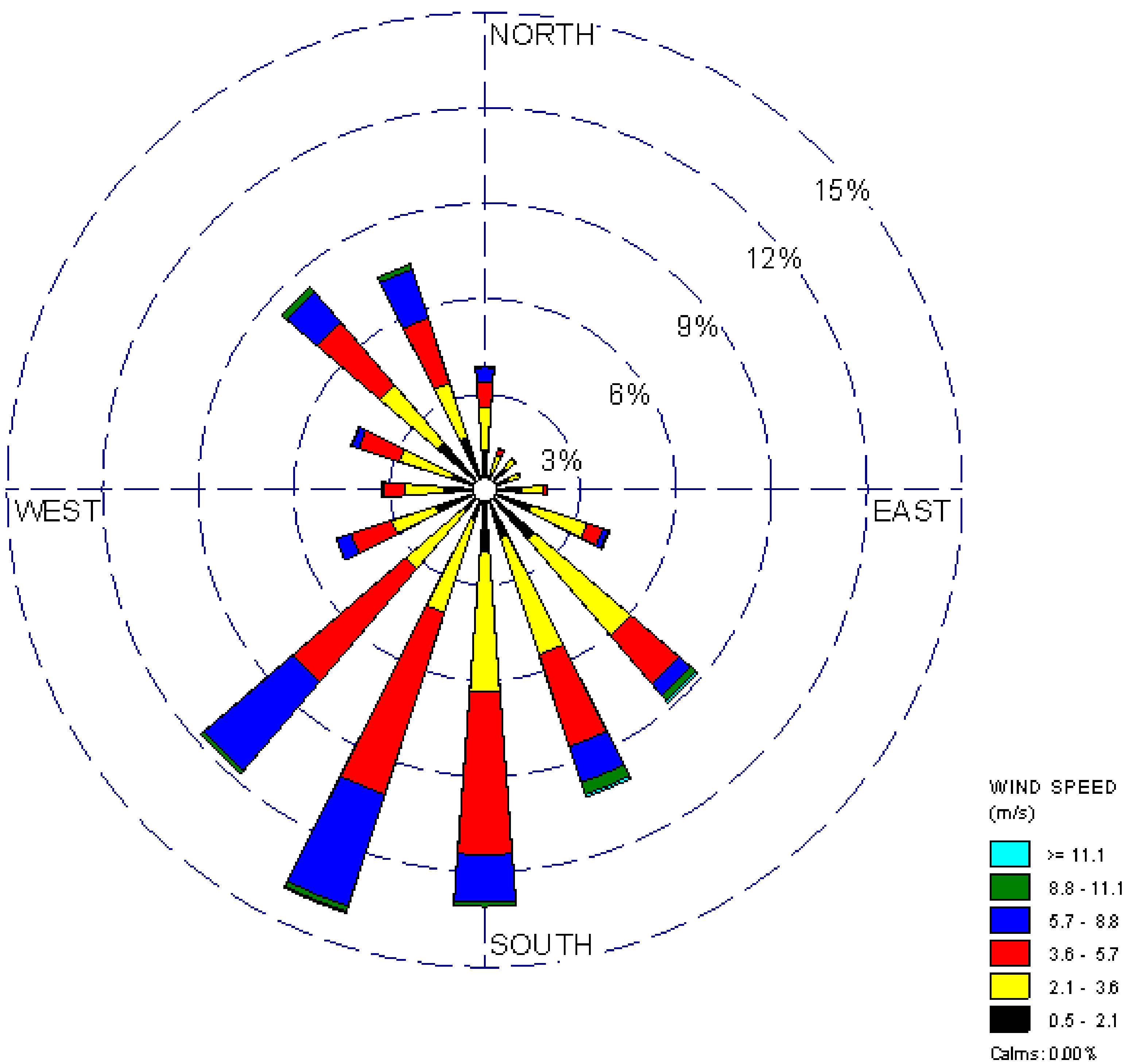
Figure 1


ROCKLIN 60, LLC
Vicinity Map
N.T.S.
PROJECT SITE
STONE RD.
BRACE RD.
TAYLOR ROAD
SOUTHERN PACIFIC RAILROAD
PACIFIC STREET
GADE LN.
DIAS LANE
BARTON RD.
LAIRD RD.
INDIAN CREEK COUNTRY CLUB
GRANITE DR.
SIERRA COLLEGE BLVD.
ROCKLIN ROAD
FUTURE CONNECTION
50
100
200
300
400
500
ACCESS TO DIAS LANE
TECATE DRIVE
MEDDLEAF DRIVE
MAKABE LANE
20' EMERGENCY ACCESS ONLY
EMERGENCY ACCESS GATE
10' LA
DIAS LANE
BUTTONBUSH LANE
SEDGE COURT
INTERSTATE 80
PARK
SADLER DRIVE
MESQUITE WAY
BLACK WILLOW COURT
6' FIRE DEPT. ACCESS
CMU WALL
FLOOD PLAIN
100 YR.
NOLINA STREET
O/S
15' LA
50' BUILDING SETBACK FROM FLOODPLAIN
SECRET RAVINE
GOWEN STREET
ENGELMANN STREET
BLACK WILLOW STREET
BLUE BLOSSOM STREET
20'Wx15' ACCESS RAMP
20' ACCESS ROAD
FIRE DEPT. ACCESS
R.O.W. BY OTHERS
EDGE OF PAVEMENT
GUTTER
BRIDGE TO CROFTWOOD
TO SIERRA COLLEGE BLVD.
SCALE 1" = 120'
DESCRIPTION
DATE
CITY APPROVAL
RSC ENGINEERING
2250 Douglas Blvd. Suite 150
Roseville, CA 95661
Ph: 916.788.2884 Fax: 916.788.4408
REGISTERED PROFESSIONAL ENGINEER
RICHARD S. CHAVEZ
No. 29033
Mar. 31, 2009
CIVIL
STATE OF CALIFORNIA
PROJECT NO. 021-001
DRAWN BY: RSC Eng
CHECKED BY: RSC Eng
DESIGNED BY: RSC Eng
SITE PLAN FOR HEALTH RISK ASSESSMENT
ROCKLIN 60 RESIDENTIAL
SIERRA COLLEGE BLVD. & I-80
ROCKLIN, CA
SHEET TITLE
EXH
SHEET NO.
1
OF 1
DATE: 07/27/07

Figure 2A 1986 Wind Rose for Sacramento Executive Airport

WIND ROSE PLOT:
Station #23232 - SACRAMENTO/EXECUTIVE ARPT, CA

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:
1986 1986
Jan 1 - Dec 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:
0.00%

TOTAL COUNT:
16790 hrs.

AVG. WIND SPEED:
3.53 m/s

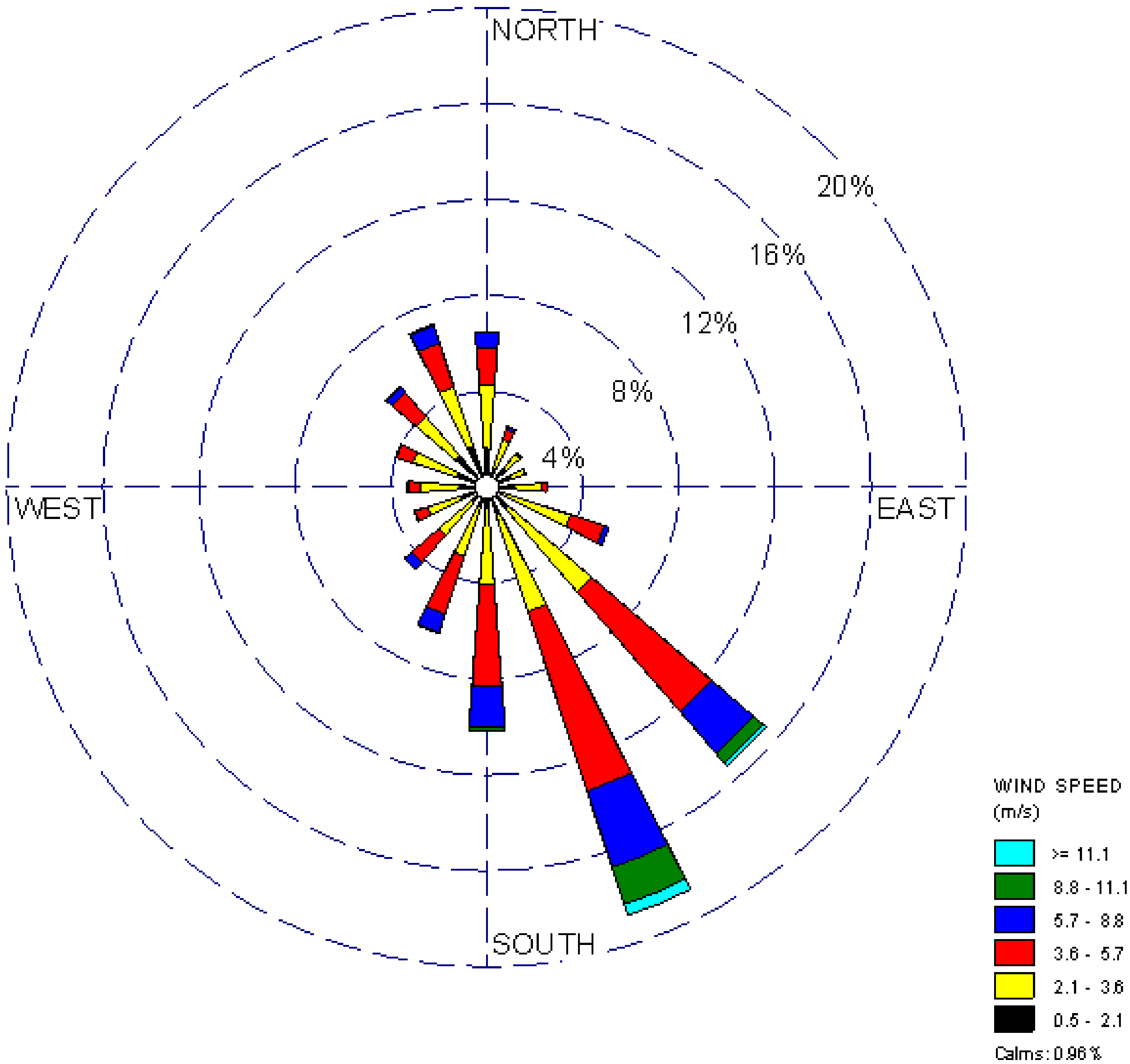
DATE:
3/4/2008

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Figure 2B 1996 Wind Rose for McClellan Air Force Base

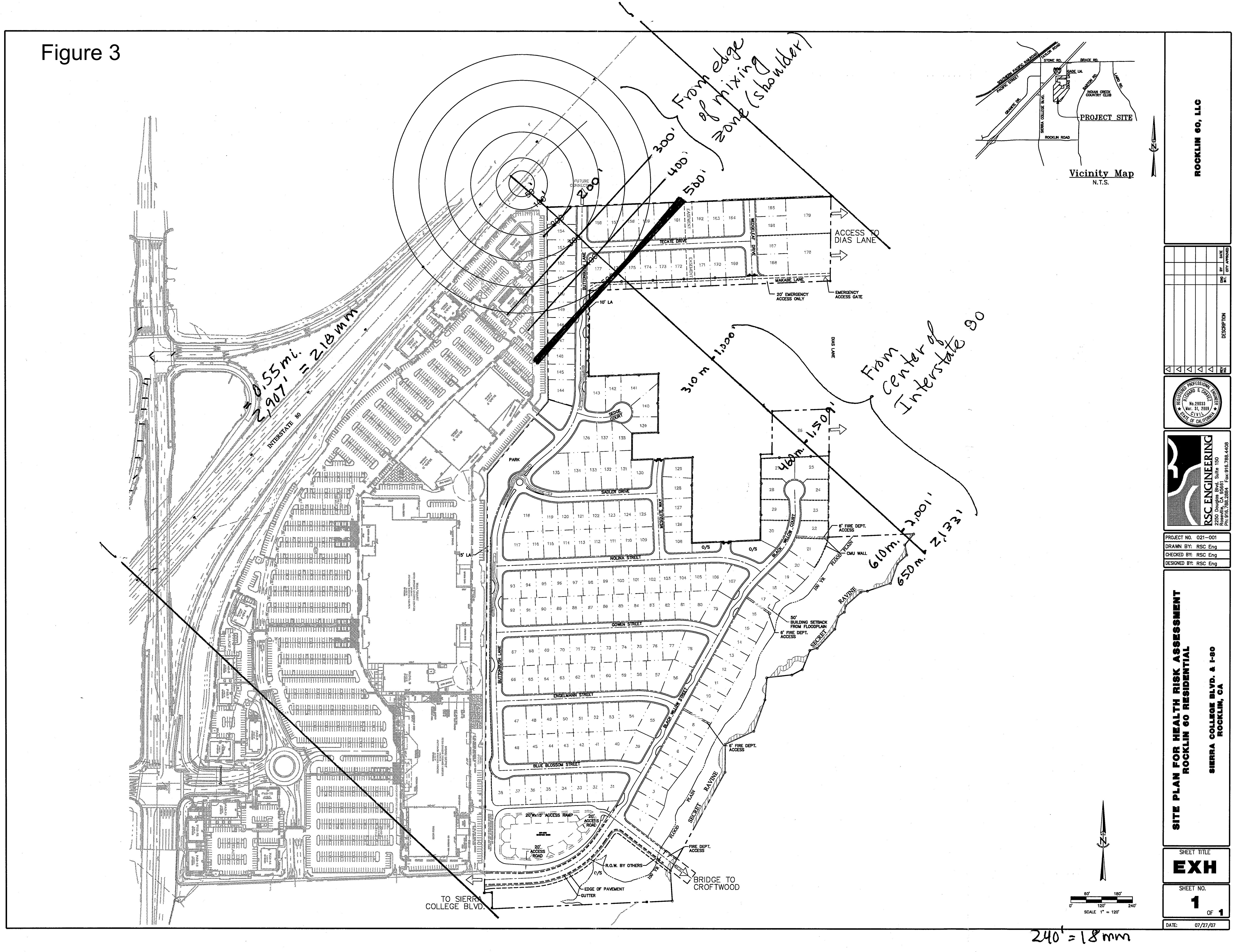
WIND ROSE PLOT: Station #72483	DISPLAY: Wind Speed Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	1996 Jan 1 - Dec 31 00:00 - 23:00	MODELER:	
	CALM WINDS: 0.96%	TOTAL COUNT: 8418 hrs.	
	AVG. WIND SPEED: 3.49 m/s	DATE: 3/4/2008	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Figure 3



From edge of mixing zone (shoulder)
300'
400'
500'
200'
From center of Interstate 80
310 m 1,000'
460m 1,509'
610m 2,001'
650m 2,133'
= 0.55 mi. 2,907' = 218mm
INTERSTATE 80
ACCESS TO DIAS LANE
TECATE DRIVE
MAKABE LANE
20' EMERGENCY ACCESS ONLY
EMERGENCY ACCESS GATE
DIAS LANE
SADLER DRIVE
NOLINA STREET
GOWEN STREET
ENGELMANN STREET
BLUE BLOSSOM STREET
BUTTONBRUSH LANE
BLACK WILLOW STREET
PARK
6' FIRE DEPT. ACCESS
CMU WALL
50' BUILDING SETBACK FROM FLOODPLAIN
SECRET RAVINE
FLOOD PLAIN
20'Wx15' ACCESS RAMP
20' ACCESS ROAD
R.O.W. BY OTHERS
FIRE DEPT. ACCESS
BRIDGE TO CROFTWOOD
EDGE OF PAVEMENT
GUTTER
TO SIERRA COLLEGE BLVD.
PROJECT SITE
Vicinity Map
N.T.S.
INDIAN CREEK COUNTRY CLUB
ROCKLIN ROAD
SIERRA COLLEGE BLVD.
SCALE 1" = 120'
240' = 18 mm
ROCKLIN 60, LLC
RSC ENGINEERING
2250 Douglas Blvd., Suite 150
Roseville, CA 95661
Ph: 916.788.2884 Fax: 916.788.4408
PROJECT NO. 021-001
DRAWN BY: RSC Eng
CHECKED BY: RSC Eng
DESIGNED BY: RSC Eng
SITE PLAN FOR HEALTH RISK ASSESSMENT
ROCKLIN 60 RESIDENTIAL
SIERRA COLLEGE BLVD. & I-80
ROCKLIN, CA
SHEET TITLE
EXH
SHEET NO.
1 OF 1
DATE: 07/27/07

Figure 4A
Average Cancer Risk by Perpendicular Distance from the Center of Interstate 80 (1986 met. data)

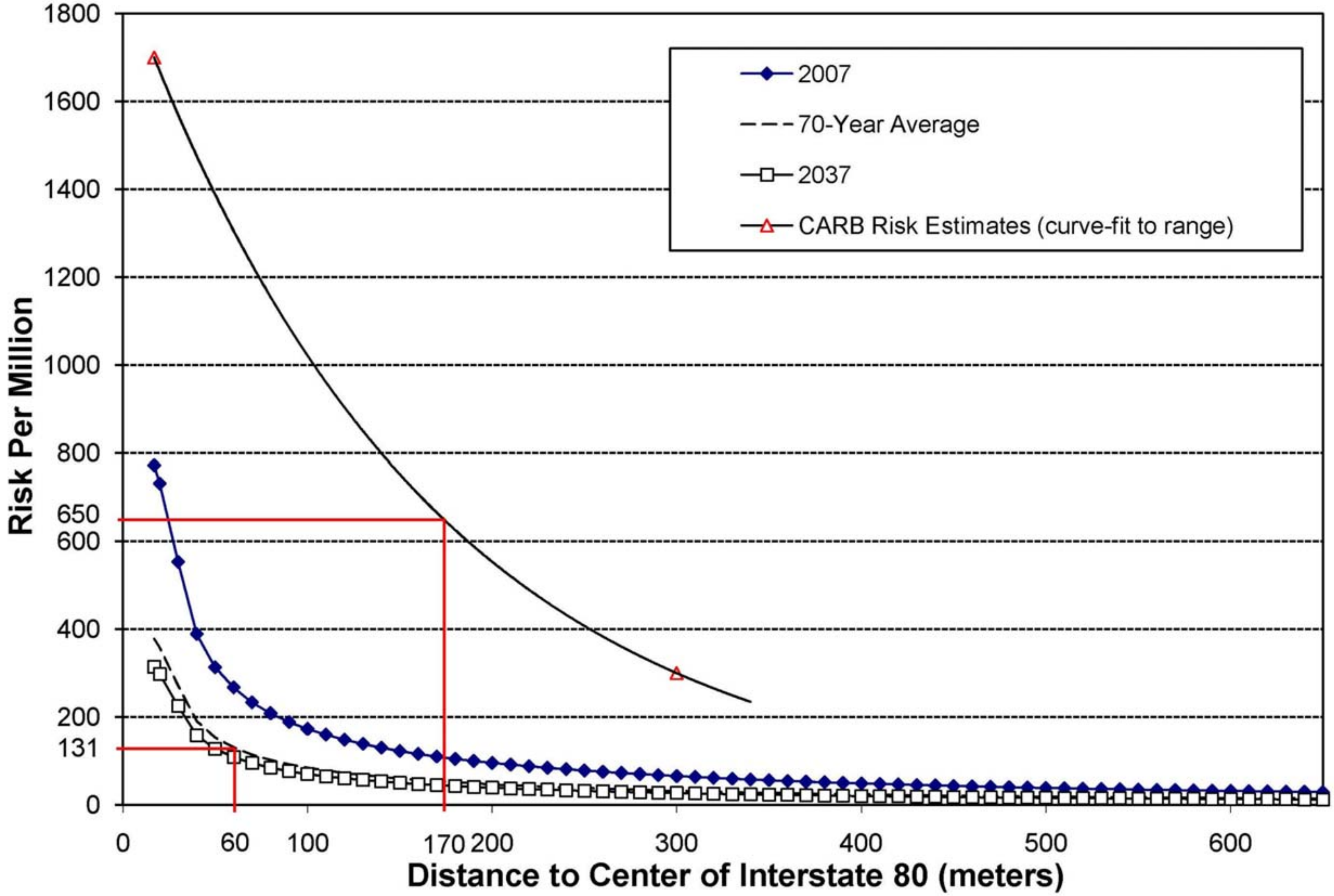
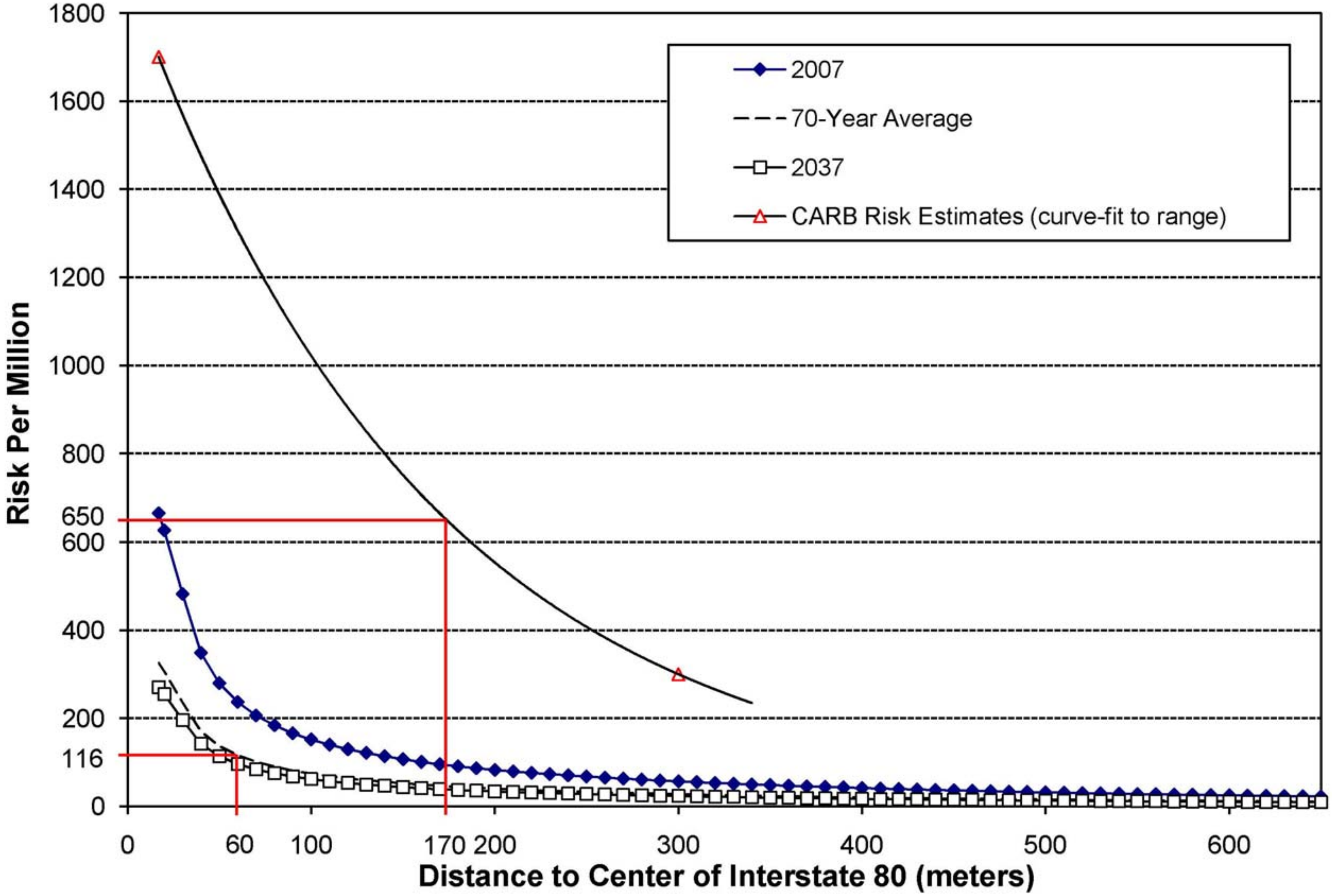


Figure 4B
Average Cancer Risk by Perpendicular Distance from the Center of Interstate 80 (1996 met. data)



APPENDIX A

Cancer Risk Adjustment for Home Air Filtering System

Introduction

As background for a discussion of how to adjust calculated lifetime cancer risk for the benefit of a home air filtering system, we review regulatory guidance applicable to calculating lifetime cancer risk in California[37].

Regulatory reporting of lifetime cancer risk requires the use of specified cancer potency slope factors, breathing rates and the following time periods of exposure: 24 hours per day, 365 days per year and 70 years. Let this "officially reported" cancer risk be called R_{70}.

The Office of Environmental Health Hazards Assessment (OEHHA) acknowledges that actual cancer risk, as distinguished from the required reporting value, varies with exposure. Based on the observation that a person typically resides in the same urban area for approximately 30 years, cancer risk may also be calculated, but not officially reported, on the following periods of exposure: 24 hours per day, 365 days per year and 30 years. Let this actual residential exposure at one urban area be called R_{30}. Hence,

$$R_{30} = R_{70} * (30/70) = 0.43\ R_{70}$$

Similarly, OEHHA acknowledges that actual cancer risk for a person during the typical nine years of residing at one specified address can be calculated and presented to the public on the basis of the following periods of exposure: 24 hours per day, 365 days per year and 9 years. Let this actual residential exposure at one specified residential address be called R_9. Hence,

$$R_9 = R_{70} * (9/70) = 0.13\ R_{70}$$

Similar logic will now be applied to calculate the actual cancer risk a person experiences when part time is spent outside the specified residence and part time inside a house equipped with a whole-house fan heating, ventilation and air conditioning (HVAC) system. For context, people spend up to about 86 to 90% of their time in the home[38,39]. The officially sanctioned calculations described earlier assume that the person breaths

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[37] California Environmental Protection Agency, Office of Environmental Health Hazards Assessment (OEHHA). *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments,* July 2003.
[38] ARB. The maximum time spent in the home is by young children (< 12 years old), 2005. Working adults typically spend 25% of their indoor time in the workplace rather than in the home.
[39] Boatman, Joe F. *Indoor Environmental Quality: Issues and Answers,* The National Environmental Journal, March/April 1995.

outside air all the time or breathes indoor air part of the time that contains the same toxic air contaminants (TACs) found in the ambient air outside the house. This assumption is most likely good in mild climates when windows and doors may be open most of the time or where the HVAC system, if it exists, is not capable of significantly removing TACs.

The next part of this analysis assumes that a new home is being built with a whole-house fan HVAC system containing a high-efficiency particulate removal (HEPA) filter located downstream of the fan, and may or may not provide for makeup air to be drawn from outside into the main flow upstream of the fan.

Let

- a = the fraction of time a person spends in the specified house (dimensionless)
- b = annual fraction of air inside the house that has first passed through the HVAC HEPA filter (dimensionless)
- c = portion of total cancer risk attributable to toxic particulate (assumed to be Diesel particulate matter [DPM])

The resulting lifetime cancer risk would be R_{70i}

$$R_{70i} = R_{70} - R_{70} * a * b * c$$

or

$$R_{70i} = R_{70} * (1 – a * b * c)$$

A quantitative example of the potential reduction follows. Since the OEHHA guidance dictates the assumption that an exposed individual spends 100% of the time at the point of exposure,

$$a = 1.0$$

Assume that half of the annual air available for breathing inside the new house has first passed through the HEPA filter. Hence,

$$b = 0.5$$

Studies performed by the South Coast Air Quality Management District (SCAQMD)[40] indicate that DPM accounts for approximately 70% of community cancer risk. Hence,

$$c = 0.7$$

and

$$R_{70i} = R_{70} * (1 – 1.0 * 0.5 * 0.7)$$

Or

$$R_{70i} = 0.65R_{70} ,$$

which provides a 35% reduction in lifetime cancer risk. If air dispersion modeling and health risk assessment modeling are used to calculate R_{70}, then the last equation can be used to calculate R_{70i}.

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[40] SCAQMD. *Multiple Air Toxics Emission Study (*MATES),

APPENDIX B

Traffic Data and Projections for Interstate 80 Segment

Table B-1
Northbound I80 Annual Average Daily Traffic
Rocklin 60 Project

Year	AADT [1]								SACOG AADT Annual Average Growth Rate (%/yr)
	Total [2]	Total Truck [3]	2-Axle [4]	3-Axle [4]	4-Axle [4]	5-Axle [4]	Chk Sum	SACOG Total [5]	
2000	117,000	6,505	1,717	322	172	4,294	6,505	**7,378,000**	
2005	133,128	7,402	1,954	366	195	4,886	7,402	**8,395,000**	
2007	138,234	7,686	2,029	380	203	5,073	7,686	8,717,041	1.9
2010	146,264	8,132	2,147	403	215	5,368	8,132	9,223,412	1.9
2012	151,875	8,444	2,229	418	223	5,574	8,444	9,577,232	1.9
2015	160,698	8,935	2,359	442	236	5,898	8,935	10,133,572	1.9
2017	166,862	9,277	2,449	459	245	6,124	9,277	10,522,306	1.9
2018	170,806	9,497	2,507	470	251	6,269	9,497	**10,771,000**	
2020	175,622	9,764	2,578	483	258	6,445	9,764	11,074,699	1.4
2022	180,574	10,040	2,650	497	265	6,627	10,040	11,386,961	1.4
2025	188,265	10,467	2,763	518	276	6,909	10,467	11,871,940	1.4
2027	193,573	10,762	2,841	533	284	7,104	10,762	12,206,682	1.4
2032	207,508	11,537	3,046	571	305	7,616	11,537	13,085,412	1.4
2035	216,065	12,013	3,171	595	317	7,930	12,013	**13,625,000**	
2037	222,446	12,368	3,265	612	327	8,164	12,368	14,027,400	1.4

1) Annual average daily trips

2) Interstate 5 segment at the junction with Route 65. 2000 value from Caltrans database; other values proportioned from SACOG projections.

3) 2000 value from Caltrans database; other values calculated as the same 2000 proportion of total AADT.

4) 2000 value from Caltrans database; other values calculated as the same 2000 proportion of total truck AADT.

5) SACOG AADT for 2000, 2005, 2018 and 2035 (bolded) taken from Table 4-8 in:
SACOG. *Draft Metropolitan Transportation Plan for 2035,* SACOG-07-034, October 2007.

Table B-2
Southbound I80 Annual Average Daily Traffic
Rocklin 60 Project

Year	AADT (1)								SACOG AADT Annual Average Growth Rate (%/yr)
	Total (2)	Total Truck (3)	2-Axle (4)	3-Axle (4)	4-Axle (4)	5-Axle (4)	Chk Sum	SACOG Total (5)	
2000	82,000	6,216	1,641	308	164	4,103	6,216	**7,378,000**	
2005	93,303	7,073	1,867	350	187	4,669	7,073	**8,395,000**	
2007	96,882	7,344	1,939	364	194	4,848	7,344	8,717,041	1.9
2010	102,510	7,771	2,051	385	205	5,129	7,771	9,223,412	1.9
2012	106,443	8,069	2,130	399	213	5,326	8,069	9,577,232	1.9
2015	112,626	8,538	2,254	423	225	5,636	8,538	10,133,572	1.9
2017	116,946	8,865	2,340	439	234	5,852	8,865	10,522,306	1.9
2018	119,710	9,075	2,396	449	240	5,990	9,075	**10,771,000**	
2020	123,086	9,330	2,463	462	246	6,159	9,330	11,074,699	1.4
2022	126,556	9,594	2,533	475	253	6,333	9,594	11,386,961	1.4
2025	131,946	10,002	2,641	495	264	6,602	10,002	11,871,940	1.4
2027	135,667	10,284	2,715	509	272	6,789	10,284	12,206,682	1.4
2032	145,433	11,025	2,910	546	291	7,277	11,025	13,085,412	1.4
2035	151,430	11,479	3,030	568	303	7,577	11,479	**13,625,000**	
2037	155,902	11,818	3,120	585	312	7,801	11,818	14,027,400	1.4

1) Annual average daily trips
2) Interstate 5 segment at the junction with Route 65. 2000 value from Caltrans database; other values proportioned from SACOG projections.
3) 2000 value from Caltrans database; other values calculated as the same 2000 proportion of total AADT.
4) 2000 value from Caltrans database; other values calculated as the same 2000 proportion of total truck AADT.
5) SACOG AADT for 2000, 2005, 2018 and 2035 (bolded) taken from Table 4-8 in:
SACOG. *Draft Metropolitan Transportation Plan for 2035,* SACOG-07-034, October 2007.

Table B-3
Northbound I80 Peak Hour Traffic Count
Rocklin 60 Project

Year	Peak Hour Traffic Count [1]								SACOG AADT Annual Average Growth Rate (%/yr)
	Total [2]	Total Truck [3]	2-Axle [4]	3-Axle [4]	4-Axle [4]	5-Axle [4]	Chk Sum	SACOG Total [5]	
2000 [1]	8,400	467	123	23	12	308	467	**7,378,000**	
2005	9,558	531	140	26	14	351	531	**8,395,000**	
2007	9,925	552	146	27	15	364	552	8,717,041	1.9
2010	10,501	584	154	29	15	385	584	9,223,412	1.9
2012	10,904	606	160	30	16	400	606	9,577,232	1.9
2015	11,537	641	169	32	17	423	641	10,133,572	1.9
2017	11,980	666	176	33	18	440	666	10,522,306	1.9
2018	12,263	682	180	34	18	450	682	**10,771,000**	
2020	12,609	701	185	35	19	463	701	11,074,699	1.4
2022	12,964	721	190	36	19	476	721	11,386,961	1.4
2025	13,516	752	198	37	20	496	752	11,871,940	1.4
2027	13,898	773	204	38	20	510	773	12,206,682	1.4
2032	14,898	828	219	41	22	547	828	13,085,412	1.4
2035	15,512	862	228	43	23	569	862	**13,625,000**	
2037	15,970	888	234	44	23	586	888	14,027,400	1.4

1) Ahead peak hour traffic count on I80 at the junction with Sierra College Boulevard from Caltrans database.

2) 2000 value from Caltrans database; other values proportioned from SACOG projections.

3) 2000 value from Caltrans database; other values calculated as the same 2000 proportion of total AADT.

4) 2000 value from Caltrans database; other values calculated as the same 2000 proportion of total truck AADT.

5) SACOG AADT for 2000, 2005, 2018 and 2035 (bolded) taken from Table 4-8 in:
SACOG. *Draft Metropolitan Transportation Plan for 2035,* SACOG-07-034, October 2007.

Table B-4
Southbound I80 Peak Hour Traffic Count
Rocklin 60 Project

Year	Peak Hour Traffic Count [1]								SACOG AADT Annual Average Growth Rate (%/yr)
	Total [2]	Total Truck [3]	2-Axle [4]	3-Axle [4]	4-Axle [4]	5-Axle [4]	Chk Sum	SACOG Total [5]	
2000 [1]	8,500	473	125	23	12	312	473	**7,378,000**	
2005	9,672	538	142	27	14	355	538	**8,395,000**	
2007	10,043	558	147	28	15	369	558	8,717,041	1.9
2010	10,626	591	156	29	16	390	591	9,223,412	1.9
2012	11,034	613	162	30	16	405	613	9,577,232	1.9
2015	11,675	649	171	32	17	428	649	10,133,572	1.9
2017	12,122	674	178	33	18	445	674	10,522,306	1.9
2018	12,409	690	182	34	18	455	690	**10,771,000**	
2020	12,759	709	187	35	19	468	709	11,074,699	1.4
2022	13,119	729	193	36	19	481	729	11,386,961	1.4
2025	13,677	760	201	38	20	502	760	11,871,940	1.4
2027	14,063	782	206	39	21	516	782	12,206,682	1.4
2032	15,075	838	221	41	22	553	838	13,085,412	1.4
2035	15,697	873	230	43	23	576	873	**13,625,000**	
2037	16,161	899	237	44	24	593	899	14,027,400	1.4

1) Ahead peak hour traffic count on I80 at the junction with Sierra College Boulevard from Caltrans database.

2) 2000 value from Caltrans database; other values proportioned from SACOG projections.

3) 2000 value from Caltrans database; other values calculated as the same 2000 proportion of total AADT.

4) 2000 value from Caltrans database; other values calculated as the same 2000 proportion of total truck AADT.

5) SACOG AADT for 2000, 2005, 2018 and 2035 (bolded) taken from Table 4-8 in:
SACOG. *Draft Metropolitan Transportation Plan for 2035,* SACOG-07-034, October 2007.