Analysis of Public Health Risks Associated with the Estrella Substation and Paso Robles Area Reinforcement Project

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SECTION 1: INTRODUCTION

1.1 Background and Project Area

The Estrella Substation and the Paso Robles Area Reinforcement Project (Project) has been proposed in order to upgrade the electrical infrastructure in the Paso Robles and San Luis Obispo area. This Project is described in the Draft Environmental Impact Report (DEIR)[1] and in the Proponent's Environmental Assessment (PEA).[2] Environmental Permitting Specialists (EPS) has prepared this evaluation to determine impacts to public health associated with the construction of this project.

The proposed project would consist of the construction of a new 230 kV/70 kV substation, a 7 mile long 230 kV transmission line interconnection and replacement/reconductoring of approximately 3 miles of an existing 70 kV power line and pole replacement, and various other equipment.

Figure 1-1 illustrates the location and the main components of the overall project. Construction would occur over 18 months. The project is scheduled to go on-line in 2023.

The objective of the health risk assessment is to determine if construction of the proposed project is likely to expose residents living near different portions of the project to significant cancer and acute health impacts.

1.2 Scope of the Risk Assessment

Preparation of risk assessments is a three step process. The first step is to identify potential contaminants that may lead to public health risks. The second step is to assess the amount of contaminants that may reach the public (exposure assessment). The last step is to calculate the magnitude of the health risks as a result of exposure to harmful contaminants on the basis of the toxicology of the contaminants.

The California Air Resources Board (CARB), the Office of Environmental Health Hazard Assessment (OEHHA), and other countries have established standards and guidelines intended to protect the public from exposure to harmful compounds.

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[1] Horizon, Draft Environmental Impact Report, Estrella Substation and Paso Robles Area Reinforcement Project, Prepared for California Public Utilities Commission (CPUC), December 2020; https://www.cpuc.ca.gov/environment/info/horizonh2o/estrella/DEIR.html.

[2] SWCA, Proponent's Environmental Assessment Estrella Substation and Paso Robles Area Reinforcement Project, Prepared for NextEra Energy Transmission West, LLC and Pacific Gas and Electric Company (PEA), January 2017; https://www.cpuc.ca.gov/environment/info/horizonh2o/estrella/docs/PEA_January2017.pdf.

The current analysis focuses on three types of risks to the public:

1. Cancer risk from exposure to toxic air contaminant (TACs)
2. Short-term (acute) risk from exposure to TACs
3. Exposure to high concentrations of certain regulated air pollutants, such as oxides of nitrogen (NOx)

1.3 Significance Criteria

The following significance criteria are used in this report to assess the significance of public health risks. These criteria are based on the Office of Environmental Health Hazard Assessment (OEHHA),[3] California Ambient Air Quality Standards, and standards established by other countries. Collectively, these standards are designed to inform the public and the Lead Agencies of the extent of public health impacts associated.

Table 1-1
Thresholds of Significance for Public Health Risks

Risk Metric	Project Level	Reference
Cancer Risk	10 cancers per million	OEHHA, SLOAPCD[4]
Ambient Concentration of Regulated Air Pollutants (NOx, CO, PM-10, etc.)	Maximum Allowable Concentration	California Ambient Air Quality Standards. For NOx, the 1-hour standard is 339 ug/m^3
Acute Hazard Index (HI)	HI = 1	Ratio of Project Impacts to the Recommended Exposure Level. For DPM,[5] the REL is 10 ug/m^3

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[3] Office of Environmental Health Hazard Assessment (OEHHA), Risk Assessment Guidelines: Guidance Manual for Preparation of Health Risk Assessments, February 2015 (OEHHA 2015), Section 8.2.10: Cancer Risk Evaluation of Short Term Projects, pp. 8-17/18; https://oehha.ca.gov/air/crnr/notice-adoption-air-toxics-hot-spots-program-guidance-manual-preparation-health-risk-0.

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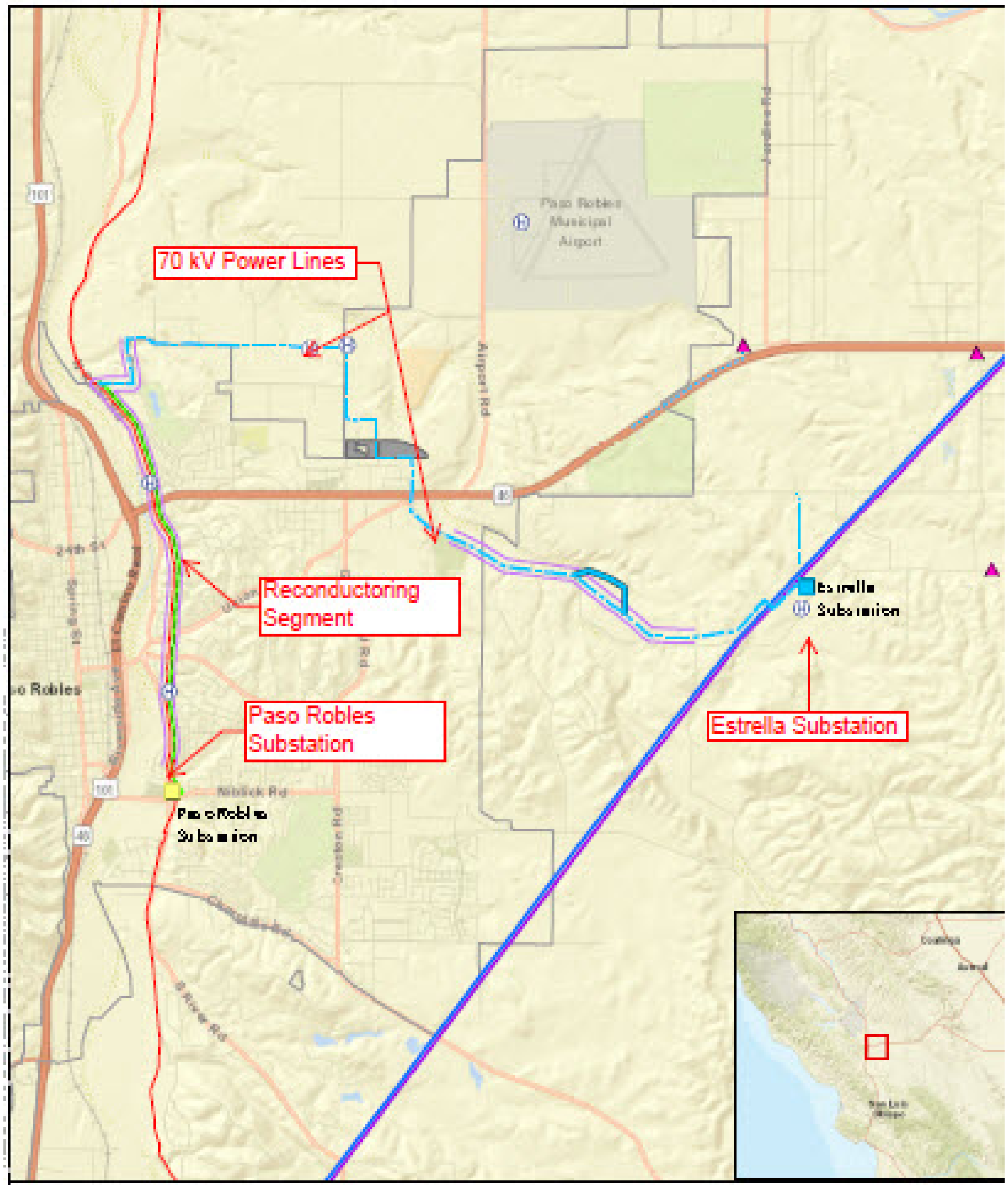
[4] SLOAPCD, "SLO County CEQA Air Quality Hadbook" Section 3.6.1 (Toxic Air Contaminants). Available at: https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/CEQA_Handbook_2012_v2%20%28Updated%20Map2019%29_LinkedwithMemo.pdf

[5] Government of Canada, Human Health Risk Assessment for Diesel Exhaust, March 4, 2016; http://publications.gc.ca/collections/collection_2016/sc-hc/H129-60-2016-eng.pdf.

1.4 Report Organization

This report is divided into four Sections and two Appendices. Immediately following this Introduction, Section 2 discusses the short-term (construction-related) emissions associated with the project. This is followed by Section 3 which describes the exposure assessment. This assessment details the data and tools used to determine the dispersion pattern of emissions from the project. This analysis takes into account the location of nearby homes and businesses and local wind patterns. Section 4 describes the risk calculations using results from Sections 2 and 3 to calculate health risks. The report concludes with Section 4 which discusses the results and the significance of the findings. Technical data and calculations are in the Appendices.

Figure 1-1
Project Map
Source: Horizon Water and Environment[6]



6 DEIR, Figure ES-1, pdf 27.

SECTION 2: EMISSIONS SUMMARY

EPS reviewed the Project's annual and daily construction emissions [CO, SOx, NOx, PM-10, ROG, PM-2.5 (DPM)] in Section 4.3 of the DEIR.[7]

EPS focused on the following air pollutants:

DPM (Diesel Particulate Matter): This is regulated as a toxic air contaminant or TAC. In addition to being a known carcinogen, it also has short-term acute (1-hour) health effects. Currently, OEHHA has not established a recommended acute exposure level for DPM. However, other countries, such as Canada have established a REL for acute DPM exposure. OEHHA Guidelines do not prohibit the use of health standards established by other countries.

NOx (Oxides of Nitrogen): California has established a short-term air quality standard for NOx. Currently, it is set at 339 micrograms per cubic meter (ug/m^3) over one hour.[8]

The main toxic air contaminant associated with construction is diesel exhaust consisting of fine particulate matter (DPM) from construction equipment. The same equipment also releases NOx. Two emission scenarios were evaluated:

Scenario 1: The construction emissions in DEIR Table 4.3-5, which assume that all construction equipment will use EPA Tier 4 final engines.[9]

Scenario 2: The DEIR only requires "expanding the use of Tier 3 off-road engines" as mitigation in APM AIR-2.[10] The PEA notes that the actual equipment that would be used would consist of Tier 2 to Tier 4 engines. Thus, the applicant can use cheaper, higher polluting lower tier engines, such as Tier 1, 2 or 3 engines. Emissions depend upon the tier and are much higher for lower tier equipment.[11] Thus, in Scenario 2, we assumed the use of 100% Tier 2 engines, which have 10 times higher DPM emissions compared to equipment equipped with Tier 4 Final engines.[12]

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[7] Abbreviations: CO: carbon monoxide, SOx: oxides of sulfur, NOx: oxides of nitrogen, ROG; reactive organic gases, PM-2.5: ultra fine particulate, PM-10: fine particulate matter, DPM: diesel particulate matter.

[8] Please add a reference.

[9] DEIR, Appendix C, pdf 3: "Construction Off-road Equipment Mitigation – Change to assume all equipment Tier 4 Final." See also Appendix C, pdf 420, 560, 561.

[10] DEIR, Appendix C, pdf 3: "Construction Off-road Equipment Mitigation – Change to assume all equipment Tier 4 Final." See also Appendix C, pdf 420, 560, 561.

[11] DieselNet, United States: Nonroad Diesel Engines, Tables 3-4; https://dieselnet.com/standards/us/nonroad.php.

[12] DEIR Appendix C indicates the Project will be constructed using a mix of equipment ranging in size from 78 hp to 402 hp. The emission factors by tier are reported at: https://dieselnet.com/standards/us/nonroad.php#tier4.

Emissions of NOx are 5 to 8 times higher for Tier 2 to Tier 4 engines depending on engine size. A factor of 5 was used in the current analysis.

In addition to emissions from on-site construction equipment, there would be emissions from mobile sources including helicopters. These emissions are distributed over a wide area and occur outside of the modeling region. As a result, these emissions have not been included.

The emissions that were modeled in the health risk assessment and NOx ambient air quality analyses are summarized below in Table 2-1.

Table 2-1 Summary of Emissions		
Pollutant	Scenario 1	Scenario 2
DPM	0.37 tons per year (740 lbs/yr)	3.7 tons per (7,400 lbs/year)
NOx	141.38 pounds per day or 17.67 lbs/hr over an 8 hour day)	707 pounds per day or 88.4 lbs/hr over an 8 hour day)

To determine emissions associated with a given phase of the project, such as construction of the Estrella Substation, reconductoring, etc., EPS reviewed the list of construction equipment that would be used. This list appears in Appendix C of the DEIR and is provided in Appendix 1 to this report. In addition to identifying the equipment, the equipment list also included fuel consumption data for each piece of equipment. Based on the review of the equipment, EPS assigned the equipment into three main construction components of the project:

1. Construction of the Estrella Substation
2. Construction along the Reconductoring Segment
3. Construction along the 70 kV Route

These are shown in Figure 1-1. By reviewing the fuel consumption and assuming that emissions are directly related to fuel consumption, it is possible to assign the percent of the total construction emissions to each of the three components of the project as summarized in Table 2-2.

Table 1 at this link reports DPM emission factors for Tier 2 equipment of 50 to 100 hp is 0.3 g/bhp-hr and for 300-600 hp engines, 0.14 g/bhp-hr. Table 3 shows that the DPM emission factor for Tier 4 equipment of 75-750 hp equipment is 0.015 g/bhp/hr. Thus, I assumed DPM emissions would increase by a factor of 0.15/0.015 = 10 in scenario 2.

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Table 2-2 Summary of Emissions						
Construction Element	Fuel Consumption	Percent of Fuel Consumption and Emissions	DPM Emissions *(lbs/yr)*		NOx Emissions *(lbs/hr)*	
	(gallons)	*(%)*	*Scenario 1*	*Scenario 2*	*Scenario 1*	*Scenario 2*
Construction of Estrella Substation	34,194	18.7%	138.1	1,381.0	3.30	16.49
Construction of the Reconductoring Segment	72,342	39.5%	292.2	2,921.7	6.98	34.89
Construction Along the 70 kV Route	76,698	41.9%	309.7	3,097.3	7.40	36.98
	183,225	100%	740	7,400	17.67	88.36

Note: Appendix C reported total annual diesel consumption to equal 183,523 gallons per year. Our review indicates the total to be 183,225 gallons per year.

SECTION 3: EXPOSURE ASSESSMENT

Exposure assessment involves translating the emission rate (e.g., lbs/hr) of individual toxic air contaminants into the concentration (e.g., grams/cubic meter or parts per million) of each toxic air contaminant. The key step in performing an exposure assessment is the application of an air dispersion model. The dispersion model incorporates the local meteorological data (wind speed, wind direction, local temperature, inversion heights, etc.), emission source geometry, release height into the concentration of individual air contaminant around the emission source. The CARB and OEHHA recommended AERMOD dispersion model (Version 19191) was employed in the current exposure assessment. The plot files created using Lakes Environmental (AERMODVIEW) Version 9.8.3 were exported into the risk model.

This section discusses the model set-up, the extent of the modeling area, and the choice and duration of meteorological data.

3.1 Model Set-Up

The following regulatory default options were used. They are based on the latest EPA guidance on running AERMOD.

- Use of Calm Wind Processing
- Use of Missing Data Processing

Emissions associated with the reconductoring route and along the 70 kV line were modeled as two separate line sources. Emissions associated with construction of the Estrella Substation were modeled as a single area source.

3.2 Modeling Grid and Coordinate System

A rectangular (x-y) Cartesian coordinate system was used. A region 7,500 x 5,250 meters (4.5 miles x 3.3 miles) was used. The modeling region was divided into 100 meter x 250 meter cells for a total of 1,575 individual receptors in the vicinity of the project area. See Figure 3-1 for a layout of the modeling grid.

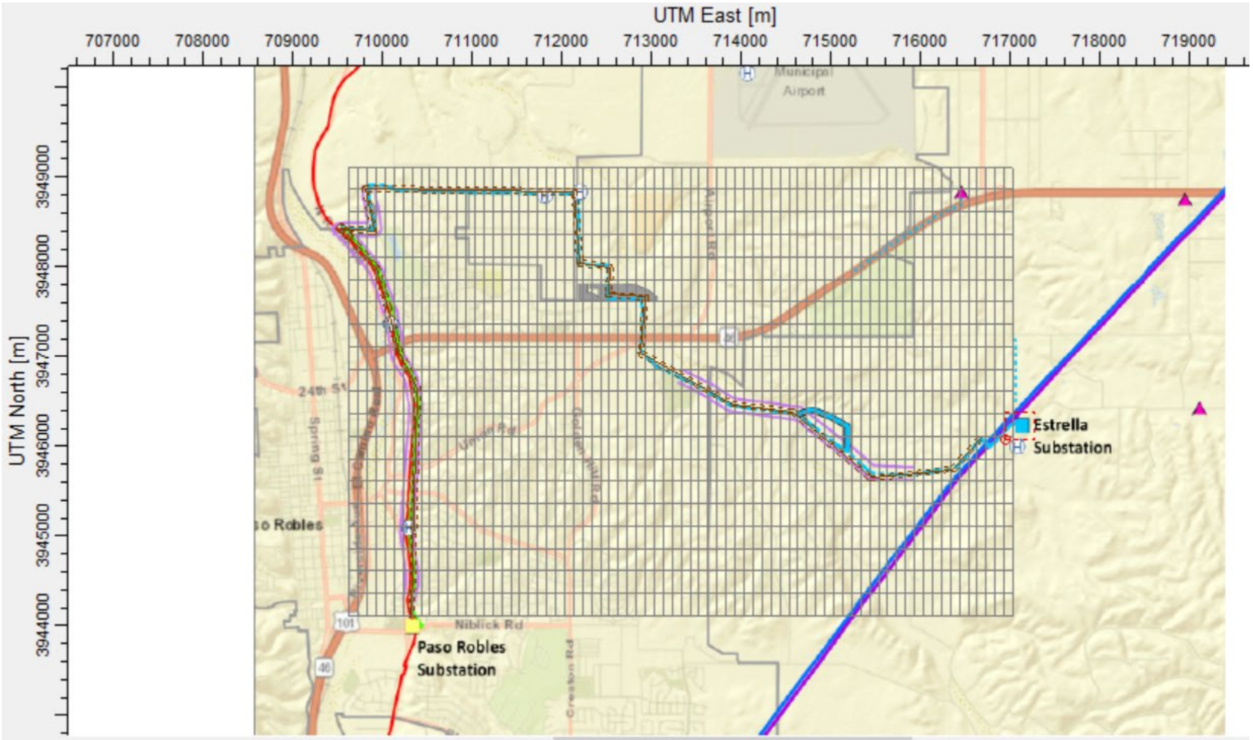
3.3 Meteorological Data

Five years (2009 to 2013) of meteorological data was used in the exposure assessment. The surface data (wind speed, wind direction, temperature, etc.) were recorded at Paso Robles Airport located 1.5 miles Northeast of the Project site. These data were obtained from CARB.

In addition to surface meteorological data, hourly inversion height data are also required. Four years of data from the nearest upper air station (Vandenberg AFB, CA) were used to develop hourly inversion heights.

Figure 3-1

Lay-Out of Modeling Grid and Emission Sources



SECTION 4: HEALTH RISK ANALYSIS

Health risks from exposure to DPM and NOx are discussed in this section. The emission rates of DPM and NOx discussed in Section 2 were used as a basis to quantify health risks. EPS used the HARP2 risk model developed by CARB and the Office of Environmental Health Hazard Assessment (OEHHA)[13] to calculate the health risks. As noted in Section 1, three types of health risks were calculated (cancer, acute non-cancer from exposure to TACs and acute non-cancer from exposure to NOx).

4.1 Cancer Risks (2 Year Exposure to DPM)

The results of the cancer risk analysis are presented in Figures 4-1 and 4-2 for Scenarios 1 and 2. For Scenario 1, the cancer risk ranges from 0.1 to 25 in a million. For Scenario 2, the cancer risk exceeds 50 in a million for hundreds of homes, especially east of the reconductoring segment. These homes are shown in Figure 4-3.

4.2 Acute Non-Cancer Risks (1-Hour Exposure to DPM)

The spatial distribution of 1-hour construction DPM is presented in Figures 4-4 and 4-5 for Scenarios 1 and 2 respectively. The results show that the 1-hour DPM concentration is below 10 ug/m^3 for Scenario 1. However, the 1-hour DPM concentration exceeds 10 ug/m^3 over a wide area around the Estrella Substation, 70 kV power line, and the reconductoring segment. Thus, acute health impacts are significant over a large area around the Estrella Substation and reconductoring segment if Tier 2 and 3 construction equipment is used, as allowed by the DEIR.

4.1 Acute Non-Cancer Risk (1-Hour Exposure to Oxides of Nitrogen (NOx))

In order to determine if the construction NOx emissions would exceed the state's 1-hour air quality standard of 339 ug/m^3, the AERMOD model was used to calculate the maximum 1-hour concentration in the vicinity of the project. The results indicate that the State's 1-hour NOx standard would not be exceeded under Scenario 1, which uses NOx emissions based on the use of all Tier 4 final construction equipment. However, it would be exceeded for Scenario 2, which assumes the use of Tier 3 construction equipment, as allowed in the DEIR.

Figures 4-6 and 4-7 show the spatial variation of NOx concentration for both scenarios. Figure 4-6 (for Scenario 1) shows that numerous homes near the reconducting corridor would be impacted with high concentrations of NOx. Figure 4-7 (for Scenario 2) shows that numerous

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[13] OEHHA Hotspots Analysis and Reporting Program (HARP) available at: https://ww3.arb.ca.gov/toxics/harp/harp.htm

homes near the reconducting corridor as well as the transmission line and substation would be impacted with high concentrations of NOx.

Figure 4-1
Spatial Variation of Cancer Risk per Million
Scenario 1

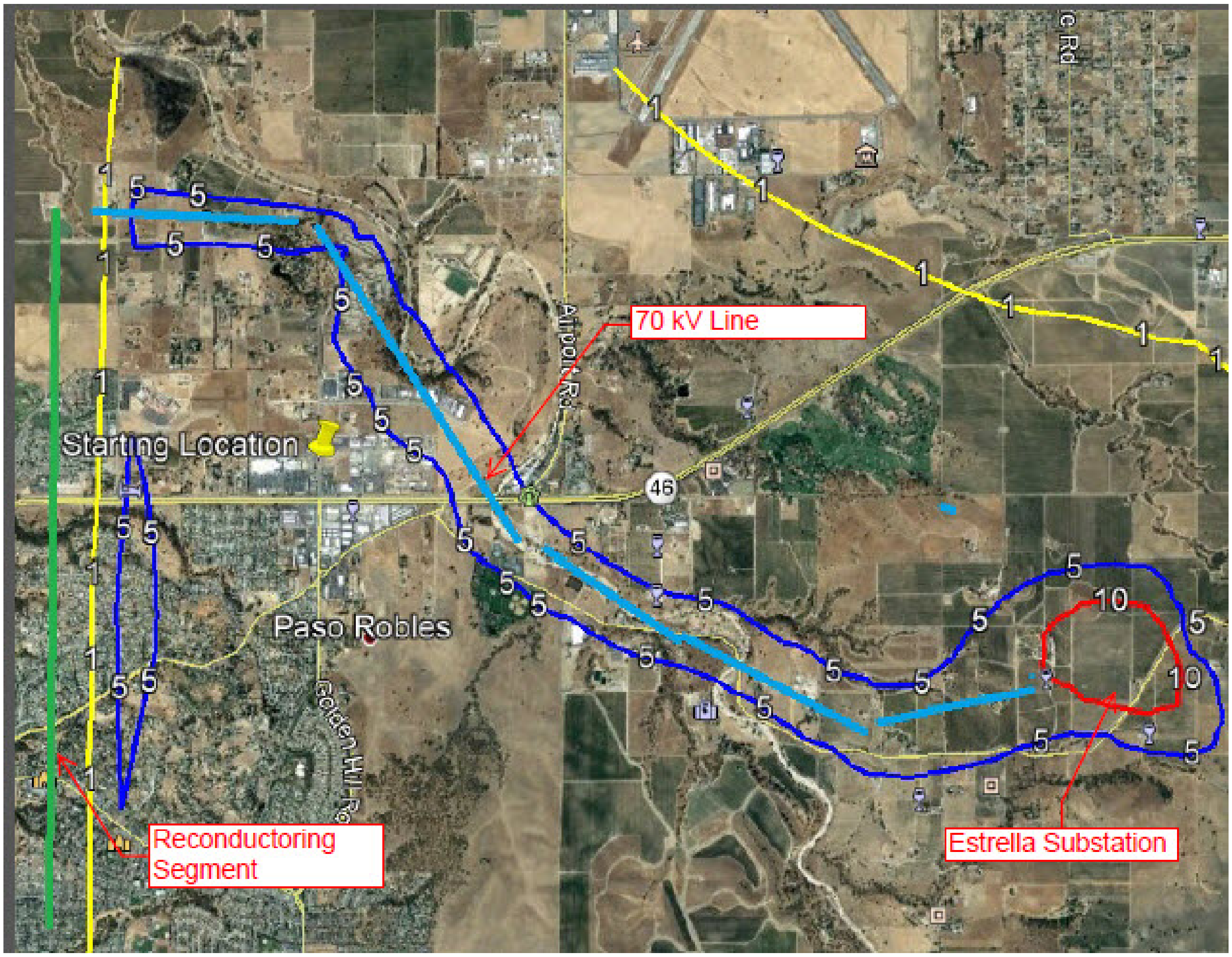


Figure 4-2
Spatial Variation of Cancer Risk per Million
Scenario 2

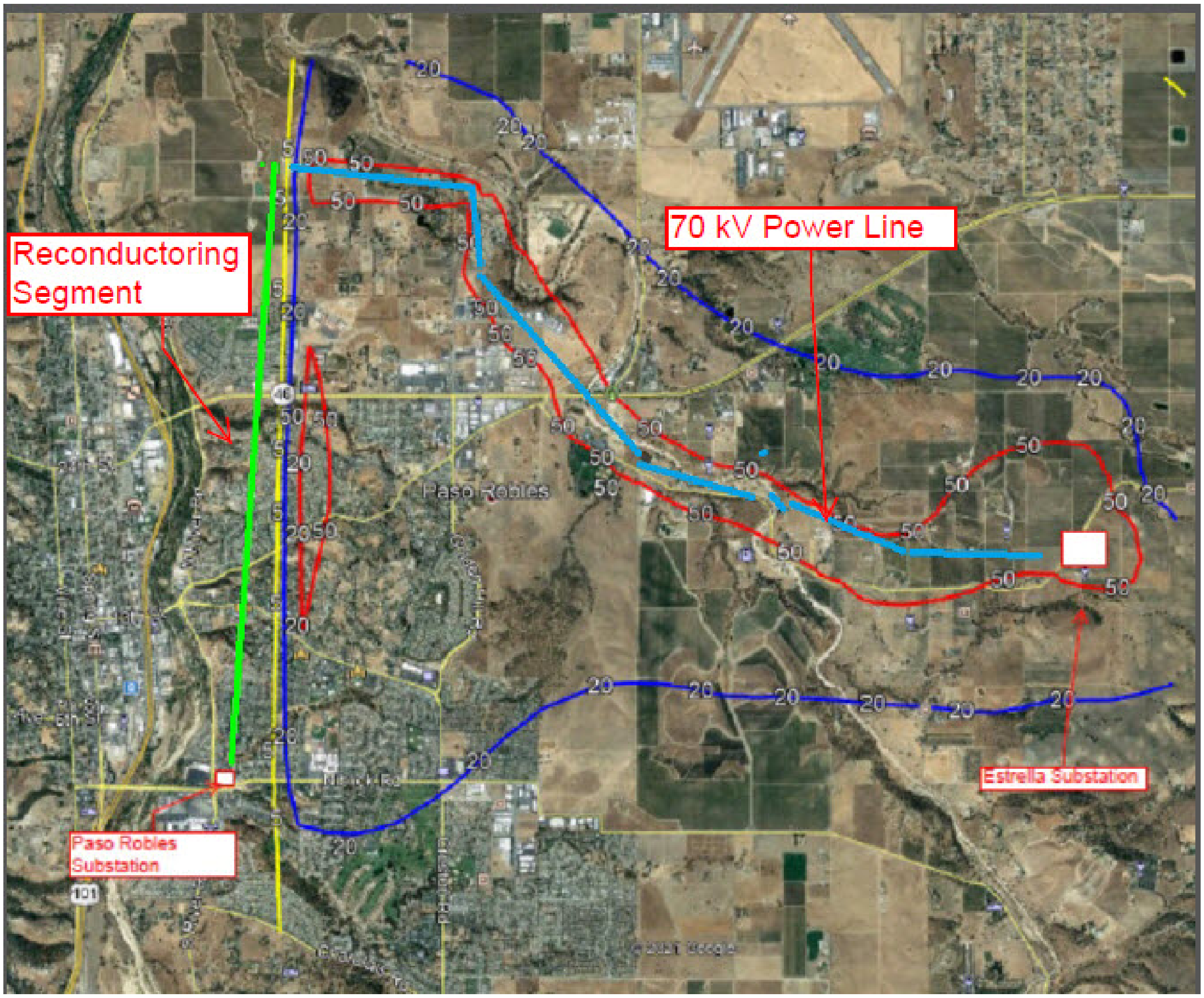


Figure 4-3

Spatial Variation of Cancer Risk Cancer Risk per Million
For Scenario 2 Showing Homes East of the Reconductoring Segment

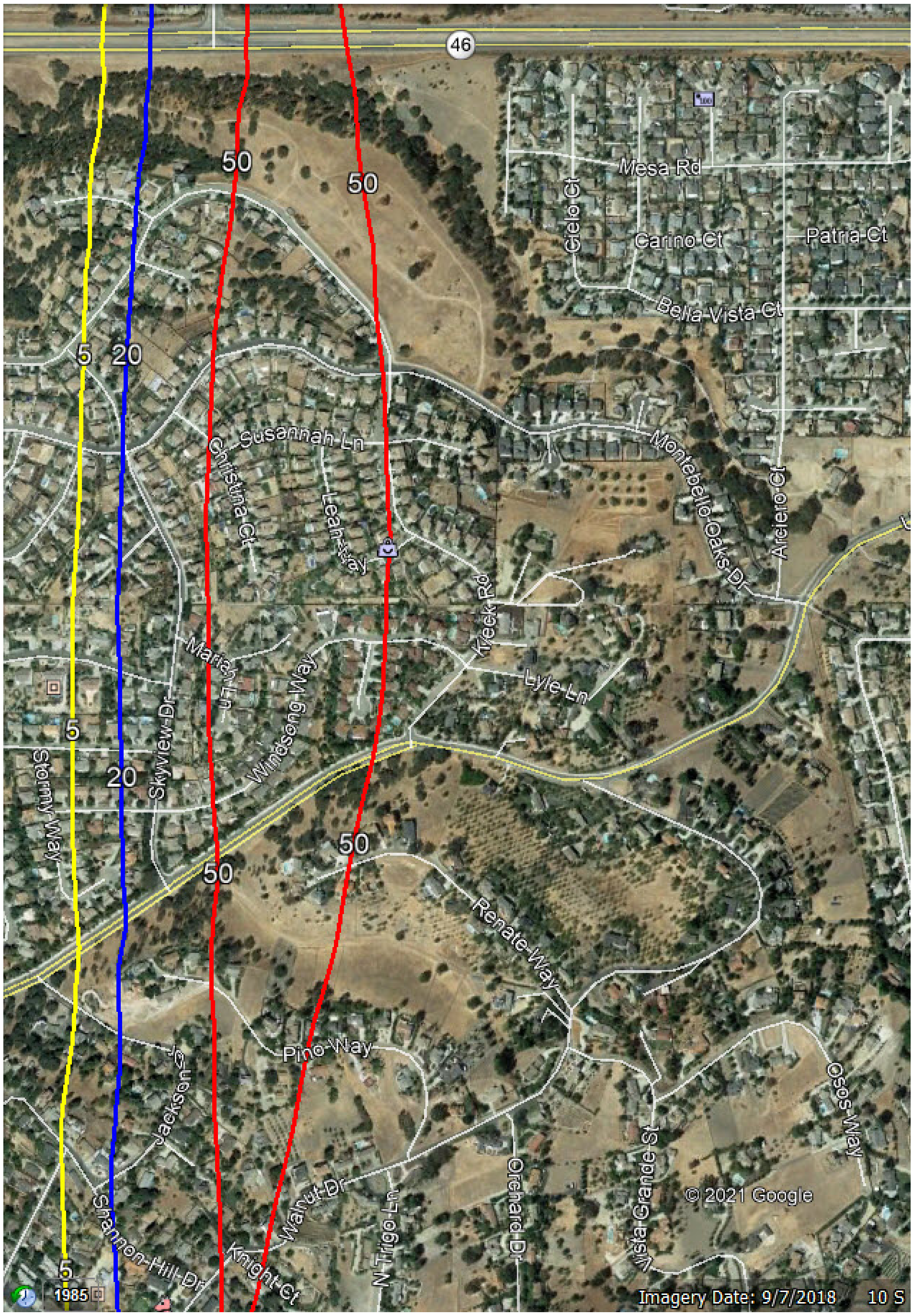


Figure 4-4
Results of Acute DPM Modeling in Micrograms per Cubic Meter
Scenario 1

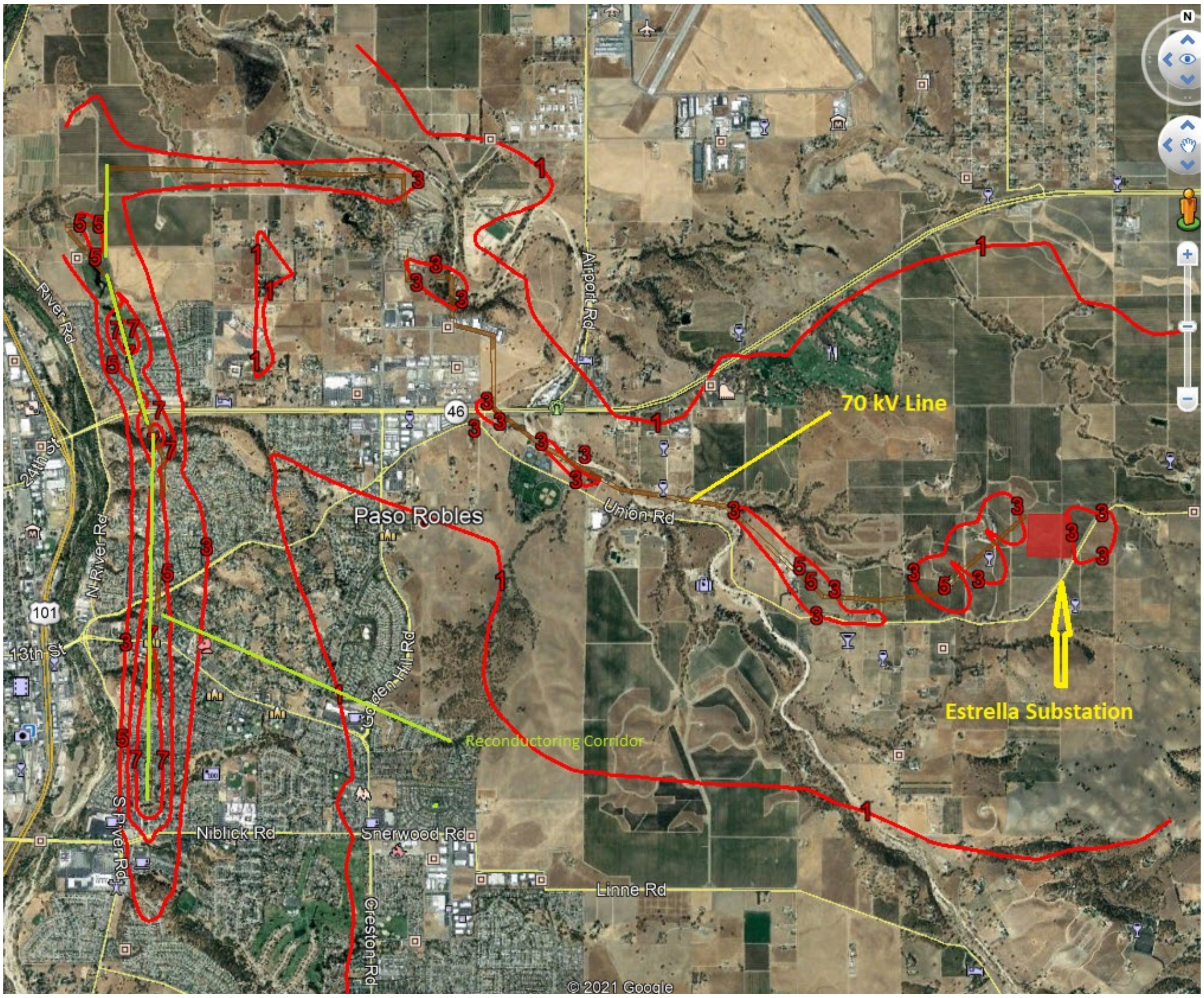


Figure 4-5
Results of Acute DPM Modeling in Micrograms per Hour
Scenario 2

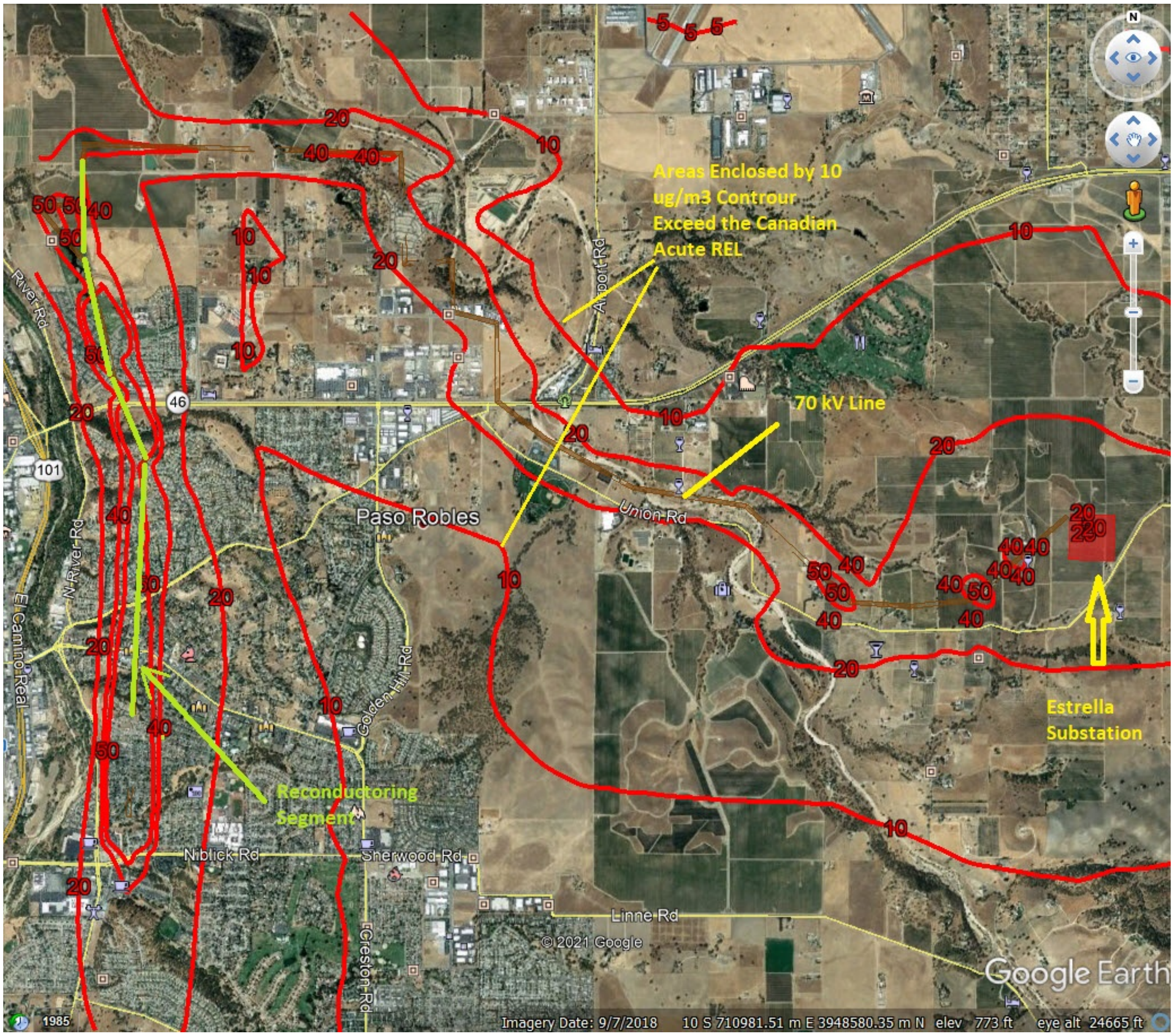


Figure 4-6
Spatial Variation of 1-Hour NOx Concentration
Scenario 1

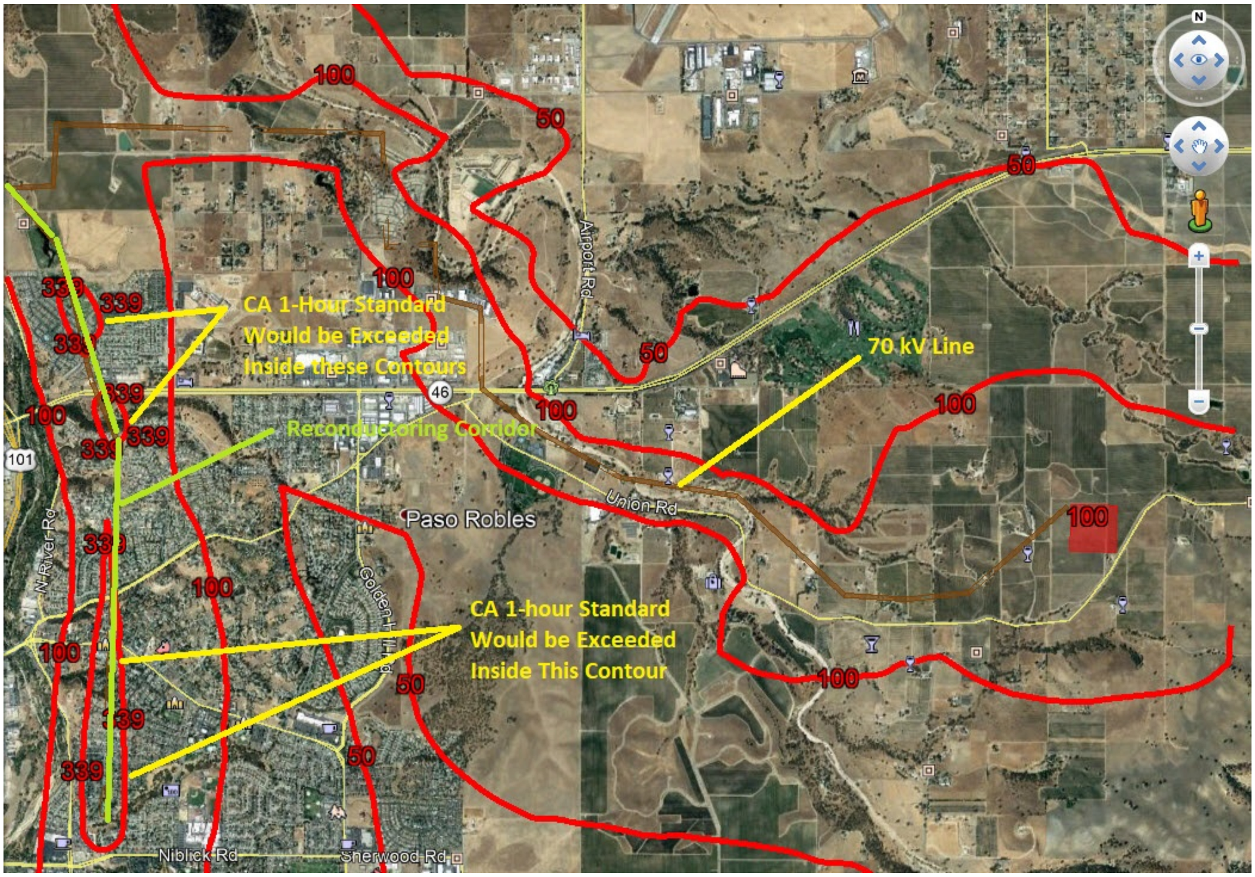
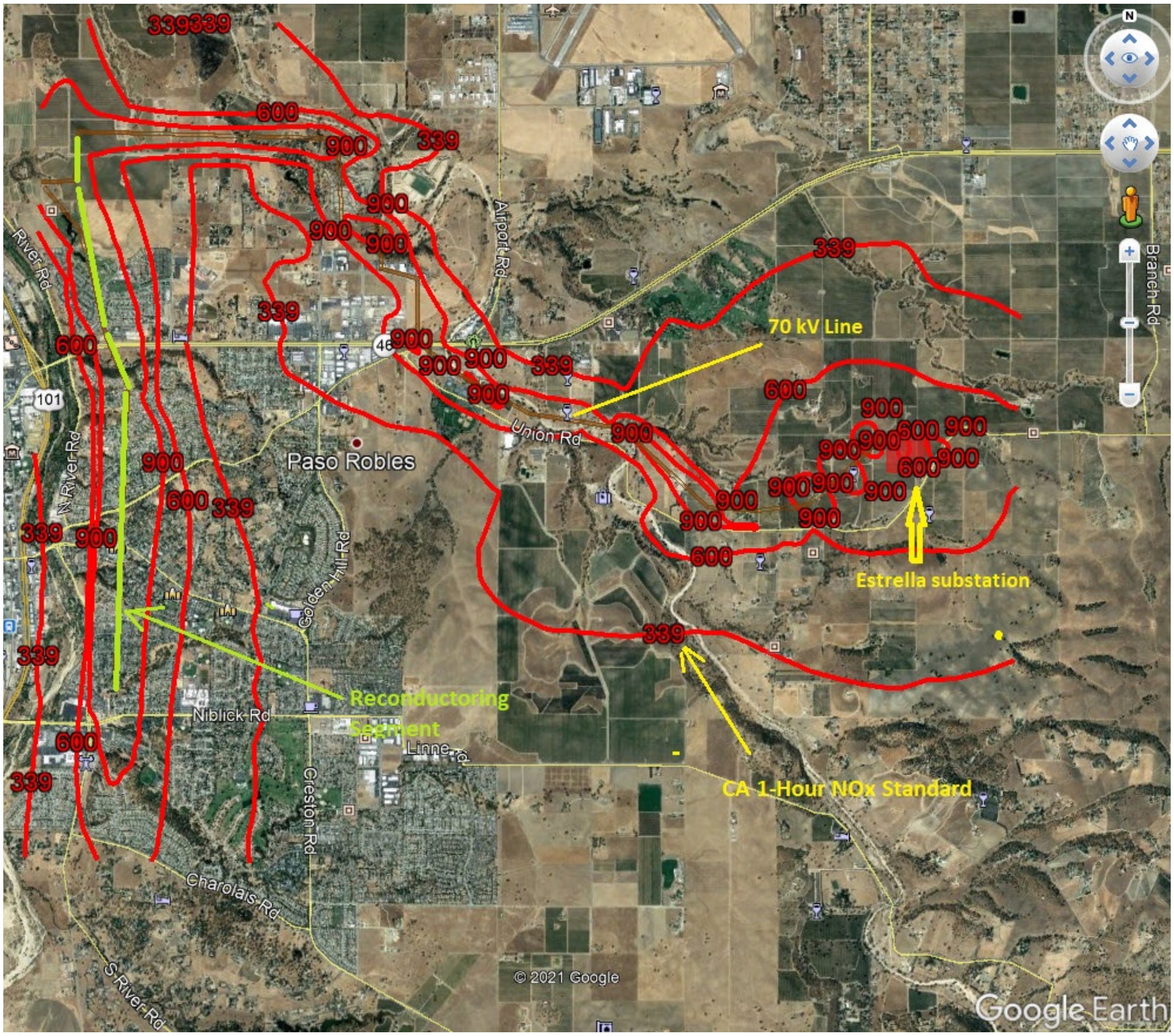


Figure 4-7
Spatial Variation of 1-Hour NOx Concentration
Scenario 2



SECTION 5: RESULTS AND CONCLUSIONS

The results of the DPM and NOx analyses are summarized in Table 5-1.

Table 5-1
Summary of Maximum Project Level Health Risks

Risk Metric	Scenario 1	Scenario 2	Significance Threshold	Significant?
Maximum Residential Cancer Risk	0.5 to 40 cancers per million	5 to 75 cancers/million	10 (per million)	Scenario 1 – Yes Scenario 2 - Yes
Maximum Acute Hazard Index from 1-Hour Exposure to DPM	0.1 to less than 0.5	1 to < 4	1.0	Scenario 1 – No Scenario 2 - Yes
Maximum Acute Impact from Exposure to 1-Hour NOx	100 to 500 ug/m^3	00 to 760 ug/m^3	339 ug/m^3	Scenario 1 – Yes Scenario 2 - Yes

The results of the current analysis demonstrate that with the exception of acute (short-term) impacts from exposure to DPM under Scenario 1, the project would have significant impacts to public health. The impact is most significant to residents adjacent to the reconductoring corridor. The highest risks are associated with Scenario 2, which assumes the use of Tier 2 construction equipment, where short-term (acute) and long-term (cancer) exposure to DPM would result in significant health impacts. This is true even if one accounts for the short duration (maximum 24 months) of the construction period.

SECTION 6: REFERENCES

Government of Canada, Human Health Risk Assessment for Diesel Exhaust, March 4, 2016; http://publications.gc.ca/collections/collection_2016/sc-hc/H129-60-2016-eng.pdf..

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CARB (2003) HARP User's Guide. Available at: http://www.arb.ca.gov/toxics/harp/harp.htm December 2003.

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OEHHA (2014) Consolidated Table of Approved health Risk Values. Cal EPA, Office of Environmental Health Hazard Assessment. Available at: file:///C:/2014%20Feather%20River%20AQMD/Hollycross%20Cemetary/OEHHA%20contable.pdf. July 3, 2014.

SLOAPCD (2012) "CEQA Air Quality Handbook". April 2012. Available at: https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/CEQA_Handbook_2012_v2%20%28Updated%20Map2019%29_LinkedwithMemo.pdf