APPENDIX A
ATTACHMENTS TO ADAMS BROADWELL JOSEPH & CARDOZA LETTER

Attachment A

SWAPE Technical Consultation, Data Analysis and Litigation Support for the Environment

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October 21, 2013

Thomas A. Enslow
Adams Broadwell Joseph & Cardozo
520 Capitol Mall, Suite 350
Sacramento, CA 95814

Subject: Comments on the East Weddell Residential Projects

Dear Mr. Enslow:

I have reviewed the Draft Environmental Impact Report (DEIR) for the East Weddell Residential Projects ("Project") in Sunnyvale, California. The Project includes two residential development projects proposed by separate developers. One development is proposed on the "Sares Regis site," which is approximately 4 acres in size, and is located at 610 and 630 East Weddell Drive. The second development would occur on the "Raintree site," which consists of two parcels totaling approximately 12 acres.

One four-story residential building is proposed for the Sares Regis site. The project would include 205 residential apartments, a four-story parking garage, and a landscaped common area. Eight apartment buildings, with a total of 465 units, are proposed for the Raintree site. The eight buildings would range in height from three to four stories,

I have found the DEIR fails to adequately disclose and evaluate issues related to Hazards and Hazardous Waste. Residual pesticide contamination was not adequately assessed and may pose risks to construction workers, nearby residents and future residents. Additionally, the Project may be subject to contamination though the migration of contaminated soil vapor, a condition not adequately evaluated in the DEIR. A revised DEIR should be prepared to adequately address these issues, including collecting additional samples, and to provide mitigation if warranted.

Sares Regis Site

The DEIR fails to disclose that residual pesticides from past agricultural use may be present in soils at concentrations that would pose a hazard to future site occupants. A revised DEIR should be prepared to include a full evaluation of health risks posed by pesticides on construction workers, future residents and existing residents in the adjacent neighborhoods.

According to the DEIR, the Sares Regis site was used for orchards from the earliest available historical records until the 1960s. The DEIR goes on to say that, although records of specific pesticide use aren't available:

> Prior to World War II, inorganic pesticides – often containing lead, arsenic, and other metals – were frequently used in agriculture. Following World War II, highly persistent organic pesticides, such as DDT, were commonly used until regulations began to restrict their use in the 1970s. Residues of inorganic and organic agricultural chemical can persist in soils for decades, potentially presenting a health risk to those who may come into contact with soils affected by those chemicals (p. 4.5-1).

The DEIR, however, fails to disclose that the dieldrin – which, like DDT, is an organochlorine pesticide -- was detected on the Sares Regis site at 30.4 ug/kg, an order of magnitude greater than the San Francisco Bay Regional Water Quality Control Board Environmental Screening Level (ESL) for residential land use of 2.3 ug/kg.[1] A 2012 Phase I Environmental Site Assessment (ESA) for 610 and 630 E Weddell Avenue[2] reported the detected dieldrin detection of 30.4 ug/kg but mistakenly concluded that the sample result was "below the Regional Board residential ESL of 34 ug/kg." The ESA's statement that the Regional Board residential ESL of 34 ug/kg was in error. As a result, the DEIR incorrectly reported that "No organic compounds were detected in soils above ESLs for residential use" (p. 4.5-2). The DEIR also fails to identify that, according to the 2012 Phase I ESA, "pesticides might have been stored, mixed and/or disposed" in association with building identified in historical air photos.[3]

Because the dieldrin detections were mistakenly dismissed as being below the residential land use ESL, the DEIR fails to disclose the actual baseline soil conditions of the Project parcel and fails to evaluate potential threats to human health posed by the pesticides in the soil. Health risks would potentially result from construction worker exposure to the residual pesticides during grading and excavation activities. The construction workers would potentially be exposed to the pesticides by touching contaminated soil and by breathing dust that has pesticides bound to the soil particles. Additionally, adjacent residents would be potentially exposed to pesticide-containing dust during earthmoving activities and if soil is exported, by trucks, from the Project site.

The U.S. EPA has determined that dieldrin is a probable human carcinogen.[4] Pesticide residuals in soils that may pose a health risk are a well-known issue for developers and local agencies in Santa Clara County. The San Jose Mercury News identified Santa Clara County to have a "hidden pesticide risk" from former agricultural operations, including old orchards.[5] Sampling conducted for a 2007 news story in the Mercury News identified undetected "hot spots" and samples taken from soils in a Los Altos park at a former walnut orchard had levels of DDT compounds above the state definition of hazardous waste. The Mercury News article concluded that Santa Clara County has more toxic cleanup sites involving old

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[1] http://www.swrcb.ca.gov/rwqcb2/water_issues/programs/ESL/Lookup_Tables_Summary_May_2013.pdf, Summary Table c

[2] WEST Environmental Services and Technology, 2012, Phase I Environmental Site Assessment, 610 and 630 East Weddell Avenue, Sunnyvale, California, p. 6.

[3] Ibid., Table 7-1

[4] http://www.atsdr.cdc.gov/phs/phs.asp?id=315&tid=56

[5] http://www.mercurynews.com/science/ci_7217803

orchard pesticides than any county in California, as well as a significant number of other sites contaminated by other types of farming or pesticide handling. Mitigation in Santa Clara County has included efforts made for the 152-acre Rivermark retail and housing development in Santa Clara, where cleanup of unsafe levels of toxins including arsenic, lead and DDT involved removing more than 450,000 tons of soil. The City of San Jose aggressively pursues residual pesticide threats, and reviews building permit applications for the assessment for agricultural chemicals.

The DEIR does provide, as mitigation, that occupancy permits for the Sares Regis site are to be issued contingent upon the site receiving closure with DTSC under the Voluntary Cleanup Program. However, the cleanup of the Sares Regis under this program is directed at volatile organic compounds in soil gas and does not consider pesticide contamination. The DEIR states "currently, remedial action is expected to be limited to excavation and off-site disposal of a small volume of soil" (p. 2-14). The DEIR goes on to describe this area as a volume of 10 cubic yards of soil that will be removed for offsite disposal (p.5-2).

The DEIR does not describe any plans for further testing of residual pesticides in soil and makes no mention of the need to address the pesticide exceedence of the residential ESL for dieldrin in soil. Failure to consider further sampling, especially in the area identified as a pesticide mixing and loading area, is inconsistent with provisions for pesticide sampling as made under other CEQA actions in Santa Clara County.

In Santa Clara County, assessments to evaluate this potential are routinely conducted as part of the CEQA process. For example, an August 2013 Initial Study (IS) for a project in Santa Clara concluded that excavation and trenching required for project construction

> … could result in impacts to construction workers from exposure to soil contamination related to agricultural operations.[6]

Mitigation for that project required shallow soil samples to be taken throughout the project site

> to determine if contaminated soil from previous agricultural land uses is located on-site with concentrations above established construction/trench worker thresholds. The soil sampling plan must be reviewed and approved by the Santa Clara Fire Chief prior to initiation of work.[7]

Consistent with provisions made under CEQA for other Santa Clara Valley projects, sampling for pesticides should be conducted site-wide. The sampling should adhere to guidance promulgated by the California Department of Toxic Substances Control (DTSC), entitled "Interim Guidance for Sampling Agricultural Properties."[8] Consistent with this guidance, sampling for pesticides at the 4 acre-site would require drilling eight borings for the collection of four composite soil samples.[9]

The results of the sampling should be assessed for health risks by appropriate regulatory agencies, including the City of Sunnyvale and DTSC. The results of the sampling, along with the regulatory determination, should be included in a revised DEIR. Any mitigation that would be necessary to protect

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[6] Ibid. p. 58
[7] Ibid. p. 58
[8] http://www.dtsc.ca.gov/Schools/upload/Ag-Guidance-Rev-3-August-7-2008-2.pdf
[9] Ibid., Table 1

construction worker health and health of the public should be identified in the DEIR. Additional mitigation, for handling any soil that would contain concentrations of pesticides at hazardous waste levels, should also be identified in the revised DEIR.

Another issue that requires further evaluation at the Sares Regis site involves volatile organic compounds (VOCs) in soil and soil gas. The groundwater and the soil gas that underlies the site was tested in 1995, 2012, and 2013 and VOCs were not found at concentrations above the ESLs with the exception of one sample in the 2013 sampling (DEIR, p. 4.5-2). On the basis of the 2013 sampling, the environmental consultant recommended the removal of 10 cubic yards of soil along with post-excavation sampling to determine if the contamination was removed.

The Sares Regis site has been enrolled in the California Department of Toxics Substances Control (DTSC) Voluntary Cleanup Program (DEIR, p. 4.5-2 ; however, no documentation was provided in the DEIR that would show that DTSC approves the plan to remove the 10 cubic yards of soil as a cleanup measure. A revised DEIR should be prepared to include a DTSC letter approving of the cleanup plans as protective of the proposed residential land use.

Raintree

Pesticides at the Raintree site also exceed the residential ESL, a condition that the DEIR does not disclose. In fact the DEIR mistakenly states:

> Soils contained petroleum hydrocarbons and pesticides at low concentrations, below ESLs for residential land uses (p. 4.5-3).

A November 2012 Treadwell & Rollo report provides the following conflicting information:

> The organochlorine pesticide DDE was detected at concentrations ranging from 0.087 mg/kg to 1.8 mg/kg in 3 of the 6 shallow soil samples analyzed. The residential and commercial/industrial shallow soil ESLs for DDE are 1.7 mg/kg and 4 mg/kg, respectively.[10]

The passage above shows that an incorrect conclusion was made by Treadwell and Rollo and, in turn, in the DEIR; in fact, the DDE detection of 1.8 mg/kg exceeds the residential ESL of 1.7 mg/kg. The U.S. EPA has determined that DDE is a probable human carcinogen.[11]

Like at the Sares Regis site, the exceedence of the residential ESL warrants further investigation. Consistent with DTSC guidance, sampling for pesticides at the12 acre-site would require drilling 22 borings for the collection of six composite soil samples.[12]

The results of the sampling should be assessed for health risks by regulatory agencies and should be included in a revised DEIR along with mitigation necessary to protect human health.

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[10] Treadwell & Rollo, November 2012, Limited Environmental Site Investigation Report for Fair Oaks Business Park, 520 to 592 East Weddell Drive, Sunnyvale, California, p. 6

[11] http://www.atsdr.cdc.gov/toxprofiles/tp35-c1.pdf, p. 7

[12] http://www.dtsc.ca.gov/Schools/upload/Ag-Guidance-Rev-3-August-7-2008-2.pdf, Table 1

Additionally, for the Raintree site, sampling data indicate total petroleum contamination (TPH) of groundwater and soil gas sampling has shown benzene at levels that approach California regulatory agency screening levels. Benzene is a known human carcinogen.[13]

The benzene detections in soil gas have been reported at concentrations of up to 30 ug/m3,[14] a level that is just below the residential California Human Health Screening Level[15] of 36.2 ug/m3 and the residential ESL of 42 ug/m3.[16]

The DEIR makes no provisions for further sampling of the benzene in the soil vapor and includes no information that the DTSC would allow for development of the site for a residential project given the findings of benzene that approach regulatory screening levels. A revised DEIR should be prepared to document notification of DTSC of the findings and to document that DTSC would agree that no further action is necessary at the site to protect human health prior to completion of the Project.

Sincerely,

Matt Hagemann, P.G., C.Hg.

[13] http://www.atsdr.cdc.gov/toxfaqs/TF.asp?id=38&tid=14
[14] Treadwell & Rollo, Limited Environmental Site Investigation Report for Fair Oaks Business Park, 520 to 592 East Weddell Drive, Sunnyvale, California, Table 5.
[15] http://www.calepa.ca.gov/brownfields/documents/2005/chhslsguide.pdf, Table 2
[16] http://www.calepa.ca.gov/brownfields/documents/2005/chhslsguide.pdf, Summary Table E

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Geologic and Hydrogeologic Characterization
Industrial Stormwater Compliance
CEQA Review
Investigation and Remediation Strategies
Litigation Support and Testifying Expert

Education:

M.S. Degree, Geology, California State University Los Angeles, Los Angeles, CA, 1984.
B.A. Degree, Geology, Humboldt State University, Arcata, CA, 1982.

Professional Certification:

California Professional Geologist
California Certified Hydrogeologist
Qualified SWPPP Developer and Practitioner

Professional Experience:

Matt has 25 years of experience in environmental policy, assessment and remediation. He spent nine years with the U.S. EPA in the RCRA and Superfund programs and served as EPA's Senior Science Policy Advisor in the Western Regional Office where he identified emerging threats to groundwater from perchlorate and MTBE. While with EPA, Matt also served as a Senior Hydrogeologist in the oversight of the assessment of seven major military facilities undergoing base closure. He led numerous enforcement actions under provisions of the Resource Conservation and Recovery Act (RCRA) while also working with permit holders to improve hydrogeologic characterization and water quality monitoring.

Matt has worked closely with U.S. EPA legal counsel and the technical staff of several states in the application and enforcement of RCRA, Safe Drinking Water Act and Clean Water Act regulations. Matt has trained the technical staff in the States of California, Hawaii, Nevada, Arizona and the Territory of Guam in the conduct of investigations, groundwater fundamentals, and sampling techniques.

Positions Matt has held include:

- Founding Partner, Soil/Water/Air Protection Enterprise (SWAPE) (2003 – present);
- Geology Instructor, Golden West College, 2010 – present;
- Senior Environmental Analyst, Komex H2O Science, Inc (2000 -- 2003);

- Executive Director, Orange Coast Watch (2001 – 2004);
- Senior Science Policy Advisor and Hydrogeologist, U.S. Environmental Protection Agency (1989–1998);
- Hydrogeologist, National Park Service, Water Resources Division (1998 – 2000);
- Adjunct Faculty Member, San Francisco State University, Department of Geosciences (1993 – 1998);
- Instructor, College of Marin, Department of Science (1990 – 1995);
- Geologist, U.S. Forest Service (1986 – 1998); and
- Geologist, Dames & Moore (1984 – 1986).

Partner, SWAPE:

With SWAPE, Matt's responsibilities have included:

- Lead analyst and testifying expert in the review of numerous environmental impact reports under CEQA that identify significant issues with regard to hazardous waste, water resources, water quality, air quality, greenhouse gas emissions and geologic hazards.
- Stormwater analysis, sampling and best management practice evaluation at industrial facilities.
- Lead analyst and testifying expert in the review of environmental issues in license applications for large solar power plants before the California Energy Commission.
- Technical assistance and litigation support for vapor intrusion concerns.
- Manager of a project to evaluate numerous formerly used military sites in the western U.S.
- Manager of a comprehensive evaluation of potential sources of perchlorate contamination in Southern California drinking water wells.
- Manager and designated expert for litigation support under provisions of Proposition 65 in the review of releases of gasoline to sources drinking water at major refineries and hundreds of gas stations throughout California.
- Expert witness on two cases involving MTBE litigation.
- Expert witness and litigation support on the impact of air toxins and hazards at a school.
- Expert witness in litigation at a former plywood plant.

With Komex H2O Science Inc., Matt's duties included the following:

- Senior author of a report on the extent of perchlorate contamination that was used in testimony by the former U.S. EPA Administrator and General Counsel.
- Senior researcher in the development of a comprehensive, electronically interactive chronology of MTBE use, research, and regulation.
- Senior researcher in the development of a comprehensive, electronically interactive chronology of perchlorate use, research, and regulation.
- Senior researcher in a study that estimates nationwide costs for MTBE remediation and drinking water treatment, results of which were published in newspapers nationwide and in testimony against provisions of an energy bill that would limit liability for oil companies.
- Research to support litigation to restore drinking water supplies that have been contaminated by MTBE in California and New York.
- Expert witness testimony in a case of oil production-related contamination in Mississippi.
- Lead author for a multi-volume remedial investigation report for an operating school in Los Angeles that met strict regulatory requirements and rigorous deadlines.
- Development of strategic approaches for cleanup of contaminated sites in consultation with clients and regulators.

Executive Director:

As Executive Director with Orange Coast Watch, Matt led efforts to restore water quality at Orange County beaches from multiple sources of contamination including urban runoff and the discharge of wastewater. In reporting to a Board of Directors that included representatives from leading Orange County universities and businesses, Matt prepared issue papers in the areas of treatment and disinfection of wastewater and control of the dischrge of grease to sewer systems. Matt actively participated in the development of countywide water quality permits for the control of urban runoff and permits for the discharge of wastewater. Matt worked with other nonprofits to protect and restore water quality, including Surfrider, Natural Resources Defense Council and Orange County CoastKeeper as well as with business institutions including the Orange County Business Council.

Hydrogeology:

As a Senior Hydrogeologist with the U.S. Environmental Protection Agency, Matt led investigations to characterize and cleanup closing military bases, including Mare Island Naval Shipyard, Hunters Point Naval Shipyard, Treasure Island Naval Station, Alameda Naval Station, Moffett Field, Mather Army Airfield, and Sacramento Army Depot. Specific activities were as follows:

- Led efforts to model groundwater flow and contaminant transport, ensured adequacy of monitoring networks, and assessed cleanup alternatives for contaminated sediment, soil, and groundwater.
- Initiated a regional program for evaluation of groundwater sampling practices and laboratory analysis at military bases.
- Identified emerging issues, wrote technical guidance, and assisted in policy and regulation development through work on four national U.S. EPA workgroups, including the Superfund Groundwater Technical Forum and the Federal Facilities Forum.

At the request of the State of Hawaii, Matt developed a methodology to determine the vulnerability of groundwater to contamination on the islands of Maui and Oahu. He used analytical models and a GIS to show zones of vulnerability, and the results were adopted and published by the State of Hawaii and County of Maui.

As a hydrogeologist with the EPA Groundwater Protection Section, Matt worked with provisions of the Safe Drinking Water Act and NEPA to prevent drinking water contamination. Specific activities included the following:

- Received an EPA Bronze Medal for his contribution to the development of national guidance for the protection of drinking water.
- Managed the Sole Source Aquifer Program and protected the drinking water of two communities through designation under the Safe Drinking Water Act. He prepared geologic reports, conducted public hearings, and responded to public comments from residents who were very concerned about the impact of designation.

- Reviewed a number of Environmental Impact Statements for planned major developments, including large hazardous and solid waste disposal facilities, mine reclamation, and water transfer.

Matt served as a hydrogeologist with the RCRA Hazardous Waste program. Duties were as follows:

- Supervised the hydrogeologic investigation of hazardous waste sites to determine compliance with Subtitle C requirements.
- Reviewed and wrote "part B" permits for the disposal of hazardous waste.
- Conducted RCRA Corrective Action investigations of waste sites and led inspections that formed the basis for significant enforcement actions that were developed in close coordination with U.S. EPA legal counsel.
- Wrote contract specifications and supervised contractor's investigations of waste sites.

With the National Park Service, Matt directed service-wide investigations of contaminant sources to prevent degradation of water quality, including the following tasks:

- Applied pertinent laws and regulations including CERCLA, RCRA, NEPA, NRDA, and the Clean Water Act to control military, mining, and landfill contaminants.
- Conducted watershed-scale investigations of contaminants at parks, including Yellowstone and Olympic National Park.
- Identified high-levels of perchlorate in soil adjacent to a national park in New Mexico and advised park superintendent on appropriate response actions under CERCLA.
- Served as a Park Service representative on the Interagency Perchlorate Steering Committee, a national workgroup.
- Developed a program to conduct environmental compliance audits of all National Parks while serving on a national workgroup.
- Co-authored two papers on the potential for water contamination from the operation of personal watercraft and snowmobiles, these papers serving as the basis for the development of nation-wide policy on the use of these vehicles in National Parks.
- Contributed to the Federal Multi-Agency Source Water Agreement under the Clean Water Action Plan.

Policy:

Served senior management as the Senior Science Policy Advisor with the U.S. Environmental Protection Agency, Region 9. Activities included the following:

- Advised the Regional Administrator and senior management on emerging issues such as the potential for the gasoline additive MTBE and ammonium perchlorate to contaminate drinking water supplies.
- Shaped EPA's national response to these threats by serving on workgroups and by contributing to guidance, including the Office of Research and Development publication, Oxygenates in Water: Critical Information and Research Needs.
- Improved the technical training of EPA's scientific and engineering staff.
- Earned an EPA Bronze Medal for representing the region's 300 scientists and engineers in negotiations with the Administrator and senior management to better integrate scientific principles into the policy-making process.
- Established national protocol for the peer review of scientific documents.

Geology:

With the U.S. Forest Service, Matt led investigations to determine hillslope stability of areas proposed for timber harvest in the central Oregon Coast Range. Specific activities were as follows:

- Mapped geology in the field, and used aerial photographic interpretation and mathematical models to determine slope stability.
- Coordinated his research with community members who were concerned with natural resource protection.
- Characterized the geology of an aquifer that serves as the sole source of drinking water for the city of Medford, Oregon.

As a consultant with Dames and Moore, Matt led geologic investigations of two contaminated sites (later listed on the Superfund NPL) in the Portland, Oregon, area and a large hazardous waste site in eastern Oregon. Duties included the following:

- Supervised year-long effort for soil and groundwater sampling.
- Conducted aquifer tests.
- Investigated active faults beneath sites proposed for hazardous waste disposal.

Teaching:

From 1990 to 1998, Matt taught at least one course per semester at the community college and university levels:

- At San Francisco State University, held an adjunct faculty position and taught courses in environmental geology, oceanography (lab and lecture), hydrogeology, and groundwater contamination.
- Served as a committee member for graduate and undergraduate students.
- Taught courses in environmental geology and oceanography at the College of Marin.

Matt currently teaches Physical Geology (lecture and lab) to students at Golden West College in Huntington Beach, California.

Invited Testimony, Reports, Papers and Presentations:

Hagemann, M.F., 2008. Disclosure of Hazardous Waste Issues under CEQA. Presentation to the Public Environmental Law Conference, Eugene, Oregon.

Hagemann, M.F., 2008. Disclosure of Hazardous Waste Issues under CEQA. Invited presentation to U.S. EPA Region 9, San Francisco, California.

Hagemann, M.F., 2005. Use of Electronic Databases in Environmental Regulation, Policy Making and Public Participation. Brownfields 2005, Denver, Coloradao.

Hagemann, M.F., 2004. Perchlorate Contamination of the Colorado River and Impacts to Drinking Water in Nevada and the Southwestern U.S. Presentation to a meeting of the American Groundwater Trust, Las Vegas, NV (served on conference organizing committee).

Hagemann, M.F., 2004. Invited testimony to a California Senate committee hearing on air toxins at schools in Southern California, Los Angeles.

Brown, A., Farrow, J., Gray, A. and **Hagemann, M.**, 2004. An Estimate of Costs to Address MTBE Releases from Underground Storage Tanks and the Resulting Impact to Drinking Water Wells. Presentation to the Ground Water and Environmental Law Conference, National Groundwater Association.

Hagemann, M.F., 2004. Perchlorate Contamination of the Colorado River and Impacts to Drinking Water in Arizona and the Southwestern U.S. Presentation to a meeting of the American Groundwater Trust, Phoenix, AZ (served on conference organizing committee).

Hagemann, M.F., 2003. Perchlorate Contamination of the Colorado River and Impacts to Drinking Water in the Southwestern U.S. Invited presentation to a special committee meeting of the National Academy of Sciences, Irvine, CA.

Hagemann, M.F., 2003. Perchlorate Contamination of the Colorado River. Invited presentation to a tribal EPA meeting, Pechanga, CA.

Hagemann, M.F., 2003. Perchlorate Contamination of the Colorado River. Invited presentation to a meeting of tribal repesentatives, Parker, AZ.

Hagemann, M.F., 2003. Impact of Perchlorate on the Colorado River and Associated Drinking Water Supplies. Invited presentation to the Inter-Tribal Meeting, Torres Martinez Tribe.

Hagemann, M.F., 2003. The Emergence of Perchlorate as a Widespread Drinking Water Contaminant. Invited presentation to the U.S. EPA Region 9.

Hagemann, M.F., 2003. A Deductive Approach to the Assessment of Perchlorate Contamination. Invited presentation to the California Assembly Natural Resources Committee.

Hagemann, M.F., 2003. Perchlorate: A Cold War Legacy in Drinking Water. Presentation to a meeting of the National Groundwater Association.

Hagemann, M.F., 2002. From Tank to Tap: A Chronology of MTBE in Groundwater. Presentation to a meeting of the National Groundwater Association.

Hagemann, M.F., 2002. A Chronology of MTBE in Groundwater and an Estimate of Costs to Address Impacts to Groundwater. Presentation to the annual meeting of the Society of Environmental Journalists.

Hagemann, M.F., 2002. An Estimate of the Cost to Address MTBE Contamination in Groundwater (and Who Will Pay). Presentation to a meeting of the National Groundwater Association.

Hagemann, M.F., 2002. An Estimate of Costs to Address MTBE Releases from Underground Storage Tanks and the Resulting Impact to Drinking Water Wells. Presentation to a meeting of the U.S. EPA and State Underground Storage Tank Program managers.

Hagemann, M.F., 2001. From Tank to Tap: A Chronology of MTBE in Groundwater. Unpublished report.

Hagemann, M.F., 2001. Estimated Cleanup Cost for MTBE in Groundwater Used as Drinking Water. Unpublished report.

Hagemann, M.F., 2001. Estimated Costs to Address MTBE Releases from Leaking Underground Storage Tanks. Unpublished report.

Hagemann, M.F., and VanMouwerik, M., 1999. Potential Water Quality Concerns Related to Snowmobile Usage. Water Resources Division, National Park Service, Technical Report.

VanMouwerik, M. and **Hagemann, M.F**. 1999, Water Quality Concerns Related to Personal Watercraft Usage. Water Resources Division, National Park Service, Technical Report.

Hagemann, M.F., 1999, Is Dilution the Solution to Pollution in National Parks? The George Wright Society Biannual Meeting, Asheville, North Carolina.

Hagemann, M.F., 1997, The Potential for MTBE to Contaminate Groundwater. U.S. EPA Superfund Groundwater Technical Forum Annual Meeting, Las Vegas, Nevada.

Hagemann, M.F., and Gill, M., 1996, Impediments to Intrinsic Remediation, Moffett Field Naval Air Station, Conference on Intrinsic Remediation of Chlorinated Hydrocarbons, Salt Lake City.

Hagemann, M.F., Fukunaga, G.L., 1996, The Vulnerability of Groundwater to Anthropogenic Contaminants on the Island of Maui, Hawaii. Hawaii Water Works Association Annual Meeting, Maui, October 1996.

Hagemann, M. F., Fukanaga, G. L., 1996, Ranking Groundwater Vulnerability in Central Oahu, Hawaii. Proceedings, Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association Publication VIP-61.

Hagemann, M.F., 1994. Groundwater Characterization and Cleanup at Closing Military Bases in California. Proceedings, California Groundwater Resources Association Meeting.

Hagemann, M.F. and Sabol, M.A., 1993. Role of the U.S. EPA in the High Plains States Groundwater Recharge Demonstration Program. Proceedings, Sixth Biennial Symposium on the Artificial Recharge of Groundwater.

Hagemann, M.F., 1993. U.S. EPA Policy on the Technical Impracticability of the Cleanup of DNAPL-contaminated Groundwater. California Groundwater Resources Association Meeting.

Hagemann, M.F., 1992. Dense Nonaqueous Phase Liquid Contamination of Groundwater: An Ounce of Prevention... Proceedings, Association of Engineering Geologists Annual Meeting, v. 35.

Other Experience:

Selected as subject matter expert for the California Professional Geologist licensing examination, 2009-2011.

Attachment B

Pless Environmental, Inc.
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(815) 572-8600 fax

BY EMAIL

October 22, 2013

Thomas A. Enslow
Adams Broadwell Joseph & Cardozo
520 Capitol Mall, Suite 350
Sacramento, CA 95814
tenslow@adamsbroadwell.com

Re: Review of Draft Environmental Impact Report for East Weddell Residential Projects, City of Sunnyvale

Dear Mr. Enslow,

Per your request, I have reviewed the Draft Environmental Impact Report ("Draft EIR") for the East Weddell Residential Projects ("Project") published by the City of Sunnyvale ("City")[1] as the lead agency under the California Environmental Quality Act ("CEQA") for impacts on air quality and public health.

I. Project Description

The overall project includes General Plan amendments for two sites; rezoning for two sites; Special Development Permits; Potential Vesting Tentative Maps; modifications to the Tasman/Fair Oaks Area Pedestrian and Bicycle Circulation Plan; and San Francisco Public Utilities Commission approval of improvements to the John W. Christian Greenbelt.[2] The Project includes the replacement of existing office/industrial buildings on two parcels, the Raintree site at 520-592 East Weddell Drive and the Sares Regis site at 610-630 East Weddell Drive in Sunnyvale, CA, with new multi-story residential buildings.[3] The Draft EIR states that "[w]hile the "project" is defined as the two development projects combined, separate development applications

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[1] City of Sunnyvale, Environmental Impact Report for East Weddell Residential Projects, SCH No. 2013052010, September 2013; available at http://sunnyvale.ca.gov/Departments/CommunityDevelopment/CurrentProjectsandHearings/EastWeddell.aspx.

[2] Draft EIR, p. 1-1.

[3] Draft EIR, Notice of Completion.

will be processed for each project and decisions on the General Plan amendments and rezonings could be independent of each other."[4]

The Draft EIR describes the two development projects as follows:

> The applicant for the Sares Regis project proposes to construct one four-story residential building. The majority of the building would be less than 55 feet tall with one tower element that may reach 55 feet. The project would contain 205 residential apartments, a four-story parking garage, and associated common area with landscaping and amenities. Apartments would range in size from 575 square feet to 1,400 square feet and would include one-, two-, and three-bedroom units. The total gross square footage (gsf) of the residential building would be approximately 280,000 square feet (Type V – wood frame construction) and the gross square footage of the garage (Type I concrete construction) would be 135,000 square feet. The proposed base density would equate to 36.3 dwelling units per acre (du/ac). With an additional 35-percent density bonus allowed for affordable housing pursuant to the State density bonus law (Government Code Section 65915) and a 5-percent density bonus for green building pursuant to City regulations, the density would be 50.7 du/ac, or a total of 205 units for the 4.04-acre site.
>
> The development project on the Raintree site proposes the construction of 465 residential apartment units within eight buildings. The units would be designed as stacked flats (single-story units with a common access hallway) in a variety of building types. The building types would include "wrap" buildings in which the units would surround one or more sides of a parking structure, "tuck-under" buildings in which units would be located above parking, and "on-grade" buildings in which residences would be located on the first floor with parking available in adjacent on-grade parking fields. The eight buildings would range in height from three to four stories, using Type V (wood frame) construction for the residential units and Type I (concrete) construction for the structured parking. A mixture of studios, one-bedroom, and two-bedroom units is planned, with an average unit size of approximately 1,000 square feet. Total gross building square footage would be 901,870 square feet (including garages). The proposed base density would equate to 36.3 du/ac. With density bonuses for affordable housing and green building, the density would be 38.6 du/ac, or a total of 465 units on the 12.04-acre site.[5]

The Project, as described above, is referred to as the "*Applicant Proposed Scenario*" throughout the Draft EIR. However, pursuant to a Sunnyvale City Council action initiating General Plan amendment studies for both sites, the Draft EIR also addresses a

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[4] *Ibid*.

[5] Draft EIR, pp. 1-1 and 1-2 and pp. 2-1 and 2-2.

maximum buildout scenario, referred to as the "*Full Buildout Scenario*", of 938 units for the two sites (259 units at the Sares Regis site and 679 units at the Raintree site).[6] The Draft EIR addresses the *Applicant Proposed Scenario* at a project level of detail and the *Full Buildout Scenario* at a program level "because details … (final site plan, circulation, etc.) were not available to review at this time."[7] The Draft EIR presents analyses for four separate scenarios: *Sares Regis Applicant Proposed Scenario*, *Sares Regis Full Buildout Scenario*, *Raintree Applicant Proposed Scenario*, and *Raintree Full Buildout Scenario*.

II. The Draft EIR's Analyses of Project Construction Air Quality Impacts Are Flawed

The Draft EIR claims that its analyses of construction impacts rely on the methodologies and thresholds of significance developed by the BAAQMD's *CEQA Air Quality Guidelines*.[8] The Draft EIR compares estimates of average daily project construction emissions in pounds per day ("lb/day) for the *Sares Regis Applicant Proposed Scenario* and *Raintree Applicant Proposed Scenario* with the CEQA thresholds of significance for construction in lb/day developed by the BAAQMD[9] and finds that "predicted average daily emissions would not exceed the BAAQMD thresholds" and that therefore "[t]he impact associated with construction-period emissions is considered *less than significant*…"[10] For the *Sares Regis Full Buildout Scenario* and *Raintree Full Buildout Scenario*, the Draft EIR finds that "construction emissions cannot be calculated at this time" since "construction techniques, equipment usage, and schedules have not been identified for the Full Buildout Scenario[s]" and therefore recommends mitigation measures "to ensure that construction-related emissions for the Full Buildout Scenario[s] would be less than significant."[11] As discussed below, contrary to its claim, the Draft EIR's analyses do not follow the BAAQMD's *CEQA Air Quality Guidelines* and, further, suffer from a number of incorrect assumptions and methodological flaws that render its conclusions regarding the significance of construction impacts erroneous and result in a failure to require adequate mitigation.

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[6] Draft EIR, p. 1-2.

[7] Draft EIR, p. 1-4.

[8] Draft EIR, p. 4.2-15. The Draft EIR erroneously cites to "May 2011 CEQA Air Quality Guidelines"; the BAAQMD's revised draft *CEQA Air Quality Guidelines* were proposed on May 3, 2010 and the final *CEQA Air Quality Guidelines* were adopted on May 31, 2012; *see* http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES/Updated-CEQA-Guidelines.aspx. My comments rely on the final *CEQA Air Quality Guidelines* adopted on May 31, 2012.

[9] Draft EIR, *Sares Regis Applicant Proposed Scenario*: Table 4.2-5, p. 4.2-19, and *Raintree Applicant Proposed Scenario*: Table 4.2-6, p. 4.2-20.

[10] Draft EIR, p. 4.2-19, *emphasis* retained.

[11] Draft EIR, p. 4.2-19.

A. *The Draft EIR Fails to Follow the Methodology Recommended by the Bay Area Air Quality Management District for Determining Significance*

The BAAQMD's *CEQA Air Quality Guidelines*, which the Draft EIR claims to have followed[12], recommends determining the significance of emissions during project construction based on the following six steps:

Step 1: Emissions Quantification;

Step 2: Comparison of Unmitigated Emissions with Thresholds of Significance;

Step 3: Mitigation and Emission Reductions;

Step 4: Comparison of Mitigated (Basic Mitigation) Emissions with Thresholds of Significance;

Step 5: Implement Additional Construction Mitigation Measures; and

Step 6: Comparison of Mitigated Emissions with Thresholds of Significance.[13]

Here, the Draft EIR skips the first five steps and only compares mitigated emissions with the BAAQMD's thresholds of significance. This approach fails to identify significant impacts of unmitigated impacts on air quality and consequently fails to require the mitigation measures that are built into the assumptions for the mitigated emissions calculations.

In this case, the Draft EIR assumed that all off-road construction equipment engines would be model year 2006 or newer and comply with the Tier 2 standard for new nonroad (or off-road) diesel engines established by the U.S. Environmental Protection Agency ("EPA").[14] (Tier 2 is met through advanced engine design with phase-in schedules from 2002 through 2006 depending on the horsepower of the engine.[15]) In other words, the Draft EIR's emission estimates assume that all construction equipment engines are only eight years old or younger.

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[12] Draft EIR, p. 4.2-15.

[13] BAAQMD, *CEQA Air Quality Guidelines*, pp. 8-1 and 8-2.

[14] Draft EIR, p. 4.2-18 ("Emission rates for construction equipment representative of U.S. EPA Tier 2 engine emission standards were assumed (a model year 2006 construction equipment fleet).") and Appx. D, Table "Off-Road Construction Equipment & On-Site Vehicle Exhaust Emissions, Sares Regis Site – 2014-2015 – Construction Emissions with Tier 2 Equipment" and Table "Off-Road Construction Equipment & On-Site Vehicle Exhaust Emissions, Raintree – 2014-2016 – Construction Emissions with Tier 2 Equipment."

[15] *See*, for example, DieselNet, Emission Standards, United States, Nonroad Diesel Engines; available at www.dieselnet.com/standards/us/nonroad.php.

The Draft EIR then compares these mitigated (Tier 2-compliant) emissions to the BAAQMD's significance thresholds to find no significant impacts. Had the Draft EIR compared unmitigated emissions from a typical construction fleet to the BAAQMD's significance thresholds, it would have found significant impacts requiring mitigation. Yet, because it skips that step, the Draft EIR finds that construction emissions would not be significant. As discussed below, not only does this analysis fail to comply with BAAQMD guidance, this erroneous methodology also results in a failure to require that the assumed mitigation measures will be undertaken.

In order to provide meaningful and supported air quality analysis, the City should prepare a revised Draft EIR that follows the six steps laid out in BAAQMD's *CEQA Air Quality Guidelines* to determine significance of construction emissions and require adequate mitigation to ensure that emissions will remain below significance thresholds.

B. The Draft EIR's Assumption that Tier 2 or Newer Engines Would Be Used for Off Road Construction Equipment Is Not Supported by Any Evidence or Required by Any Enforceable Measures

The Draft EIR's assumption that Tier 2 or newer engines would be used for off-road construction equipment is not supported by any evidence and is contrary to studies regarding the average age and lifespan of construction equipment. By failing to determine the significance of emissions based on the likely range of construction equipment, the Draft EIR fails to disclose actual emissions, fails to determine and disclose actual significance of these emissions and fails to impose appropriate mitigation, including restrictions on the age and type of construction engines.

The Draft EIR does not incorporate its assumption of Tier 2 compliance into a corresponding mitigation measure and thus does not actually require either Tier 2 compliance or the use of only model year 2006 or newer engines for all off-road construction equipment. It is only because the Draft EIR finds excess cancer risks from diesel particulate matter exhaust emissions (mostly attributable to off-road construction equipment) that it requires any mitigation for construction equipment at all in Mitigation Measure AIR-5a. This measure, however, does not require compliance with EPA's Tier 2 standards for all construction engines. (*See* discussion regarding the inadequacies of Mitigation Measure AIR-5a, *infra*, in Section VI.)

The assumption that only model year 2006 or newer engines, *i.e.*, an age of only eight years, would be used for off-road construction equipment that would be used to construct the project is not realistic unless specifically required in mitigation measures. Studies of the average useful life of construction fleet equipment demonstrate that is very likely that some engines in the construction equipment fleet would be considerably

older. The following table shows a summary of the useful life of construction equipment in years and their corresponding percentage emissions of the entire construction fleet as estimated by the Union of Concerned Scientists. [16]

	Percent of Total PM from Construction Equipment	Percent of Total NOx from Construction Equipment	Useful Life (in years)
Excavators	17%	18%	17
Tractors/Loaders/Backhoes	16%	12%	18
Crawler Tractors (Tracked Bulldozers)	13%	13%	29
Rubber-Tired Loaders	12%	12%	21
Skid-Steer Loaders	7%	4%	13
Off-Highway Trucks	5%	9%	17
Rough-Terrain Forklifts	5%	3%	16
Graders	5%	5%	23
Off-Highway Tractors	4%	5%	31
Rollers	3%	3%	20
Trenchers	3%	2%	28
Scrapers	3%	4%	26
Cranes	3%	4%	19
Rubber-Tired Dozers	2%	2%	32
Pavers	2%	1%	26
Bore/Drill Rigs	1%	1%	10
Other Construction Equipment	0.4%	1%	16
Paving Equipment	0.3%	0.2%	24
Surfacing Equipment	0.04%	0.1%	22

As the above table shows, the useful life of construction equipment, which is defined as *the age at which half of the equipment of a given model year* has been retired, varies from 10 to 32 years. In other words, the other half of equipment of a given model year continues to be operated considerably longer than 10 to 32 years. For example, the average useful life for skid steer loaders is 13 years and for excavators 17 years. Thus, assuming that the exempted equipment in the Project's construction fleet would only be eight years old and comply with EPA Tier 2 standards without requiring a corresponding mitigation measure is not realistic.

Older construction equipment has considerably higher emissions and is frequently not subject to federal or state regulations because it is too old. The same study by the Union of Concerned Scientists summarizes:

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[16] Union of Concerned Scientists, Digging up Trouble, The Health Risk of Construction Pollution in California, November 2006, p. 4; available http://www.ucsusa.org/assets/documents/clean_vehicles/digging-up-trouble.pdf.

> Highway truck and bus engine manufacturers have had to meet increasingly stringent emission regulations since the late 1980s. Construction and other off-road equipment, however, did not face new particulate matter (PM) emission standards until 1996, with some engines unregulated as late as 2003. In 2004, the U.S. Environmental Protection Agency (EPA) finally forced construction equipment to meet similar standards to highway trucks and buses, requiring 90 percent reductions in nitrogen oxides (NOx) and PM for most engine sizes. These standards will phase in over a seven-year period starting in 2008, reaching full implementation in 2014 (EPA 2004). Although these standards will significantly reduce pollutants from new engines, the full benefits will not be realized until sometime after 2030, when the long-lasting equipment currently in use today is finally retired. There are technology options available to clean up these existing machines, but neither the EPA nor the state of California currently requires them. As a result, if no additional requirements are put in place, the construction sector will continue emitting high levels of toxic and smog-forming pollution for the next two to three decades.[17]

In July 2007, as the first state in the nation, California adopted a regulation requiring construction and off-road equipment owners to be responsible for the emissions their equipment emits. In addition to idling restrictions and reporting requirements, the revised rule, as adopted on December 14, 2011, restricts adding older vehicles to a fleet and establishes compliance deadlines for achieving declining fleet-average emission levels depending on the fleet size (*i.e.*, all of the off-road horsepower under common ownership or control in the fleet) based on total horsepower ("hp").[18] However, the existing construction fleet operating in California is not regulated beyond EPA's standards for purchases of new engines.

By each compliance deadline, a fleet must demonstrate that it has either met the fleet average target for that year, or has completed the Best Available Control Technology requirements ("BACT"). Large fleets (>5000 hp) have compliance deadlines each year from 2014 through 2023, medium fleets (2501 to 5,000 hp) each year from 2017 through 2023, and small fleets (<2500 hp) each year from 2019 through 2028.[19] The rule offers flexibility in meeting the increasingly stringent requirements as emission reductions can be achieved through equipment replacement, engine repowering, and

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[17] *Ibid*, p. 3.

[18] California Air Resources Board, In-Use Off-Road Diesel-Fueled Fleets and LSI [Large Spark Ignition], Rulemaking to Consider the Proposed Amendments to the Regulations for In-Use Off-Road Diesel-Fueled Fleets and Off-Road Large Spark Ignition Engine Fleet Requirements, May 7, 2012; *see* http://www.arb.ca.gov/regact/2010/offroadlsi10/offroadlsi10.htm.

[19] California Air Resources Board, In-Use Off-Road Diesel Vehicle Regulation Overview, revised May 2012; available at http://www.arb.ca.gov/msprog/ordiesel/faq/overview_fact_sheet_dec_2010-final.pdf.

exhaust retrofits. Thus, companies could choose to meet the requirements through equipment turnover alone because the fleet average targets are never more stringent than the new engine standards in effect. Further, the rule allows for exemptions in the case of retrofit technology being unavailable.

Therefore, it is highly unlikely that all exempted engines of the construction fleet for Project construction would meet EPA's Tier 2 emission factors. Because older equipment has disproportionately higher emissions, exhaust emissions from this equipment are likely substantially underestimated in the Draft EIR.

I recommend that the Draft EIR be revised to either require that all Project construction equipment comply with Tier 2 or better (as is now erroneously assumed) or to provide revised emission estimates and associated health risks based on worst-case, reasonably likely construction fleet emissions rather on unrealistic, optimistic assumptions.

B. The Draft EIR Impermissibly Piecemeals the Impacts on Air Quality from Project Construction instead of Evaluating Impacts from the Whole of the Project

The Draft EIR's air quality analysis segments evaluation of air quality emissions from demolition, construction and operations on the Raintree site from evaluation of demolition, construction and operations on the Sares Regis site. By looking at the emissions from development activities on each site separately, the Draft EIR understates and fails to disclose the impacts on air quality from the project as a whole, contrary to CEQA's mandate to review a project's impacts as a whole.[20] CEQA prohibits such "piecemealing" since, by dividing a project up into two or more pieces each with a comparatively lesser environmental impact, it makes each phase appear less significant.[21] CEQA prohibits such a "piecemeal" approach.

The Draft EIR describes the project under review as the amendment of current General Plan and zoning designations of existing office/industrial parcels to allow the construction of new multi-story residential buildings on two immediately adjacent properties, the Raintree site and the Sares Regis site. The Notice of Completion for the Draft EIR states that the "project" is defined as "the two development projects *combined*."[22]

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[20] CEQA Guidelines, § 15378, subd. (a); *Burbank- Glendale-Pasadena Airport Authority v. Hensler* (1991) 233 Cal.App.3d 577, 592.

[21] *Citizens Ass'n for Sensible Devel. of Bishop Area v. Inyo*, supra, 172 Cal.App.3d at 165-166.

[22] City of Sunnyvale, Notice of Completion of an Environmental Impact Report for the East Weddell Residential Projects, p. 1; *emphasis* added.

More specifically, the Notice of Completion describes the "overall project" as including the following "components":[23]

- General Plan amendments for two sites[24]
- Rezoning for two sites
- Special Development Permits
- Potential Vesting Tentative Maps
- Modifications to the Tasman/Fair Oaks Area Pedestrian and Bicycle Circulation Plan
- San Francisco Public Utilities Commission (SFPUC) approval of improvements to the John W. Christian Greenbelt

In addition, the Draft EIR states that "as part of the proposed projects," the project applicants for the two sites shall jointly replace the existing 8-inch public sewer main in North Fair Oaks Avenue with a 10-inch main.[25]

Since CEQA requires reviewing the impacts of the whole of a project rather than evaluating each of the separate components or phases of a Project independently, the Draft EIR should have evaluated the potential significance of emissions from all of the listed Project components, as a whole. The Draft EIR fails to take this approach and instead evaluates emissions from development on the Raintree site in isolation from emissions from development of the Sares Regis site.

As discussed below, this approach results in a failure to disclose and mitigate potentially significant impacts. When the Project's components are analyzed as a whole, as required by CEQA, their construction emissions result in significant impacts on air quality where the Draft EIR found none.

Specifically, the Draft EIR adopts the thresholds of significance for construction developed by the Bay Area Air Quality Management District ("BAAQMD") for emissions of ozone precursors reactive organic gases ("ROG"), nitrogen oxides ("NOx") as well as for particulate matter exhaust with an average aerodynamic diameter[26] of

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[23] *Ibid*.

[24] While the Notice of Completion states that separate development applications will be processed for the Raintree site and the Sares Regis site, it states that the General Plan Amendment and rezoning could be processed either together or separately. City of Sunnyvale, Notice of Completion of an Environmental Impact Report for the East Weddell Residential Projects, p. 2.

[25] Draft EIR at p. 4.11-11.

[26] The aerodynamic diameter describes the diameter of a sphere with a unit density that has aerodynamic behavior identical to that of the particle in question; *i.e.*, an expression of aerodynamic behavior of an

10 and 2.5 micrometers or less ("PM10" and "PM2.5", respectively).[27] The table below compares total mitigated construction emissions in pounds per day ("lb/day) as presented by the Draft EIR for the *Applicant Proposed Scenarios*[28] (*i.e.*, assuming Tier 2-compliant engines only) to the BAAQMD's daily thresholds of significance for these pollutants.

Mitigated Construction Emissions (lb/day)

	ROG	NOx	PM10	PM2.5
Applicant Proposed Scenarios				
Sares Regis	6.9	13.0	0.9	0.4
Raintree	35.6	32.2	2.3	1.9
Total Applicant Proposed Scenarios	**52.5**	**45.2**	**3.2**	**2.3**
BAAQMD Threshold	54	54	82	54
Significant?	no	no	no	no

The table shows that total mitigated ROG emissions from construction of the *Sares Regis* and *Raintree Applicant Proposed Scenarios*, 52.5 lb/day, are just 1.5 lb/day shy of the BAAQMD's threshold of 54 lb/day. As discussed below, the Draft EIR underestimates mitigated emissions that would occur during construction. When these errors are corrected, mitigated ROG emissions from the total *Applicant Proposed Scenarios* would by far exceed the BAAQMD's construction significance threshold for ROG and NOx emissions.

The Draft EIR does not provide emission estimates for construction of the *Full Buildout* scenarios because "because details … (final site plan, circulation, etc.) were not available to review at this time"[29] and requires a "complete air emissions analysis for construction emissions" once this information becomes available.[30] This future analysis must analyze the combined impacts of all construction activities that would occur contemporaneously unless the Draft EIR is revised to require phasing of construction activities.

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irregularly shaped particle in terms of the diameter of an idealized particle. Particles having the same aerodynamic diameter may have different dimensions and shapes.

[27] Draft EIR, p. 4.2-15.

[28] Draft EIR, Tables 4.2-5 (Sares Regis) and 4.2-6 (Raintree).

[29] Draft EIR, p. 1-2.

[30] Draft EIR, Mitigation Measure AIR-2, p. 4.2-23.

C. The Draft EIR Fails to Correctly Estimate Daily Emissions during Construction

The Draft EIR claims that its analyses of construction impacts rely on the methodologies and thresholds of significance developed by the BAAQMD's *CEQA Air Quality Guidelines*.[31] As Step 1 of a significance determination, this document recommends the following for quantification of construction emissions:

> BAAQMD recommends using URBEMIS to quantify construction emissions for proposed land use development projects and the Roadway Construction Emissions Model (RoadMod) for proposed linear projects such as, new roadway, roadway widening, or pipeline installation. …[32]

The recommended model, URBEMIS, has been superseded by the exclusive use of the California Emissions Estimator Model ("CalEEMod") and the BAAQMD now recommends:

> On July 31, 2013, the California Air Pollution Control Officers Association (CAPCOA) released CalEEMod 2013.2. This land use model can be downloaded from www.caleemod.com. From this point forward, the BAAQMD will no longer support the use of Urbemis. Please perform all future analyses using CalEEmod.[33]

Here, the Draft EIR uses CalEEMod to estimate reactive organic gases ("ROG") emissions from architectural coatings during construction (*i.e.*, painting).[34,35] However, instead of using CalEEMod to estimate emissions for all other construction activities as well, the Draft EIR computes annual and average daily exhaust emissions from off-road construction equipment (excavators, dozers, loaders, scrapers, backhoes, etc.) with spreadsheets based on the project construction schedule and using emission factors from the OFFROAD Model developed by the California Air Resources Board ("CARB").

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[31] Draft EIR, p. 4.2-15. The Draft EIR erroneously cites to "May 2011 CEQA Air Quality Guidelines"; the BAAQMD's revised draft *CEQA Air Quality Guidelines* were proposed on May 3, 2010 and the final *CEQA Air Quality Guidelines* were adopted on May 31, 2012; *see* http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES/Updated-CEQA-Guidelines.aspx. My comments rely on the BAAQMD's final *CEQA Air Quality Guidelines* adopted on May 31, 2012.

[32] BAAQMD, *CEQA Air Quality Guidelines,* p. 8-1.

[33] BAAQMD, website "CEQA Guidelines", last updated August 6, 2013; http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES.aspx.

[34] Draft EIR, p. 4.2-18.

[35] CalEEMod version 2011.1.1 has been superseded by version 2013.2.2; *see* http://www.caleemod.com/. However, review of revisions shows that architectural coatings were not affected other than permitting the user to modify the square footage; *see* http://www.aqmd.gov/caleemod/doc/Revisions-2013-2-2.pdf.

For estimating exhaust emissions for on-road vehicles (water, haul, cement, and vendor trucks and construction worker vehicles), the Draft EIR relies on emission factors from CARB's EMFAC2011 mobile source emissions model.[36] (Both OFFROAD and EMFAC2011 are incorporated into CalEEMod for estimating construction emissions.[37]) The Draft EIR explains that "average daily" emissions "were computed from total emissions and dividing [by] the number of construction days."[38] The Draft EIR computed the number of construction days for the *Sares Regis Applicant Proposed Scenario* at 462 (assuming 22 days per month and 21 months of construction) and for the *Raintree Applicant Proposed Scenario* at 528 (assuming 22 days per month and 24 months of construction).[39] The Draft EIR provides no explanation why it did not use the CalEEMod model for these emission sources as well, as recommended by the BAAQMD, and instead undertook the laborious spreadsheet approach. This approach is not consistent with BAAQMD guidance nor is it industry standard (I have encountered this approach only in CEQA documents prepared by the Draft EIR's consultant).

The intent of the BAAQMD's *CEQA Air Quality Guidelines* is clearly to compare daily construction emissions <u>as determined with the current agency-recommended models</u> to the respective daily thresholds of significance. CalEEMod (as well as its predecessor URBEMIS) provides daily emissions <u>separately for each construction phase</u> (*e.g.*, demolition, grading, building construction, etc.):

> Since construction phases may or may not overlap in time, the maximum daily construction emissions will not necessarily be the sum of all possible daily emissions. CalEEMod therefore calculates the maximum daily emissions *for each construction phase*. The program will then add together the maximum daily emissions for each construction phase that overlaps in time. Finally the program will report the highest of these combined overlapping phases as a daily maximum. For fugitive dust calculations during grading, the maximum amount of acres graded in a day is determined by the number of grading equipment which is assumed to operate for 8 hours.[40]

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[36] Draft EIR, pp. 4.2-17 and 4.2-18.

[37] California Air Pollution Control Officers Association, CalEEMod, California Emissions Estimator Model, User's Guide, Version 2013.2, July 2013 (hereafter "CalEEMod User's Guide"); available at http://www.aqmd.gov/caleemod/doc/UsersGuide.pdf. (At p. 2 for off-road construction equipment: "Horsepower and load factors are loaded with the default average values of the mode tier according to population based on OFFROAD2011…")

[38] Draft EIR, pp. 4.2-18 and 4.2-19.

[39] Draft EIR, pp. 4.2-18 and 4.2-19.

[40] California Air Pollution Control Officers Association, California Emissions Estimator Model, User's Guide, Appendix A, Calculation Details for CalEEMod, revised July 2013, CalEEMod v.2013.2, *emphasis* added; available at http://www.aqmd.gov/caleemod/doc/AppendixA.pdf.

The BAAQMD's *CEQA Air Quality Guidelines* provide the following instructions for determining total daily emissions during overlapping construction activities:

> Following quantification of project-generated construction-related emissions, the total average daily emissions of each criteria pollutant and precursor should be compared with the lead agency's determined project thresholds. If construction-related emissions have been quantified using multiple models or model runs, *sum the criteria air pollutants and precursor levels from each where said activities would overlap. In cases where the exact timing of construction activities is not known, sum any phases that could overlap to be conservative*.[41]

Here, instead of summing emissions during potentially overlapping activities, the Draft EIR "averages" all emissions over the entire construction period. This approach substantially underestimates impacts on a short-term basis. The consequences of this "averaging" approach become particularly apparent when considering ROG emissions from architectural coating, which occur only during four weeks. ROG emissions are precursors to ground-level ozone formation through a complex series of chemical reactions between ROG and NOx in the presence of sunlight. Clearly, any contribution to ozone formation from the ROG precursors would occur on a daily basis. Thus, averaging ROG emissions from architectural coatings over the entire construction period of two years (104 weeks) severely underestimates the Project's contribution to daily ozone formation.

The BAAQMD established quantitative daily and annual significance thresholds to maintain or achieve attainment with the national and state ambient air quality standards. These standards have been established for both long-term and short-term concentrations of pollutants in the ambient air. Specifically, national ambient air quality standards exist for 1-hour and 8-hour ozone, 24-hour and annual PM10, and 24-hour and annual PM2.5 concentrations; state ambient air quality standards exist for 8-hour ozone, 24-hour PM10, and 24-hour and annual PM2.5 concentrations. The daily average significance thresholds established by the BAAQMD for construction (and operational) emissions address compliance with the short-term ambient air quality standards; the BAAQMD did not establish a significance threshold for annual emissions during construction because construction activities are typically short-term or temporary in duration. In contrast, for operational emissions, the BAAQMD establishes both average daily and maximum annual significance thresholds to ensure ongoing compliance with both short-term and long-term ambient air quality standards.

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[41] BAAQMD, *CEQA Air Quality Guidelines*, p. 8-1.

The Draft EIR's "averaging" approach does not assess the potential impacts from construction activities on compliance with daily and hourly national and state ambient air quality standards. Without such an evaluation, the Draft EIR cannot demonstrate that Project construction emissions would not "[r]esult in a cumulatively considerable net increase of any criteria pollutant for which the project region is in nonattainment under an applicable federal or state ambient air quality standard (including emissions which exceed quantitative threshold for ozone precursors)" or "[v]iolate any air quality standard or contribute substantially to an existing or projected air quality violation." The Draft EIR should be revised to evaluate daily construction emissions using the CaEEMod in compliance with BAAQMD guidance.

D. The Draft EIR Fails to Estimate Emissions Associated with the Fair Oaks Sewer Pipe Replacement

In the *Utilities and Service Systems* section, the Draft EIR states that an existing 8-inch sewer main in North Fair Oaks Avenue immediately northeast of the Raintree site will have to be upsized to a 10-inch sewer main to have adequate capacity to handle flows from the proposed Project.[42] The Draft EIR claims that "[a]nnual and average daily emissions for construction were calculated, including both on-site and off-site activities."[43] However, the description of these off-site activities indicates that only "haul trips, vendor trips and construction worker trips" were included in the emission estimates[44] but not the upsizing of the sewer main. Review of the construction emission calculations in the Draft EIR's Appendix D shows that the North Fair Oaks sewer upgrade project component was indeed not considered in the emission calculations. The Draft EIR emission estimates must be revised to account for emissions associated with upsizing the sewer.

Instead of evaluating the North Fair Oaks Avenue sewer replacement activities with the rest of the Project activities, the Draft EIR instead spends one paragraph looking at the potential impacts of the North Fair Oaks Avenue sewer replacement activities in isolation.[45] The failure to include this project component in the overall analysis of project impacts improperly segments review of air quality impacts from the North Fair Oaks Avenue sewer replacement activities from the rest of the project. Its entire analysis and discussion of air quality impacts from this activity consists of the following conclusory sentence: "Construction noise and air emissions would be short

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[42] Draft EIR, p. 4.11-10.

[43] Draft EIR, p. 4.2-17.

[44] Draft EIR, p. 4.2-18.

[45] Draft EIR at p. 4.11-10.

term and would not result in significant air quality or noise impacts."[46] This sentence is not included in the Draft EIR's *Air Quality* section but only in the section on *Utilities and Service Systems*. Moreover, the Draft EIR lacks any analysis or evidence to support its analysis of the air quality impacts from the North Fair Oaks Avenue sewer replacement activities. Thus, this one-sentence, piecemealed analysis is conclusory and unsupported by any citations, data, evidence or meaningful analysis.

E. The Draft EIR's Analysis of Construction Health Risks Is Flawed and Fails to Identify Significant Cancer Risks after Implementation of Recommended Mitigation Measures

The Project would be constructed near existing residences including apartment buildings located near the north and west edges of the Raintree site and single-family residences to the north and east of the Sares Regis site.[47] Residents of these buildings would be exposed to exhaust emissions of diesel particulate matter ("DPM"),[48] a known toxic air contaminant ("TAC") and classified human carcinogen.[49]

1. Excess Cancer Risks Are Underestimated

The Draft EIR provides a refined health risk assessment to assess the potential health risks for residents of buildings adjacent to the construction sites. This health risk assessment relies on dispersion modeling of DPM (as PM2.5) exhaust emissions from construction equipment (which, as discussed previously, are underestimated) to predict resulting offsite DPM concentrations and predicts excess (increased) lifetime cancer risks.[50] For the *Sares Regis Applicant Proposed Scenario*, the Draft EIR finds that the maximum excess residential child cancer risk of 11.4 in one million would exceed the BAAQMD's significance threshold of 10 in one million and would therefore be significant; the Draft EIR finds that the maximum excess residential adult cancer risk of 0.6 in one million would not exceed the BAAQMD's significance threshold and would therefore not be significant.[51] For the *Raintree Applicant Proposed Scenario*, the Draft EIR finds that the maximum excess residential child cancer risk of 19.7 in one million would exceed the BAAQMD's significance threshold of 10 in one million and would therefore

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[46] Draft EIR, p. 4.11-10.

[47] Draft EIR, p. 4.2-41.

[48] *Ibid*.

[49] World Health Organization, International Agency for Research on Cancer, IARC: Diesel Engine Exhaust Carcinogenic, June 12, 2012; available at http://www.iarc.fr/en/media-centre/pr/2012/pdfs/pr213_E.pdf.

[50] Draft EIR, p. 4.2-40.

[51] Draft EIR, p. 4.2-43 through 4.2-44.

be significant; the Draft EIR finds that maximum excess residential adult cancer risk of 1.0 in one million would not exceed the BAAQMD's significance threshold and would therefore not be significant.[52] These conclusions are erroneous because the methodology employed by the health risk assessment to compute excess cancer risks is flawed.

Specifically, the Draft EIR models the average daily emissions, which, as discussed before, were improperly averaged over the entire construction period. The Draft EIR then calculates cancer risks assuming that residents would be exposed to these average modeled concentrations for only one year, 2014; all following years are assumed at zero.[53] This approach is incorrect on several accounts.

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[52] *Ibid*.

[53] *See* Draft EIR, Appx. D., Tables "Maximum DPM Cancer Risk Calculations from Construction Off-Site Residential Receptor Locations" for Sares Regis Site, Raintree Site and Raintree & Sares Regis Sites.' *See* "Annual" DPM concentrations of 0.0000 µg/m^3 for both Child and Adult in excerpted tables below.

Sares Regis site:

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Year	Exposure Exposure Duration (years)	Child - Exposure Information DPM Conc (ug/m3) Year	Annual	Exposure Adjust Factor	Child Cancer Risk (per million)	Adult - Exposure Information Modeled DPM Conc (ug/m3) Year	Annual	Exposure Adjust Factor	Adult Cancer Risk (per million)
1	1	2014	0.1299	10	11.37	2014	0.1299	1	0.59
2	1		0.0000	10	0.00		0.0000	1	0.00
3	1		0.0000	4.75	0.00		0.0000	1	0.00
4	1		0.0000	3	0.00		0.0000	1	0.000
5	1		0.0000	3	0.00		0.0000	1	0.00
6	1		0.0000	3	0.00		0.0000	1	0.00

Raintree site:

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Year	Exposure Exposure Duration (years)	Child - Exposure Information DPM Conc (ug/m3) Year	Annual	Exposure Adjust Factor	Child Cancer Risk (per million)	Adult - Exposure Information Modeled DPM Conc (ug/m3) Year	Annual	Exposure Adjust Factor	Adult Cancer Risk (per million)
1	1	2014	0.2170	10	19.00	2014	0.2170	1	0.99
2	1		0.0000	10	0.00		0.0000	1	0.00
3	1		0.0000	4.75	0.00		0.0000	1	0.00
4	1		0.0000	3	0.00		0.0000	1	0.000
5	1		0.0000	3	0.00		0.0000	1	0.00
6	1		0.0000	3	0.00		0.0000	1	0.00

First, because the Draft EIR averaged emissions over the entire construction period, modeled emissions in 2014 are lower than they would be if evaluated separately for each construction year.

Second, as the Draft EIR states, "[c]onstruction at the Sares Regis site is anticipated to occur over an approximate 22-month period year period [sic] (January 2014 to October 2015) and construction at the Raintree project site is anticipated to occur over a 2-year period (September 2014 to September 2014)."[54] Thus, DPM construction emissions from the sites occur over at least two years, assuming that both projects are constructed simultaneously. If constructed one after another some sensitive receptors could potentially be exposed to high levels of DPM emissions for almost four years.

The BAAQMD recommends that health risk assessments follow the most recent guidance developed by the Office of Environmental Health Hazard Assessment ("OEHHA"):

> The Exposure Assessment components are based on the procedures developed by the California Office of Environmental Health Hazard Assessment (OEHHA). These calculation methodologies may change over time as OEHHA further refines its exposure guidelines. **It is important that the user apply the most current risk assessment methodology and toxicity factors from OEHHA's health risk assessment guidelines.**[55]

With respect to short-term projects, the most recent OEHHA guidance recommends the following regarding the determining the exposure duration used in health risk assessments:

Sares Regis & Raintree sites:

Construction Cancer Risk by Year - Maximum Impact Receptor Location

		Child - Exposure Information				Adult - Exposure Information			
						Modeled			
	Exposure		DPM Conc (ug/m3)	Exposure	Child		DPM Conc (ug/m3)	Exposure	Adult
Year	Duration (years)	Year	Annual	Adjust Factor	Cancer Risk (per million)	Year	Annual	Adjust Factor	Cancer Risk (per million)
1	1	2013	0.2251	10	19.71	2014	0.2251	1	1.02
2	1		0.0000	10	0.00		0.0000	1	0.00
3	1		0.0000	4.75	0.00		0.0000	1	0.00
4	1		0.0000	3	0.00		0.0000	1	0.000
5	1		0.0000	3	0.00		0.0000	1	0.00
6	1		0.0000	3	0.00		0.0000	1	0.00

[54] Draft EIR, p. 4.2-41.

[55] BAAQMD, Recommended Methods for Screening and Modeling Local Risks and Hazards, Version 3.0, May 2012, p. 4, **emphasis** retained; available at http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/Risk%20Modeling%20Approach%20May%202012.ashx?la=en.

> We recommend that exposure from projects less than 6 months be assumed to last 6 months (e.g., a 2-month project would be evaluated as if it lasted 6 months). … *We recommend that exposure from projects lasting more than 6 months be evaluated for the duration of the project.* In all cases the exposure should be assumed to start in the third trimester to allow for the use of the Age Sensitivity Factors (OEHHA, 2009). Thus, if the District is evaluating a proposed 5-year mitigation project at a hazardous waste site, the exposure duration for the residents would be from the third trimester through the first five years of life. …[56]

Thus, the excess cancer risks for residential adult receptors are underestimated by a factor of 1.83 for the Sares Regis site[57] and 2.0 for the Raintree site[58] and can be computed at 1.1 in one million[59] and 2.0 in one million[60] respectively. For residential child receptors, the age sensitivity factors (termed "exposure adjustment factor by the Draft EIR) are 10.0 for both Year 1 and Year 2 of exposure; thus excess cancer risks for both sites can be computed the above factors. The resulting excess residential child cancer risks are 20.8 in one million for the Sares Regis site [61] and 38.0 in one million for the Raintree site.[62]

The cancer risks from Project construction are further underestimated because the Draft EIR fails to account for emissions related to upsizing the sewer mains (as discussed in Section II.D above) and due to the Draft EIR's unsupported assumption that all demolition, grading and construction equipment engines would be Tier 2-compliant.

Because of these calculation errors, the Draft EIR significantly underestimates and fails to accurately disclose the scope of potential cancer risks from Project construction. The Draft EIR should be revised to address these errors and determine cancer risks based on OEHHA guidance as outlined above.

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[56] OEHHA, Air Toxics Hot Spots Program Risk Assessment Guidelines, Technical Support Document for Exposure Assessment and Stochastic Analysis, Chapter 11: Residential and Worker Exposure Duration, Individual vs. Population Cancer Risk, and Evaluation of Short Term Projects, Final August, 2012, *emphasis* added; available at http://www.oehha.ca.gov/air/hot_spots/pdf/2012tsd/Chapter11_2012.pdf.

[57] (22 months) / (12 months) = 1.83.

[58] (24 months) / (12 months) = 2.00.

[59] (0.59 in one million) × 1.83 = 1.08 in one million.

[60] (1.02 in one million) × 2.00 = 2.04 in one million.

[61] (11.37 in one million) × 1.83 = 20.845 in one million.

[62] (19.0 in one million) × 2.0 = 38.0 in one million.

2. *The Proposed Mitigation to Reduce Excess Cancer Risks Is Not Adequate to Reduce Risks below the Threshold of Significance*

Further, assuming for sake of argument that the Draft EIR's estimates of emissions were correct, its conclusions regarding the significance of excess cancer risks after mitigation are nonetheless incorrect. The Draft EIR concludes that implementation of Mitigation Measure AIR-5a would reduce the maximum residential child excess cancer risk "from each of the projects as well as the combination of both projects to below 9.9 in one million."[63] The Draft EIR provides no quantitative demonstration to support this conclusion. As discussed below, this conclusion is erroneous.

The Draft EIR's determination that maximum residential child excess cancer risk "from each of the projects as well as the combination of both projects" would be reduced to below 9.9 in one million appears to rest on an erroneous assumption that implementation of Mitigation Measure AIR-5a would reduce DPM (as PM2.5) emissions during construction (and resulting excess cancer risks) by 50 percent.[64]

Review of Mitigation Measure AIR-5a shows that this assumption is erroneous. Specifically, Mitigation Measure AIR-5a requires:

> A plan shall be developed demonstrating that the off-road equipment (*more than 50 horsepower and on-site for more than two consecutive workdays*) to be used in project construction would achieve an additional 50-percent reduction in exhaust particulate matter emissions, compared to similar equipment that meets U.S. EPA Tier 2 standards. Based on the construction plans presented for this project, *a feasible method to achieve this objective* would be the following:
>
> - All diesel-powered air compressors, welders, forklifts (including rough terrain forklifts), paint spray rigs, and all types of cranes, forklifts or aerial lifts (man lifts, boom lifts, etc.) used during all construction phases shall meet or exceed U.S. EPA Tier 4 standards for particulate matter emissions or substituted with alternatively fueled equipment (e.g., LPG fuel).
> - All other off-road construction equipment used on the site shall, on a fleet-wide average, meet U.S. EPA Tier 2 emission standards.

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[63] Draft EIR, p. 4.2-45.

[64] (Sares Regis: 11.4 in one million) × (0.50 for MM AQ-5a) = 5.70 in one million;
(Raintree: 19.7 in one million) × (0.50 for MM AQ-5a) = 9.50 in one million; and
(Sares Regis + Raintree: 19.7 in one million) × (0.50 for MM AQ-5a) = 9.85 in one million.
For maximum excess residential child cancer risks for each site and for the combination, *see* Draft EIR, Appx. D "Maximum DPM Cancer Risk Calculation from Construction, Off-Site Residential Receptor Locations."

- Portable diesel generators operating for more than two days shall be prohibited.
- Grid power electricity shall be used to provide power at construction sites, or non-diesel generators (or diesel generators using bio-diesel fuel) may be used when grid power electricity is not feasible.[65]

Under this mitigation, only off-road equipment more than "*50 horsepower and on-site for more than two consecutive workdays*" would be required to meet the additional 50-percent reduction of emissions compared to EPA's Tier 2 standard, which was assumed for estimating construction emissions. Review of the detailed emission calculations in the Draft EIR's Appendix D shows that several pieces of equipment would be exempted from compliance because they would have less than 50 horsepower. Specifically, for the *Sares Regis Applicant Proposed Scenario*, two 46-hp welders would be exempted; for the *Raintree Applicant Proposed Scenario*, the exempted equipment based on horsepower includes two 45-hp skid steer loaders during demolition and grading/excavation, one 30-hp excavator during trenching/site preparation, one 46-hp welder during the exterior building phase, and five 30-hp compressors, one 30-hp texture spray rig, and one 30-hp paint spray rig during the interior building/architectural coating phase.[66]

For the *Raintree Applicant Proposed Scenario*, emissions from this exempted equipment account for 15 percent of total emissions from the off-road construction equipment fleet.[67] Thus, assuming 50 percent emission reduction for the non-exempted remainder of the off-road construction equipment after implementation of Mitigation Measure AIR-5a would result in total emission reductions of only 35 percent, *i.e.*, reduce emissions to 65 percent.[68] In addition, on-site on-road vehicles, *i.e.*, diesel-powered trucks such as the water, haul, and cement trucks, are not affected by Mitigation Measure AIR-5a because it only applies to off-road equipment.

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[65] Draft EIR, pp. 4.2-44 and 4.2-45, *emphasis* added.

[66] *See* Draft EIR, Appx. D, Table "Off-Road Construction Equipment & On-Site Vehicle Exhaust Emissions, Sares Regis Site – 2014-2015 – Construction Emissions with Tier 2 Equipment" and Table "Off-Road Construction Equipment & On-Site Vehicle Exhaust Emissions, Raintree – 2014-2016 – Construction Emissions with Tier 2 Equipment."

[67] *Raintree Applicant Proposed Scenario* exempted off-road construction equipment PM2.5 emissions: (5.5 + 2.7 + 0.8 + 3.0 + 67.0 + 13.4 + 13.4) pounds = 105.8 pounds; total off-road construction equipment emissions: 711.4 pounds; percentage emissions of exempted equipment/total off-road construction equipment: 105.8/711.4 = 0.149.

[68] Including mitigation: [(exempted off-road: 105.8) + (non-exempted off-road: 711.4 × 0.50) + (trucks: 9.5)] /(total 720.9) = 0.653.

When the actual reductions in emissions that would result from Mitigation Measure AIR-5a are calculated, based on the Draft EIR's own emission estimates, total mitigated emissions from construction of the *Raintree Applicant Proposed Scenario* would result in an excess residential child cancer risk of 13 in one million.[69] Because this substantially exceeds the BAAQMD's significance threshold of 10 in one million, the Draft EIR's conclusion that Mitigation Measure AIR-5a will reduce construction-related cancer risks below a level of significance is not supported by the record even when looking at the Raintree construction activities in isolation from the rest of the Project components. In addition, when the Project is looked at as a whole, the combined excess child cancer risk from the *Raintree Applicant Proposed Scenario* and the *Sares Regis Applicant Proposed Scenario* would also exceed the BAAQMD's significance threshold.

3. The Draft EIR's Evaluation of Post-Mitigation Cancer Risks from Construction Emissions Fails to Take into Account Errors in Pre-Mitigation Emission Estimates

The Project's post-mitigation cancer risks would be even more significant in scope than the 13 in one million calculated above when the errors in pre-mitigation emission estimates discussed previously in this comment letter are taken into account. These errors include the additional emissions from the likely use of older, non-Tier 2, construction equipment and the additional emissions from the North Fair Oaks Avenue sewer replacement activities. As discussed above, it is highly unlikely that all construction equipment engines will meet or exceed the EPA's Tier 2 emission factors.

For example, because Draft EIR contains no other mitigation measures for construction equipment exhaust emissions, the exempted equipment is likely to be much older than the 2006 engine year model engines assumed for construction emission estimates. [70] Because older equipment has disproportionately higher emissions, exhaust emissions from this equipment are likely substantially underestimated. As a result, associated health risks are also substantially underestimated.

III. The Draft EIR's Analyses of Project Operational Air Quality Impacts Are Flawed

Because the Draft EIR finds that operational emissions from any of the buildout scenarios for either the Sares Regis or the Raintree sites would be less-than-significant

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[69] 19.9 × 0.653 = 13.0.

[70] See Union of Concerned Scientists, Digging up Trouble, The Health Risk of Construction Pollution in California, November 2006, p. 4 (table showing useful life of construction equipment); available http://www.ucsusa.org/assets/documents/clean_vehicles/digging-up-trouble.pdf.

and, consequently, does not require any mitigation.[71] As discussed below, the Draft EIR's approach to arrive at its conclusion of less-than-significance is flawed and, as a result, the Draft EIR fails to disclose and mitigated significant impacts on air quality associated with Project operation.

A. The Draft EIR Fails to Follow the Methodology Recommended by the Bay Area Air Quality Management District for Determining Significance

The BAAQMD's *CEQA Air Quality Guidelines*, which the Draft EIR claims to have followed[72], recommends determining the significance of emissions during project operation based on the following four steps:

Step 1: Emissions Quantification;

Step 2: Comparison of Unmitigated Emissions with Thresholds of Significance;

Step 3: Mitigation and Emission Reductions; and

Step 4: Comparison of Mitigated Emissions with Thresholds of Significance.[73]

As previously discussed for construction impacts, the Draft EIR skips all steps prior to comparing mitigated emissions with the BAAQMD's thresholds of significance for project operation. Because the Draft EIR finds that (mitigated) operational emissions from any of the buildout scenarios for either the Sares Regis or the Raintree sites would be less-than-significant, it does not require any mitigation.[74] The Draft EIR fails to require the assumptions it relied upon to model these mitigated emissions. These assumptions include that the Project would have no wood fireplaces, would exceed Title 24 requirements, would install high-efficiency lighting, and would install energy-efficient appliances.[75] The Draft EIR must specify that these mitigation measures be realized before it may rely upon these measures to support its finding that impacts will be reduced below a level of significance.

B. The Project as a Whole Will Generate Significant Operational Emissions

As discussed above in Section II.B, CEQA requires reviewing the impacts of the whole of a project rather than evaluating each of the separate components or phases of a

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[71] Draft EIR, p. 4.2-24.

[72] Draft EIR, p. 4.2-15.

[73] BAAQMD, *CEQA Air Quality Guidelines*, pp. 4-5 through 4-7.

[74] Draft EIR, p. 4.2-24.

[75] *See* Draft EIR, Appx. D, printouts of CalEEMod runs.

Project independently. Accordingly, the Draft EIR should have evaluated the potential significance of operational emissions from the Raintree site and the Sares Regis site, "combined."[76] As with its evaluation of construction emissions, the Draft EIR evaluates operational emissions on the Raintree site in isolation from emissions from development of the Sares Regis site. This approach results in a failure to disclose and mitigate potentially significant impacts. When the Project's operational emissions are analyzed as a whole, as required by CEQA, they result in significant, undisclosed impacts on air quality.

Using the estimates presented in the Draft EIR,[77] the table below compares the Project's combined operational pollutant emissions of ROG, NOx, PM10 and PM2.5 to the BAAQMD's respective daily thresholds of significance for project operations.

Operational Pollutant Emissions (lb/day)

	ROG	**NOx**	**PM10**	**PM2.5**
Applicant Proposed Scenarios				
Sares Regis	17.0	10.0	9.0	1.0
Raintree	37.0	21.0	20.0	2.0
Total Applicant Proposed Scenarios	**54.0**	**31.0**	**29.0**	**3.0**
BAAQMD Threshold	54	54	82	54
Significant?	**YES**	no	no	no
Full Buildout Scenarios				
Sares Regis	20.0	11.0	11.0	1.0
Raintree	52.0	27.0	28.0	2.0
Total Full Buildout Scenarios	**72.0**	**38.0**	**39.0**	**3.0**
BAAQMD Threshold	54	54	82	54
Significant?	**YES**	no	no	no

The table shows that total ROG operational emissions from the *Sares Regis* and *Raintree Applicant Proposed Scenarios*, 54.0 lb/day, are the same as the BAAQMD's threshold of significance for operational emissions of this pollutant and are therefore significant. (The BAAQMD's CEQA Air Quality Guidelines state: "If, after proper analysis, the project or plan's air quality impacts are found to be *below the significance thresholds* determined by the lead agency, then the air quality impacts may be considered less than significant.")[78] Further, total operational ROG emissions for the *Sares Regis* and *Raintree Applicant Proposed Scenarios*, 72.0 lb/day, by far exceed the BAAQMD's threshold of significance and are therefore significant. The Draft EIR fails to

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[76] City of Sunnyvale, Notice of Completion of an Environmental Impact Report for the East Weddell Residential Projects at p. 1 (stating that the "project" is defined as "the two development projects *combined*").

[77] Draft EIR, Tables 4.2-7 (Sares Regis) and 4.2-8 (Raintree).

[78] BAAQMD, CEQA Air Quality Guidelines, p. 1-4, *emphasis* added.

recognize and mitigate these significant impacts on air quality based on its own analyses.

IV. The Draft EIR's Proposed Mitigation Measures Fail to Reduce Community Health Risks during Operation of the Project to a Less-than-significant Level

The Project would place sensitive receptors near potential sources of TAC emissions. Specifically, the Project would locate new residences adjacent to two busy roadways, Highway 101 and North Fair Oaks Avenue, and within 1000 feet of five diesel-fired emergency backup generators.[79] The Draft EIR finds that emissions from Highway 101 traffic would cause significant excess cancer risk for future residents throughout the entire Sares Regis site and across portions of the Raintree site under both *Applicant Proposed* and *Full Buildout* scenarios.[80] Significant annual PM2.5 concentration would occur across portions of the Sares Regis and the Raintree sites under both *Applicant Proposed* and *Full Buildout* scenarios.[81] In addition, the Draft EIR finds that annual PM2.5 concentrations from cumulative sources would be significant for the *Raintree Full Buildout Scenario*.[82]

To reduce the long-term exposure of future residents to TACs, the Draft EIR requires implementation of Mitigation Measure AIR-4, which consists of the following five recommendations:

1. Provides site layout recommendations to locate windows and air intakes as far as possible from Highway 101 traffic lanes and to plant additional trees along the highway edge.
2. Requires installation of an air filtration system rated at a minimum efficiency rating value ("MERV") of 13 or higher where sensitive receptors are predicted to be exposed to PM2.5 concentrations above 0.3 $\mu g/m^3$ and maintained as long as significant excess cancer risks or annual PM2.5 concentrations are predicted.
3. Requires that lease agreement include cleaning, maintenance and monitoring requirements; provide information on ventilation system to owners and tenants; and include provisions that fees associated with owning or leasing a unit include funds for cleaning, maintenance, monitoring, and replacement of the air filtration system.
4. Suggests that applicants "consider" phasing developments located within 330 feet of Highway 101 to "avoid significant excess cancer risks and required installation of filtered ventilation systems."

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[79] Draft EIR, pp. 4.2-24 and 4.2-36.

[80] Draft EIR, p. 4.2-37.

[81] Draft EIR, p. 4.2-37.

[82] *Ibid*.

5. Requires that prior to building occupancy, an authorized air pollutant consultant verify the installation of all necessary measures to reduce toxic air contaminant exposure.

The Draft EIR finds that that with implementation of these five recommendations, the community risk for sensitive receptors at the two project sites would be reduced to a less-than-significant level.[83] The Draft EIR's conclusion is not supported by an adequate quantitative demonstration. Further, the proposed mitigation is not adequate to reduce impacts to less than significance.

Phasing Developments

Mitigation Measure AIR-4(4) appears to eliminate the requirement for air filtration systems if development within a site is phased. Specifically, the measure states "Consider phasing developments located within 330 feet of Highway 101 to avoid significant excess cancer risks and required installation of filtered ventilation systems (described above). Note that new United States Environmental Protection Agency (U.S. EPA) engines standards combined with California Air Resources Board (CARB) rules and regulations will reduce on-road emissions of diesel particulate matter (DPM) and PM 2.5 substantially, especially after 2014." The Draft EIR provides is no discussion how it arrived at 330 feet nor does it provide a quantitative justification that cancer risks would be reduced to below the significance threshold or a requirement to prepare a health risk assessment in case the project components are phased. Simply because emission standards will reduce on-road emissions it does not follow that emissions are necessarily reduced to a level that results in cancer risks below the significance threshold by the time the phased project would be inhabited. Considering that the excess cancer risks from Highway 101 alone were estimated at 20.1 in one million for the Sares Regis site and 26.3 in one million for the Raintree site[84], this is highly unlikely since vehicle emissions would have to be reduced by more than fifty percent to reduce cancer risk below the significance threshold of ten in one million. Despite EPA's and CARB's regulations for engine standards, a reduction of 50 percent of emissions over those assumed in the Draft EIR will not occur in the near future. The Draft EIR states that "CARB anticipates a 68-percent reduction in PM2.5 (including DPM) emission from trucks in 2014 with this regulation."[85] CARB's estimate for a 68 percent reduction in emissions by 2014 is based on a comparison of estimated emission reductions by its on-road rule for trucks and buses *compared to a year 2000 baseline*,[86] not compared to the

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[83] Draft EIR, p. 4.2-20.

[84] Draft EIR, Tables 4.2-10 (Sares Regis) and 4.2-11 (Raintree).

[85] Draft EIR, p. 4.2-27.

[86] *See*, for example, CARB, Updated Informative Digest, Adoption of New Regulation to Reduce Emissions of Diesel Particulate Matter, and Other Pollutants from In-Use Heavy-Duty Diesel-Fueled

2014 baseline assumed by the Draft EIR's emission estimates. Further, while the rule was adopted by CARB in 2007, CARB did not receive authorization from EPA to implement the rule until September 13, 2013.[87] Enforcement of the restrictions on adding Tier 0 and Tier 1 vehicles to existing vehicle fleets will not begin until January 1, 2014. Enforcement of the first fleet average requirements for large fleets (> 5,000 total fleet horsepower) will begin on July 1, 2014. Tier 2 requirements for large and medium fleets will not begin until January 1, 2018, for, and for small fleets until January 1, 2023.[88] Therefore, it will take many years for the rule to fully take effect and emission reductions compared to the 2014 baseline assumed by the Draft EIR will be considerably less than 50 percent by the time any "phased" project component would be inhabited. I recommend that the City strike this mitigation measure from the document.

Air Filtration Systems

Mitigation Measure AIR-4(5) requires that "prior to building occupancy, an authorized air pollutant consultant verify the installation of all necessary measures to reduce toxic air contaminant exposure." The Draft EIR neither specifies what qualifications this air pollutant consultant must possess nor by whom the consultant would be authorized.

Further, the Draft EIR provides the following discussion how the authorized air pollutant consultant would verify whether all necessary measures are installed:

> A properly maintained vegetative barrier *could* reduce particulate concentrations, including DPM, by an estimated 30 percent. Combined with the vegetation barrier along the freeway, a properly installed and operated ventilation system with MERV13 air filters *may* reduce PM 2.5 concentrations from DPM mobile and stationary sources by approximately 70 percent indoors when compared to outdoors. A ventilation system with MERV16 filters *could* achieve reductions of 90 percent. … The overall effectiveness calculations take into consideration time spent outside and the outdoor exposure of each affected unit. The U.S. EPA

Vehicles as Part of the Public Hearing to Consider Proposed Regulation to Reduce Emissions from In-Use On-Road Diesel Vehicles, and Amendments To The Regulations for In-Use Off-Road Vehicles, Drayage Trucks, Municipality and Utility Vehicles, Mobile Cargo Handling Equipment, Portable Engines and Equipment, Heavy-Duty Engines and Vehicle Exhaust Emissions Standards and Test Procedures and Commercial Motor Vehicle Idling, 2008; available at http://www.arb.ca.gov/regact/2008/truckbus08/pt2uid.pdf.

[87] *See* CARB, In-Use Off-Road Diesel Vehicle Regulation; http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm.

[88] CARB, Regulatory Advisory, Enforcement of the In-Use Off-Road Vehicle Regulation, September 2013; http://www.arb.ca.gov/msprog/mailouts/msc1325/msc1325.pdf.

> reports that people, on average, spend 90 percent of their time indoors. The overall effectiveness calculations should take into effect time spent outdoors. Assuming 2 hours of outdoor exposure plus 1 hour of open windows (calculated as outdoor exposure) per day, the overall effectiveness of filtration systems would be about 60 percent for MERV13 systems and about 80 percent for MERV16 systems.
>
> A ventilation system with MERV13 filtration would be necessary to reduce cancer risk to less-than-significant levels for areas where cancer risk is between 10 and 25.0 per million. A more efficient filtration system would be required for cancer risks that exceed 25.0 per million. A ventilation system with MERV16 filters would result in cancer risk of less than 10 per million where outdoor cancer risk is predicted to be 50.0 per million or less. …
>
> PM2.5 concentrations would also be reduced with the ventilation system that uses a MERV13 filter or greater. Maximum annual PM2.5 concentrations of 0.75 $\mu g/m^3$ or less *could* be mitigated using ventilation systems with MERV13 filters.[89]

In sum, Mitigation Measure AIR-4(5) instructs the "authorized air pollutant consultant" to verify that all residential units would have an air filtration system installed rated at MERV 13 for those units identified by the Draft EIR with cancer risks between 10 and 25 per million and at MERV16 for those units identified by the Draft EIR with cancer risks above 25 per million. The problems with this measure are manifold.

First, presumably, the "authorized air pollutant consultant" would refer to the figures provided by the Draft EIR showing cancer risks for individual buildings (Figure 4.2-2 for Sares Regis site and Figure 4.2-4 for Raintree site). However, these figures show only modeled cancer risks resulting from Highway 101 traffic emissions. Traffic emissions from North Fair Oaks Avenue, another high volume roadway, and nearby stationary sources are not included in the modeling.

Second, it is not as easy as simply installing a MERV13-rated filter for one residential unit and a MERV16-rated filter for another residential unit. Air filtration systems, which serve the entire building, must be properly sized to accommodate the resistance to airflow from the installed filters.[90] A building ventilation system may

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[89] Draft EIR, p. 4.2-39 and 4.2-40, *emphasis* added.

[90] California Air Resources Board, Status of Research on Potential Mitigation Concepts to Reduce Exposure to Nearby Traffic Pollution, August 23, 2012; available at http://www.arb.ca.gov/research/health/traff-eff/research%20status%20-reducing%20exposure%20to%20traffic%20pollution.pdf. ("High efficiency filters associated with central

accommodate one or the other MERV rating but not both at the same time. Further, a MERV designation for the filters alone is insufficient. Even though this represents a comprehensive specification for the filter itself, it does not address the efficiency of the total air filtration system in the building because it does not address the total performance of the air filter when considered in tandem with the filter holding device. The use of a MERV-rated filter in a holding frame or housing that has gaps or leaks defeats any filter evaluation system. Air flow will follow the path of least resistance. Since a filter offers airflow resistance, gaps or leaks within the holding mechanism will allow air bypass. Therefore, system performance must be evaluated to assure that all the air moving through the system is treated by the filter. To ensure that the building's entire air filtration system would function at the specified efficiency, other aspects of the ventilation system design such as ventilation rates, infiltration rates, and maintenance of positive pressure must be explicitly specified.

Third, MERV16-rated filters and systems are considerably more costly than MERV13-rated filters and systems and are typically only installed only in hospitals and general surgery. Even superior residential developments typically have a maximum of MERV13-rated filtration systems installed. The Draft EIR does not discuss the feasibility of a MERV16-rated filtration system for a residential development.

Fourth, the Draft EIR's assumption that cancer risks would be reduced levels below the significance threshold of 10 in one million by the respective filtration systems rests on the assumption that the filtration system would be fully operational and effective for 21 hours per day (residents would open their window for one hour per day and spend two hours outdoors) at an assumed rating of 70 percent for MERV13 and 90 percent for MERV16.[91] This assumption is not supported. Residents may open their windows for longer time periods than one hour per day. Further, filters are not uniformly effective for filtering particles of all sizes but are increasingly less efficient for decreasing particle sizes. A MERV13 has no minimum requirement for removing 0.3 to 1.0 micrometer particles; a MERV16 is designed to remove 95% of this particle range. Neither rating ensures any removal of ultrafine particles, *i.e.*, those smaller than 100 nanometers (<0.1 micrometers) which associated with more aggressive health implications than larger particles. Because a large number of particles emitted by motor vehicles are smaller than 50 nanometers[92] (<0.05 micrometers), the effectiveness of filtration systems at reducing cancer risks cannot be assumed to be identical to its specified filtration efficiency. Finally, as recognized by the Draft EIR, while the

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heating, ventilating and air conditioning (HVAC) systems must be carefully selected to assure the mechanical system can handle the increased airflow resistance.")

[91] MERV13: (cancer risk: 25 in one million)(100%-70%)(21 hours)/(24 hours) = 9.69 in one million.

[92] Kittelson, D.B., Engines and Nanoparticles: A Review, Journal of Aerosol Science, 1998, 29, pp. 575-588.

proposed filtration systems *could* theoretically achieve the specified removal efficiencies, however, these removal efficiencies are not guaranteed, are affected by maintenance, and the effectiveness of air filtration systems may be compromised by allowing air flow from open windows and has not been studied. The California Air Resources Board ("CARB") discusses the limitations of air filtration systems as follows:

> Although they can substantially reduce indoor concentrations of pollutants, mechanical filtration systems alone are insufficient to fully protect occupants from particles and other emissions from nearby roadways, for several reasons.
>
> - First, most people tend to open their windows or doors at least part of each day (Offermann, 2009; Phillips et al., 1990), and such natural ventilation involves no filtration of incoming air and can diminish any pollutant reductions attained through the use of the mechanical system. The effectiveness of high efficiency filtration in homes whose occupants open their doors and windows regularly has not been quantified.
> - Second, as higher MERV filters are used, greater attention must be paid to the increased air flow resistance that occurs with some filter types; mechanical system motors must be sufficiently sized to accommodate the air flow needs.
> - Third, studies have shown that homeowners are not provided with sufficient information regarding use and maintenance of their central HVAC systems, or do not read and follow instructions for maintaining their filters (EPA, 2009; Offermann, 2009). Filtration is only effective if filters are well-fitted and are replaced or maintained according to the manufacturer's recommendations, and duct leakage is minimized (Thatcher et al., 2001; Wallace et al., 2004). Older (aged) filters have been associated with increased irritant health symptoms and decreased work performance in studies of filtration maintenance in workplaces (Clausen, 2004; Seppänen and Fisk, 2002; Wargocki et al., 2004).
> - Finally, as discussed above, gaseous pollutants are not removed by most particle filters, and the technologies for VOC removal in residential applications are limited and still evolving.

Finally, the City should require a construction indoor air quality ("IAQ") management plan to prevent indoor air quality problems resulting from the construction process in order to protect the building's occupants after construction is complete and people move into the building. The following control measures have been suggested to meet the U.S. Green Building Council Leadership in Energy and Environmental Design ("LEED") Green Building Rating System:

- A common practice used to protect the HVAC system during construction is to shut down the return side of the HVAC system during heavy construction activities, and to replace the ventilation system filters at frequent intervals throughout the construction process. Returns should be shrink-wrapped with plastic or even dampered off during especially disruptive construction activities.

- Temporary barriers should be constructed in an effort to isolate areas under construction from clean or occupied areas. If weather permits, construction areas should also be ventilated directly to the outdoors if particularly dusty operations or installation of VOC-emitting materials are being performed.
- Ensure that materials stored onsite do not get contaminated by dirt or other particulate matter that is always present on construction sites. An overall jobsite maintenance program should be developed that includes the storage and protection of building materials in a dry, clean location. Ductwork should be delivered to the jobsite shrink-wrapped on both ends until immediately prior to installation, and the returns should be kept wrapped until final installation of the finish grates. Implementing a no smoking policy for the workers during construction, using HEPA vacuums for cleanup, and making everyone on the jobsite aware of the housekeeping plan through onsite training programs.
- Conduct a minimum two-week building flush-out with new MERV 13 filtration media at 100% outside air. After the two-week flush-out is complete, new MERV 13 filters must be replaced in all locations except those that have been processing only outside air during the flush-out.[93]

V. The Project Is Inconsistent with the City's General Plan

The City's General Plan includes the following goal and policy relevant to the air quality impacts of proposed project:

> GOAL EM-11 – Improved Air Quality: Improve Sunnyvale's air quality and reduce the exposure of its citizens to air pollutants.
>
> Policy EM-11.3: Require all new development to utilize site planning to protect citizens from unnecessary exposure to air pollutants.

While the Draft EIR identifies the City's General Plan goal and policy for protecting its citizens from air pollution[94], it fails entirely to make a finding whether the Project (or any of the individual buildout scenarios) would be consistent with the General Plan's goal and policy for air quality. As discussed in the above comments, the Project as a whole and its individual scenarios are inconsistent with the General Plan's goal and policy for air quality and protection of its citizens because the Draft EIR fails to mitigate impacts with respect to air quality and community health risks to levels below significance.

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[93] Abbreviated from: Southwest Contractor, Indoor Air Quality Management Plan to Meet LEED Requirements; available at http://southwest.construction.com/features/archive/0510_feature7.asp.

[94] Draft EIR, p. 4.2-14.

VI. Recommendation

It appears that the Project location is particularly poorly suited for residential development. As discussed, even with advanced filtration systems, community cancer risks for future residents cannot be reduced to less-than-significant levels. Given the proposal by the Applicants to include low-income residential units, this raises environmental justice issues that were not addressed by the Draft EIR and should be carefully evaluated. In light of these significant and unmitigable impacts, I recommend that the City deny approval of any residential project at this particular location.

Please feel free to call me at (415) 492-2131 or e-mail at petra.pless@gmail.com if you have any questions.

With best regards,

Petra Pless, D.Env.

Petra Pless, D.Env.

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Dr. Pless has over 15 years of experience in environmental engineering and science conducting and managing interdisciplinary environmental research projects and preparing and reviewing environmental permits and other documents for U.S. and European stakeholder groups. This broad-based experience includes air quality and air pollution control; water quality, water supply, and water pollution control; biology; public health and safety; and noise studies. National Environmental Policy Act ("NEPA"), California Environmental Quality Act ("CEQA"), and Clean Air Act ("CAA") review; industrial ecology and risk assessment; and use of a wide range of environmental software.

EDUCATION

Doctorate in Environmental Science and Engineering (D.Env.), University of California, Los Angeles, 2001

M.S. Biology (with focus on botany/ecology/limnology), Technical University of Munich, Germany, 1991

PROFESSIONAL HISTORY

Environmental consultant 2006–present

Leson & Associates (previously Leson Environmental Consulting), Kensington, CA, Environmental Scientist/Project Manager, 1997–2005

University of California Los Angeles, Graduate Research Assistant/Teaching Assistant, 1994–1996

ECON Research and Development, Environmental Scientist, Ingelheim, Germany, 1992–1993

Biocontrol, Environmental Projects Manager, Ingelheim, Germany, 1991–1992

REPRESENTATIVE EXPERIENCE

Air Quality and Pollution Control

Projects include CEQA/NEPA review; attainment and non-attainment new source review ("NSR"), prevention of significant deterioration ("PSD") and Title V permitting; control technology analyses (BACT, LAER, RACT, BARCT, MACT); technology evaluations and cost-effectiveness analyses; criteria and toxic pollutant emission inventories; emission offsets; ambient and source monitoring; analysis of emissions estimates and ambient air pollutant concentration modeling. Some typical projects include:

- Critically reviewed and prepared technical comments on the air quality, biology, noise, water quality, and public health and safety sections of CEQA/NEPA documents for numerous commercial, residential, and industrial projects (*e.g.*, power plants, airports, residential developments, retail developments, hospitals, refineries, slaughterhouses, quarries, and mines).
- Critically reviewed and prepared technical comments on the air quality and public health sections of the Los Angeles Airport Master Plan (Draft, Supplement, and Final Environmental Impact Statement/Environmental Impact Report) for the City of El Segundo. Provided technical comments on the Draft and Final General Conformity Determination for the preferred alternative submitted to the Federal Aviation Administration.
- For several California refineries, evaluated compliance of fired sources with Bay Area Air Quality Management District ("BAAQMD") Rule 9-10. This required evaluation and review of hundreds of source tests to determine if refinery-wide emission caps and compliance monitoring provisions were being met.
- Critically reviewed and prepared technical comments on Draft Title V permits for several refineries and other industrial facilities in California.
- Reviewed state-wide average emissions, state-of-the-art control devices, and emissions standards for construction equipment and developed recommendations for mitigation measures for numerous large construction projects.
- Researched sustainable building concepts and alternative energy and determined their feasibility for residential and commercial developments, *e.g.*, regional shopping malls and hospitals.
- Evaluated the public health impacts of locating big-box retail developments in densely populated areas in California and Hawaii. Monitored and evaluated impacts of diesel exhaust emissions and noise on surrounding residential communities.
- In conjunction with the permitting of several residential and commercial developments, conducted studies to determine baseline concentrations of diesel exhaust particulate matter using an aethalometer.
- For an Indiana steel mill, evaluated technology to control NOx and CO emissions from fired sources, including electric arc furnaces and reheat furnaces, to establish BACT. This required a comprehensive review of U.S. and European operating experience. The lowest emission levels were being achieved by steel mills using selective catalytic reduction ("SCR") and selective non-catalytic reduction ("SNCR") in Sweden and The Netherlands.
- For a California petroleum coke calciner, evaluated technology to control NOx, CO, VOCs, and PM10 emissions from the kiln and pyroscrubbers to establish BACT and LAER. This required a review of state and federal clearinghouses, working with regulatory agencies and pollution control vendors, and obtaining and reviewing permits and emissions data from other similar facilities. The best-controlled facilities were located in the South Coast Air Quality Management District ("SCAQMD").
- For a Kentucky coal-fired power plant, identified the lowest NOx levels that had been permitted and demonstrated in practice to establish BACT. Reviewed operating experience of European, Japanese, and U.S. facilities and evaluated continuous emission monitoring data.

The lowest NOx levels had been permitted and achieved in Denmark and in the U.S. in Texas and New York.

- In support of efforts to lower the CO BACT level for power plant emissions, evaluated the contribution of CO emissions to tropospheric ozone formation and co-authored report on same.
- Critically reviewed and prepared technical comments on applications for certification ("AFCs") for numerous natural-gas fired and geothermal power plants in California permitted by the California Energy Commission ("CEC"). The comments addressed construction and operational emissions inventories and dispersion modeling, BACT determinations for combustion turbine generators, etc.
- Critically reviewed and prepared technical comments on draft PSD permits for several natural gas-fired power plants in California, Indiana, and Oregon. The comments addressed emission inventories, BACT, case-by-case MACT, compliance monitoring, cost-effectiveness analyses, and enforceability of permit limits.
- For a California refinery, evaluated technology to control NOx and CO emissions from CO Boilers to establish RACT/BARCT to comply with BAAQMD Rule 9-10. This required a review of BACT/RACT/LAER clearinghouses, working with regulatory agencies across the U.S., and reviewing federal and state regulations and State Implementation Plans ("SIPs"). The lowest levels were required in a SCAQMD rule and in the Texas SIP.
- In support of several federal lawsuits filed under the Clean Air Act, prepared cost-effectiveness analyses for SCR and oxidation catalysts for simple cycle gas turbines and evaluated opacity data.
- Critically reviewed draft permits for several ethanol plants in California, Indiana, and Ohio and prepared technical comments.
- Provided comprehensive environmental and regulatory services for an industrial laundry chain. Facilitated permit process with the SCAQMD. Developed test protocol for VOC emissions, conducted field tests, and used mass balance methods to estimate emissions. Reduced disposal costs for solvent-containing waste streams by identifying alternative disposal options. Performed health risk screening for air toxics emissions. Provided permitting support with SCAQMD. Renegotiated sewer surcharges with wastewater treatment plant. Identified new customers for shop-towel recycling services.
- Designed computer model to predict performance of biological air pollution control (biofilters) as part of a collaborative technology assessment project, co-funded by several major chemical manufacturers. Experience using a wide range of environmental software, including air dispersion models, air emission modeling software, database programs, and geographic information systems ("GIS").

Water Quality and Pollution Control

Experience in water quality and pollution control, including surface water and ground water quality and supply studies, evaluating water and wastewater treatment technologies, and identifying, evaluating and implementing pollution controls. Some typical projects include:

- For a homeowner's association, reviewed a California Coastal Commission staff report on the replacement of 12,000 linear feet of wooden bulkhead with PVC sheet pile armor. Researched and evaluated impact of proposed project on lagoon water quality, including sediment resuspension, potential leaching of additives and sealants, and long-term stability. Summarized results in technical report.
- For a 500-MW combined-cycle power plant, prepared a study to evaluate the impact of proposed groundwater pumping on local water quality and supply, including a nearby stream, springs, and a spring-fed waterfall. The study was docketed with the CEC and summarized in a journal article.
- Evaluated impacts of on-shore oil drilling activities on large-scale coastal erosion in Nigeria.
- For a 500-MW combined-cycle power plant, identified and evaluated methods to reduce water use and water quality impacts. These included the use of zero-liquid-discharge systems and alternative cooling technologies, including dry and parallel wet-dry cooling. Prepared cost analyses and evaluated impact of options on water resources. This work led to a settlement in which parallel wet dry cooling and a crystallizer were selected, replacing 100 percent groundwater pumping and wastewater disposal to evaporation ponds.

Applied Ecology, Industrial Ecology and Risk Assessment

Experience in applied ecology, industrial ecology and risk assessment, including human and ecological risk assessments, life cycle assessment, evaluation and licensing of new chemicals, and fate and transport studies of contaminants. Experienced in botanical, phytoplankton, and intertidal species identification and water chemistry analyses. Some typical projects include:

- For the California Coastal Conservancy, San Francisco Estuary Institute, Invasive Spartina Project, evaluated the potential use of a new aquatic pesticide for eradication of non-native, invasive cordgrass (*Spartina spp.*) species in the San Francisco Estuary with respect to water quality, biological resources, and human health and safety. Assisted staff in preparing an amendment to the Final EIR.
- Evaluated likelihood that measured organochlorine pesticide concentrations at a U.S. naval air station are residuals from past applications of these pesticides consistent with manufacturers' recommendations. Retained as expert witness in lawsuit.
- Prepared human health risk assessments of air pollutant emissions from several industrial and commercial establishments, including power plants, refineries, and commercial laundries.
- Managed and conducted studies to license new pesticides. This work included the evaluation of the adequacy and identification of deficiencies in existing physical/chemical and health effects data sets, initiating and supervising studies to fill data gaps, conducting environmental fate and transport studies, and QA/QC compliance at subcontractor laboratories. Prepared licensing applications and coordinated the registration process with German licensing

agencies. This work led to regulatory approval of several pesticide applications in less than six months.

- Designed and implemented database on physical/chemical properties, environmental fate, and health impacts of pesticides for a major European pesticide manufacturer.
- Designed and managed toxicological study on potential interference of delta-9-tetrahydro-cannabinol in food products with U.S. employee drug testing; co-authored peer-reviewed publication.
- Critically reviewed and prepared technical comments on AFCs for several natural-gas fired and geothermal power plants and transmission lines in California permitted by the CEC. The comments addressed avian collisions and electrocution, construction and operational noise impacts on wildlife, risks from brine ponds, and impacts on endangered species.
- For a 180-MW geothermal power plant, evaluated the impacts of plant construction and operation on the fragile desert ecosystem in the Salton Sea area. This work included baseline noise monitoring and assessing the impact of noise, brine handling and disposal, and air emissions on local biota, public health, and welfare.
- Designed research protocols for a coastal ecological inventory; developed sampling methodologies, coordinated field sampling, determined species abundance and distribution in intertidal zone, and analyzed data.
- Designed and conducted limnological study on effects of physical/chemical parameters on phytoplankton succession; performed water chemistry analyses and identified phytoplankton species; co-authored two journal articles on results.
- Conducted technical, ecological, and economic assessments of product lines from agricultural fiber crops for European equipment manufacturer; co-authored proprietary client reports.
- Developed life cycle assessment methodology for industrial products, including agricultural fiber crops and mineral fibers; analyzed technical feasibility and markets for thermal insulation materials from plant fibers and conducted comparative life cycle assessments.
- Conducted and organized underwater surveying and mapping of plant species in several lakes and rivers in Sweden and Germany as ecological indicators for the health of limnological ecosystems.

PRO BONO ACTIVITIES

Founding member of "SecondAid," a non-profit organization providing tsunami relief for the recovery of small family businesses in Sri Lanka. (www.secondaid.org)

PROFESSIONAL AFFILIATIONS

Association of Environmental Professionals

SELECTED PUBLICATIONS

Leson G. and Pless P., Hemp seeds and hemp oil, in: Grotenhermen F. and Russo E. (eds.), *Cannabis* und Cannabinoids, Pharmacology, Toxicology, and Therapeutic Potential, The Haworth Integrative Healing Press, New York, 2002.

Leson G., Pless P., Grotenhermen F., Kalant H., and ElSohly M., Evaluating the impact of hemp food consumption on workplace drug tests, Journal of Analytical Toxicology, Vol. 25, No. 11/12, pp. 1-8, 2001.

Leson G. and Pless P., Assessing the impact of THC uptake from hemp oil cosmetics on workplace drug testing, Report to the Agricultural Research and Development Initiative ("ARDI"), Morris, MB, 2001.

Pless P., Technical and environmental assessment of thermal insulation materials from fiber crops, doctoral dissertation in Environmental Science and Engineering, University of California, Los Angeles, 2001.

Center for Waste Reduction Technologies in the American Institute of Chemical Engineers, Collaborative Biofilter Project, Technical Report, co-author with Leson G. of sections 'Compound Database,' 'Design Manual,' and 'Literature Database,' 1998.

Hantke B., Domany I., Fleischer P., Koch M., Pless P., Wiendl M., and Melzer M., Depth profiles of the kinetics of phosphatase activity in hardwater lakes of different trophic level, Arch. Hydrobiologia, vol. 135, pp. 451–471, 1996.

Hantke B., Fleischer P., Domany I., Koch M., Pless P., Wiendl M., and Melzer M., P-release from DOP by phosphatase activity in comparison to P-excretion by zooplankton: studies in hardwater lakes of different trophic level, Hydrobiologia, vol. 317, pp. 151–162, 1996.

Pless P., Untersuchungen zur Phytoplanktonentwicklung im Herrensee (investigations on phytoplankton succession in an oligotrophic hardwater lake), Masters Thesis in biology with focus on botany/ecology/limnology, Technical University of Munich, Germany, 1991.

Attachment C

COUNTY LEADS STATE IN CONTAMINATION FROM OLD ORCHARDS

By April Lynch Mercury News San Jose Mercury News
Posted:
MercuryNews.com

Santa Clara County's most neglected environmental problem sits right under our feet.

While officials have spent decades cleaning up toxins from the technology industry, no state or county agency has tried to gauge the scope of an older hazard - agricultural pesticides left by the farms and orchards that once covered Silicon Valley.

Santa Clara County has more toxic cleanup sites involving old orchard pesticides than any county in California, as well as a significant number of other sites contaminated by other types of farming or pesticide handling, according to a Mercury News analysis of state records.

But most of those sites have been found, documented and cleaned up only because developers recently wanted to build on them, not because environmental investigators went searching for them. Given the limits of that approach, the problem is almost certainly more extensive than official records suggest.

That's because much of the region's former farmland was turned into homes, shopping centers and office buildings long before soil testing for old pesticides was required.

As a result, tens of thousands of acres have never been scrutinized for lead, arsenic, DDT or other legacypesticides, as experts call them. And health investigators have never examined whether these old toxins may have caused health problems over the years.

Tests conducted by the Mercury News at eight public parks suggest that undetected "hot spots" exist. For example, one sample from a park in Los Altos, still home to remnants of a walnut orchard, showed combined levels of DDT compounds above the state definition of hazardous waste.

Unlike other parts of the country with farming pasts, California doesn't offer residents simple public health and safety advice about living on old orchard land.

Those lapses, some experts say, put people at risk every day.

Law limitations: Land-use changes spur testing

"This isn't something to be taken lightly," said Richard Wiles, executive director of Environmental Working Group, a Washington, D.C., non-profit focused on toxins research. "People are being exposed and they don't even know it."

With limited funding and legal authority, officials say they pursue the problem as aggressively as they can. Many building projects now require at least some government-scrutinized environmental review, which makes catching problems such as pesticides more likely than in earlier decades.

Santa Clara County, which has done no exploratory pesticide testing, says it's the state's job to promote soil safety. But except for a school testing program, the state does not actively search for legacy pesticide pollution.

The state says that under current law, as long as pesticides were used on a farm within normal and acceptable practices for the time, environmental regulators cannot scrutinize the land until it is used for another purpose.

"We don't really look for legacy pesticides unless we look at a change in land use," said Barbara Cook, division chief for the state Department of Toxic Substances Control, which handles most of the state's soil contamination cases. "It's not something we would have the authority to look at."

In many cases, soil contaminated by old pesticides probably isn't dangerous. At very low levels, pesticides are usually harmless, toxicologists say. In California, that's made the issue a lower priority.

But long-term exposure to higher concentrations poses health risks. And other states chase the ghosts of their former farms more aggressively.

"It is a hard issue," said Dave Bradley, a policy manager with Washington state's Department of Ecology, which tests parks and school play areas for old pesticide residues in farm-rich eastern Washington as part of a statewide push for safer soil. "But it is harder not to look at it comprehensively. There are always going to be questions, but we decided to take some simple steps."

Old pesticides are tricky pollutants. They break down slowly, persisting in soil for decades or longer. Some of these toxins, such as lead and arsenic, don't move easily, making them a bigger problem in soil than water. Other pesticides, such as DDT, are more mobile and sometimes taint water, although soil contamination remains a bigger issue in this county.

The use of these pesticides varied widely from crop to crop, and orchard to orchard. In a neighborhood now, that means one home's yard might show low but safe levels of pesticide residue, while another home a block away could have risky levels.

"Dose makes a poison," said Ron Tjeerdema, a professor of environmental toxicology at the University of California-Davis, who takes a restrained view of the issue. "We know legacy pesticides are in certain locations. But just because they are there doesn't automatically make them a problem."

Officials gauge the problem every time they are asked to oversee a potential pesticide site. In Santa Clara County, the state Department of Toxic Substances Control supervises most such cases, although some are handled locally. According to a Mercury News tally of state and county records, 54 sites involving old agricultural pesticides in Santa Clara County have required significant study or cleanup.

They range from Santa Clara's 152-acre Rivermark retail and housing development, where cleanup of unsafe levels of toxins including arsenic, lead and DDT involved removing more than 450,000 tons of soil, to a four-acre housing and park project in San Jose that required little more than moving DDT-laden soil and burying it under a parking lot.

But these sites have been documented only since the late 1980s as stricter environmental enforcement compelled developers to test for and report contamination. That reactive method only nibbles at the problem. The sites logged in state and county files cover just 3,200 acres - about 3 percent of the county's former farm and orchard land.

The Mercury News' tests showed that pesticides are not isolated to the sites already recorded in officials'

files. The newspaper tested for arsenic, lead, DDT and other banned synthetic pesticides such as dieldrin.

In addition to the elevated DDT level at Los Altos' Heritage Oaks Park, arsenic levels at all eight tested parks exceeded state health standards. It's difficult to say whether the high arsenic levels come from natural or agricultural sources. But one park in Santa Clara slightly exceeded the generally accepted residential standard for naturally occurring arsenic in the region.

In Los Altos, public works superintendent Brian McCarthy said the city hasn't done any soil testing of its own in parks, but may take a closer look at Heritage Oaks. Part of the five-acre park features grass and playgrounds. A small section of open dirt at the back, dotted with walnut trees, is kept as open space.

"We'd want to look at it and make it a safe site, if it's not safe," McCarthy said.

The Mercury News tests could not determine the overall safety of any one park. That would require many more tests - work that most local cities haven't undertaken.

San Jose's review: Projects checked for pesticide studies

San Jose, however, pursues old pesticides more than other local communities. It recently started an environmental review of all its parks. The city also aggressively reviews building permit applications that involve subdividing land to make sure adequate environmental review, including pesticide studies, are done.

Last year, city officials said, 35 projects required assessment for agricultural chemicals; of those, 12 required some level of cleanup by the owner or developer.

"It's just a matter of putting the dots together," said Napp Fukuda, the city's environmental compliance officer. "At first, people think 'Farmland? Great!' But historically we used a lot of things over time that weren't so good."

To understand what lies in Santa Clara County's soil, look back about 100 years when growers first sought big money in tiny blossoms.

The valley's sunny climate and rich soil made it ideal for soft fruits, such as plums, prunes, cherries and apricots. Unfortunately, the crops lured more than 40 varieties of hungry moths, worms and other pests.

Local farmers looked for help. The answer, they heard, was pesticides.

"They said it was the only way to get a consistent yield," said Charlie Olson, 72, who remembers his father's stories of joining other growers to seek pesticide advice from experts in Davis in 1918. "And once you started spraying, you had to continue. You came to depend on it."

Back then, pesticides meant progress, not possible health hazards. Olson, the son of a long-time Sunnyvale orchard family, still runs some of the valley's last fruit-producing acres. He recalls coming in from spraying the orchards covered in blue residue. To scrub off the goo, he'd bathe in kerosene. He's not worried.

"The sprays did the job and harmed nobody," he said. "Now, people overreact."

Early in the 20th century, toxic metals such as lead, copper and arsenic formed the most effective pesticides. Many fruit growers reached for lead arsenate - literally, a powdered blend of lead and arsenic that was mixed with water and sprayed onto trees at regular intervals throughout the year.

In the late 1940s, DDT arrived. The synthetic bug killer was cheaper and more lethal. Growers snatched it up.

By 1949, the number of acres in the county growing fruits, nuts and vegetables hit 124,000. Every spring, a dazzling blanket of flowering fruit trees brightened the valley. Tourists flocked to "blossom tour" train rides that ran from Palo Alto to Morgan Hill.

At its height, farming brought the region about $500 million in today's terms.

"If the yields dropped, thousands of people didn't have jobs," Olson said. "Things got desperate."

So the pesticides flowed with the rhythms of the growing season. No one realized they were enveloping the county in a chemical blanket that would last long after the orchards disappeared.

Back then, the guidelines for handling pesticides weren't as stringent as they are today. One grower might use a lot, his neighbor less. One might wield chemicals carefully or spray only trees. Others might use them all over the property.

During spraying, chemicals settled in soil as well as on the trees. Stronger concentrations tended to soak into the ground near barns and sheds, where spray ingredients were usually mixed - and sometimes spilled.

"Where were the old irrigation channels?" said David Dixon, a cleanup expert with Bay Area environmental consulting firm Treadwell & Rollo, who works on old pesticide sites. "That's where these things would collect in runoff. Any area where they had fence lines might have really gotten nuked. . . . It's there somewhere, but it's hard to know where."

To pinpoint contamination, that knowledge is essential.

Health risks: Dangers follow long-term exposure

The greatest health risks from old pesticides come from long-term exposure to contaminated soil and are highest for children and people who work often in open dirt.

DDT, now banned, damages the nervous system and disrupts reproduction in birds and animals. Lead can trigger brain damage and other developmental problems. Arsenic can cause lung damage and has been linked to cancer.

"I think the government should find out the dimension of the problem," said Tom Dunlap, a historian at Texas A&M University who specializes in legacy pesticides. "It really is a public health problem. Homeowners can't do it individually."

Federal, state and local agencies all list old pesticides as a potential health and environmental hazard. But because they use differing sets of safety standards, it's sometimes difficult to determine what qualifies as

unacceptable contamination.

The Department of Toxic Substances Control, or DTSC, is California's soil safety watchdog. Its safety standards are often tougher than federal guidelines and the department uses them to supervise cleanups at pesticide sites throughout the state.

A review of the agency's case files shows that when it comes to pesticides, Santa Clara County keeps DTSC busy. As of mid-October, the agency lists 40 sites at which old pesticides from orchards, row-crop farming or nurseries have been investigated or cleaned up. That tally includes 18 old orchard sites - more orchard-related cleanup locations than any other county in the state.

Examining other cases of pesticide contamination, such as residues left by other types of farming or old storage facilities, along with cases handled by the State Water Resources Control Board or the county environmental health department, pushes Santa Clara County's total to 54..

State records also make it clear that pesticides affect all of California. Riverside County, for example, leads the state in pesticide-related cleanup cases, with a total of 135 as of mid-October. Almost all of those reflect contamination from row crops.

Builders' pace: Hazards discovered as land develops

Regulators and builders say the number reflects the pace of development here and an environmental awareness heightened by a hazard that followed the orchards. In the mid-1980s, water safety officials realized that toxic chemicals leaking from computer-chip plants had seeped into groundwater all over the county.

Because much of the region's drinking water comes from groundwater, local, state, and federal officials scrambled to ensure safe water supplies and clean up the problem. Twenty-three sites in Santa Clara County sit on the federal Superfund list, most of them involving computer-chip solvents.

Officials say those hazards have long been controlled - and that the episode left local agencies more watchful of environmental risks.

"This county has been in a lead role," said Joe Horwedel, San Jose's director of planning and building. "If no one asks the question, the state will never know about it. What you'll find is that in other parts of the state, they haven't asked the questions."

Each of the county's pesticide sites tells the story of the switch from farms to offices and subdivisions.

At the edge of Anderson Reservoir in Morgan Hill, the long-time owners of a 14-acre orchard plot decided to sell to housing developers - only to find themselves first signing an agreement with DTSC in 2004 to clean up unsafe levels of old synthetic pesticides on the property.

In Santa Clara, high-tech giant Intel owns a 17-acre parcel laced with lead and arsenic left by an old orchard. According to DTSC records, the contamination is capped with protective covers and much of the site is used only for parking lots and vehicle storage.

On 11 acres of old orchard land near Montague Expressway and the Guadalupe River in San Jose, state

water officials have been overseeing a pesticide study before hundreds of townhomes and condominiums are built.

Because government agencies do little proactive testing, builders have become today's pesticide detectives.

"Given the past of the valley was predominantly orchards, it's quite common to find pesticides," said Katia Kamangar, senior vice president with Bay Area developer SummerHill Homes, which has cleaned up soil at building projects throughout the county. "It's a common thread."

Some environmental advocates, however, say the government shouldn't let developers be the primary pesticide watchdog.

"The public has no idea what is going on," said Kathryn Mathewson, a Silicon Valley landscape designer who urges her clients to test their soil for old pesticides.

"In terms of the history and legacy of agriculture, there is almost no awareness," said Mathewson, who also is part of a campaign to clean up and preserve an old agricultural research center in Santa Clara. "Forget the government. They pretend this problem doesn't exist. They don't care to see its relationship to health."

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Attachment D

2013 Tier 1 ESLs

(screening levels resulting from default settings)

CALIFORNIA Water Boards

EDMUND G. BROWN JR. GOVERNOR

MATTHEW RODRIQUEZ SECRETARY FOR ENVIRONMENTAL PROTECTION

San Francisco Bay Regional Water Quality Control Board

Chemicals	Groundwater (µg/L)	Soil (mg/kg)	Soil Gas (µg/m^3)	Indoor Air (µg/m^3)
Acenaphthene	2.0E+01	1.6E+01	2.6E+05	5.1E+02
Acenaphthylene	3.0E+01	1.3E+01	No Value	No Value
Acetone	1.5E+03	5.0E-01	1.5E+07	3.1E+04
Aldrin	2.0E-03	3.2E-02	1.3E+05	5.0E-04
Anthracene	7.3E-01	2.8E+00	No Value	No Value
Antimony	6.0E+00	2.0E+01	No Value	No Value
Arsenic	1.0E+01	3.9E-01	No Value	5.7E-04
Barium	1.0E+03	7.5E+02	No Value	5.2E-01
Benzene	1.0E+00	4.4E-02	4.2E+01	8.4E-02
Benzo(a)anthracene	2.7E-02	3.8E-01	No Value	2.2E-02
Benzo(b)fluoranthene	5.6E-02	3.8E-01	No Value	2.2E-02
Benzo(k)fluoranthene	5.6E-02	3.8E-01	No Value	2.2E-02
Benzo(g,h,i)perylene	1.0E-01	2.7E+01	No Value	No Value
Benzo(a)pyrene	1.4E-02	3.8E-02	No Value	2.2E-03
Beryllium	5.3E-01	4.0E+00	No Value	1.0E-03
1,1-Biphenyl	5.0E-01	6.5E-01	3.0E+04	6.0E+01
Bis(2-chloroethyl) ether	5.5E-03	7.0E-05	1.7E+00	3.4E-03
Bis(2-chloroisopropyl) ether	1.2E+01	1.3E-01	1.1E+06	2.2E+03
Bis(2-ethylhexyl) phthalate	4.0E+00	1.6E+02	No Value	1.0E+00
Boron	1.6E+00	1.6E+00	No Value	No Value
Bromodichloromethane	1.0E+02	4.8E-01	3.3E+01	6.6E-02
Bromoform (Tribromomethane)	1.0E+02	2.2E+00	6.7E+06	2.2E+00
Bromomethane	8.7E+00	3.5E-01	2.6E+03	5.2E+00
Cadmium (water)	2.5E-01	No Value	No Value	No Value
Cadmium (soil)	No Value	1.2E+01	No Value	5.8E-04
Carbon tetrachloride	5.0E-01	1.1E-01	2.9E+01	5.8E-02
Chlordane	4.0E-03	4.4E-01	4.2E+03	7.2E-03
p-Chloroaniline	5.0E+00	5.3E-02	No Value	No Value
Chlorobenzene	2.5E+01	1.5E+00	5.0E+05	1.0E+03
Chloroethane	1.6E+01	1.1E+00	1.6E+07	3.1E+04
Chloroform	7.0E+01	1.1E+00	2.3E+02	4.6E-01
Chloromethane	1.6E+02	2.4E+01	4.7E+04	9.4E+01
2-Chlorophenol	1.8E-01	1.2E-02	9.5E+03	1.9E+01
Chromium (total)	5.0E+01	0.0E+00	No Value	No Value
Chromium III	1.8E+02	7.5E+02	No Value	No Value
Chromium VI	1.1E+01	8.0E+00	No Value	1.6E-05
Chrysene	3.5E-01	3.8E+00	No Value	2.2E-01
Cobalt	3.0E+00	2.3E+01	No Value	2.7E-04
Copper	3.1E+00	2.3E+02	No Value	No Value
Cyanide	1.0E+00	3.6E-03	3.3E+05	6.5E+02
Dibenz(a,h)anthracene	1.6E-02	1.1E-01	No Value	2.0E-03
Dibromochloromethane	1.0E+02	7.6E+00	No Value	No Value
1,2-dibromo-3-chloropropane	2.0E-01	4.5E-03	6.1E-01	1.2E-03
1,2-Dibromoethane	5.0E-02	3.3E-04	1.7E+01	3.4E-02
1,2-Dichlorobenzene	1.0E+01	1.1E+00	1.0E+05	2.1E+02

Chemicals	Groundwater (µg/L)	Soil (mg/kg)	Soil Gas (µg/m^3)	Indoor Air (µg/m^3)
1,3-Dichlorobenzene	6.5E+01	7.4E+00	No Value	No Value
1,4-Dichlorobenzene	5.0E+00	5.9E-01	1.1E+02	2.2E-01
3,3-Dichlorobenzidine	5.6E-02	1.5E-02	No Value	8.1E-03
Dichlorodiphenyldichloroethane (DDD)	1.0E-03	2.4E+00	No Value	3.5E-02
Dichlorodiphenyldichloroethene (DDE)	1.0E-03	1.7E+00	No Value	2.5E-02
Dichlorodiphenyltrichloroethane (DDT)	1.0E-03	1.7E+00	No Value	2.5E-02
1,1-Dichloroethane	5.0E+00	2.0E-01	7.6E+02	1.5E+00
1,2-Dichloroethane	5.0E-01	4.5E-03	5.8E+01	1.2E-01
1,1-Dichloroethene	6.0E+00	1.0E+00	1.0E+05	2.1E+02
cis-1,2-Dichloroethene	6.0E+00	1.9E-01	No Value	No Value
trans-1,2-Dichloroethene	1.0E+01	6.7E-01	3.1E+04	6.3E+01
2,4-Dichlorophenol	3.0E-01	3.0E-01	7.0E+05	1.4E+03
1,2-Dichloropropane	5.0E+00	1.2E-01	1.2E+02	2.4E-01
1,3-Dichloropropene	5.0E-01	5.9E-02	7.6E+01	1.5E-01
Dieldrin	1.9E-03	2.3E-03	No Value	5.3E-04
Diethyl phthalate	1.5E+00	3.5E-02	No Value	No Value
Dimethyl phthalate	1.5E+00	3.5E-02	No Value	No Value
2,4-Dimethylphenol	1.0E+02	6.7E-01	5.0E+02	1.0E+00
2,4-Dinitrophenol	1.5E+01	4.2E-02	No Value	No Value
2,4-Dinitrotoluene	9.9E-02	7.4E-04	No Value	2.7E-02
1,4-Dioxane	2.5E+00	1.5E-03	3.1E+08	3.2E-01
Dioxin (2,3,7,8-TCDD)	1.0E-06	4.5E-06	No Value	6.4E-08
Endosulfan	8.7E-03	4.6E-03	No Value	No Value
Endrin	2.3E-03	6.5E-04	No Value	No Value
Ethylbenzene	3.0E+01	3.3E+00	4.9E+02	9.7E-01
Fluoranthene	8.0E+00	4.0E+01	No Value	No Value
Fluorene	3.9E+00	8.9E+00	No Value	No Value
Heptachlor	3.6E-03	1.3E-02	1.5E+05	2.1E-03
Heptachlor epoxide	3.6E-03	1.4E-02	1.5E+05	9.4E-04
Hexachlorobenzene	1.0E+00	3.1E-01	No Value	4.8E-03
Hexachlorobutadiene	8.6E-01	4.3E+00	6.0E+06	1.2E+04
g-Hexachlorocyclohexane (Lindane)	1.6E-02	9.8E-03	No Value	No Value
Hexachloroethane	1.7E+00	5.8E+00	No Value	2.2E-01
Indeno(1,2,3-c,d)pyrene	5.6E-02	3.8E-01	No Value	2.2E-02
Lead	2.5E+00	8.0E+01	No Value	No Value
Mercury (elemental)	2.5E-02	6.7E+00	1.6E+01	3.1E-02
Methoxychlor	3.0E-03	1.9E+01	No Value	No Value
Methylene chloride	5.0E+00	7.7E-02	2.6E+03	5.2E+00
Methyl ethyl ketone	7.1E+03	6.5E+00	2.6E+06	5.2E+03
Methyl isobutyl ketone	1.2E+02	2.8E+00	2.1E+05	4.2E+02
Methyl mercury	3.0E-03	6.1E+00	No Value	No Value
2-Methylnaphthalene	2.1E+00	2.5E-01	3.4E+04	6.8E+01
tert-Butyl methyl ether	5.0E+00	2.3E-02	4.7E+03	9.4E+00
Molybdenum	1.8E+02	4.0E+01	No Value	No Value
Naphthalene	6.2E+00	1.2E+00	3.6E+01	7.2E-02

Chemicals	Groundwater (µg/L)	Soil (mg/kg)	Soil Gas (µg/m^3)	Indoor Air (µg/m^3)
Nickel	8.2E+00	1.5E+02	No Value	5.2E-02
Pentachlorophenol	1.0E+00	3.0E+00	No Value	4.8E-01
Perchlorate	6.0E+00	5.5E+01	No Value	No Value
Phenanthrene	4.6E+00	1.1E+01	2.8E+04	5.5E+01
Phenol	5.0E+00	7.6E-02	7.8E+04	1.6E+02
Polychlorinated biphenyls (PCBs)	1.4E-02	2.2E-01	No Value	2.4E-02
Pyrene	2.0E+00	8.5E+01	No Value	No Value
Selenium	5.0E+00	1.0E+01	No Value	No Value
Silver	1.9E-01	2.0E+01	No Value	No Value
Styrene	1.0E+01	1.5E+00	4.7E+05	9.4E+02
tert-Butyl alcohol	1.2E+01	7.5E-02	No Value	No Value
1,1,1,2-Tetrachloroethane	5.1E-01	9.1E-03	1.6E+02	3.2E-01
1,1,2,2-Tetrachloroethane	1.0E+00	1.8E-02	2.1E+01	4.2E-02
Tetrachloroethene	5.0E+00	5.5E-01	2.1E+02	4.1E-01
Thallium	2.0E+00	7.8E-01	No Value	No Value
Toluene	4.0E+01	2.9E+00	1.6E+05	3.1E+02
Toxaphene	2.0E-04	4.2E-04	No Value	7.2E-03
TPH (gasolines)	1.0E+02	1.0E+02	5.0E+04	1.0E+02
TPH (middle distillates)	1.0E+02	1.0E+02	6.8E+04	1.4E+02
TPH (residual fuels)	1.0E+02	5.0E+02	No Value	No Value
1,2,4-Trichlorobenzene	5.0E+00	1.5E+00	2.1E+03	4.2E+00
1,1,1-Trichloroethane	6.2E+01	7.8E+00	2.6E+06	5.2E+03
1,1,2-Trichloroethane	5.0E+00	7.0E-02	7.6E+01	1.5E-01
Trichloroethene	5.0E+00	4.6E-01	3.0E+02	5.9E-01
2,4,5-Trichlorophenol	1.1E+01	1.8E-01	No Value	No Value
2,4,6-Trichlorophenol	3.7E+00	1.2E+00	1.5E+02	3.0E-01
Vanadium	1.5E+01	2.0E+02	No Value	No Value
Vinyl chloride	5.0E-01	3.2E-02	1.6E+01	3.1E-02
Xylenes	2.0E+01	2.3E+00	5.2E+04	1.0E+02
Zinc	8.1E+01	6.0E+02	No Value	No Value

Notes: A chemical is considered to be volatile if Henry's Law constant (atm m^3/mol) > 10^{-5} and molecular weight < 200.

Summary Table A. Environmental Screening Levels (ESLs)
Shallow Soils (≤3m bgs)
Groundwater is Current or Potential Source of Drinking Water

Chemical	Shallow Soil					
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis	Groundwater (µg/L)	Basis
Acenaphthene	1.6E+01	GW Protection	1.6E+01	GW Protection	2.0E+01	Ceiling Value
Acenaphthylene	1.3E+01	GW Protection	1.3E+01	GW Protection	3.0E+01	Aquatic Habitat Goal
Acetone	5.0E-01	GW Protection	5.0E-01	GW Protection	1.5E+03	Aquatic Habitat Goal
Aldrin	3.2E-02	Human Health	6.4E-02	Human Health	2.0E-03	Drinking Water
Anthracene	2.8E+00	GW Protection	2.8E+00	GW Protection	7.3E-01	Aquatic Habitat Goal
Antimony	2.0E+01	Ecotox	4.0E+01	Ecotox	6.0E+00	Drinking Water
Arsenic	3.9E-01	Human Health	9.6E-01	Human Health	1.0E+01	Drinking Water
Barium	7.5E+02	Ecotox	1.5E+03	Ecotox	1.0E+03	Drinking Water
Benzene	4.4E-02	GW Protection	4.4E-02	GW Protection	1.0E+00	Drinking Water
Benzo(a)anthracene	3.8E-01	Human Health	4.5E-01	Human Health	2.7E-02	Aquatic Habitat Goal
Benzo(b)fluoranthene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Drinking Water
Benzo(k)fluoranthene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Drinking Water
Benzo(g,h,i)perylene	2.7E+01	GW Protection	2.7E+01	GW Protection	1.0E-01	Aquatic Habitat Goal
Benzo(a)pyrene	3.8E-02	Human Health	4.5E-02	Human Health	1.4E-02	Aquatic Habitat Goal
Beryllium	4.0E+00	Ecotox	8.0E+00	Ecotox	5.3E-01	Aquatic Habitat Goal
1,1-Biphenyl	6.5E-01	GW Protection	6.5E-01	GW Protection	5.0E-01	Ceiling Value
Bis(2-chloroethyl) ether	7.0E-05	GW Protection	7.0E-05	GW Protection	5.5E-03	Drinking Water
Bis(2-chloroisopropyl) ether	1.3E-01	GW Protection	1.3E-01	GW Protection	1.2E+01	Aquatic Habitat Goal
Bis(2-ethylhexyl) phthalate	1.6E+02	Human Health	2.2E+02	Human Health	4.0E+00	Drinking Water
Boron	1.6E+00	Ecotox	2.0E+00	Ecotox	1.6E+00	Aquatic Habitat Goal
Bromodichloromethane	4.8E-01	Human Health	1.9E+00	GW Protection	1.0E+02	Drinking Water
Bromoform (Tribromomethane)	2.2E+00	GW Protection	2.2E+00	GW Protection	1.0E+02	Drinking Water
Bromomethane	3.5E-01	GW Protection	3.5E-01	GW Protection	8.7E+00	Drinking Water
Cadmium (water)		Ceiling Value		Ceiling Value	2.5E-01	Aquatic Habitat Goal
Cadmium (soil)	1.2E+01	Ecotox	1.2E+01	Ecotox	No Value	
Carbon tetrachloride	1.1E-01	GW Protection	1.1E-01	GW Protection	5.0E-01	Drinking Water
Chlordane	4.4E-01	Human Health	9.5E-01	Human Health	4.0E-03	Aquatic Habitat Goal
p-Chloroaniline	5.3E-02	GW Protection	5.3E-02	GW Protection	5.0E+00	Aquatic Habitat Goal
Chlorobenzene	1.5E+00	GW Protection	1.5E+00	GW Protection	2.5E+01	Aquatic Habitat Goal
Chloroethane	1.1E+00	GW Protection	1.1E+00	GW Protection	1.6E+01	Ceiling Value
Chloroform	1.1E+00	Human Health	2.1E+00	GW Protection	7.0E+01	Drinking Water
Chloromethane	2.4E+01	GW Protection	2.4E+01	GW Protection	1.6E+02	Drinking Water
2-Chlorophenol	1.2E-02	GW Protection	1.2E-02	GW Protection	1.8E-01	Ceiling Value
Chromium (total)		Ecotox		Ecotox	5.0E+01	Drinking Water
Chromium III	7.5E+02	Ecotox	7.5E+02	Ecotox	1.8E+02	Aquatic Habitat Goal
Chromium VI	8.0E+00	Ecotox	8.0E+00	Ecotox	1.1E+01	Aquatic Habitat Goal
Chrysene	3.8E+00	Human Health	4.5E+00	Human Health	3.5E-01	Aquatic Habitat Goal
Cobalt	2.3E+01	Human Health	8.0E+01	Ecotox	3.0E+00	Aquatic Habitat Goal
Copper	2.3E+02	Ecotox	2.3E+02	Ecotox	3.1E+00	Aquatic Habitat Goal
Cyanide	3.6E-03	GW Protection	3.6E-03	GW Protection	1.0E+00	Aquatic Habitat Goal
Dibenz(a,h)anthracene	1.1E-01	Human Health	1.3E-01	Human Health	1.6E-02	Drinking Water
Dibromochloromethane	7.6E+00	Human Health	8.3E+00	GW Protection	1.0E+02	Drinking Water
1,2-dibromo-3-chloropropane	4.5E-03	GW Protection	4.5E-03	GW Protection	2.0E-01	Drinking Water
1,2-Dibromoethane	3.3E-04	GW Protection	3.3E-04	GW Protection	5.0E-02	Drinking Water
1,2-Dichlorobenzene	1.1E+00	GW Protection	1.1E+00	GW Protection	1.0E+01	Ceiling Value
1,3-Dichlorobenzene	7.4E+00	GW Protection	7.4E+00	GW Protection	6.5E+01	Aquatic Habitat Goal
1,4-Dichlorobenzene	5.9E-01	GW Protection	5.9E-01	GW Protection	5.0E+00	Ceiling Value
3,3-Dichlorobenzidine	1.5E-02	GW Protection	1.5E-02	GW Protection	5.6E-02	Drinking Water
Dichlorodiphenyldichloroethane (DDD)	2.4E+00	Human Health	6.0E+00	Human Health	1.0E-03	Aquatic Habitat Goal
Dichlorodiphenyldichloroethene (DDE)	1.7E+00	Human Health	4.0E+00	Ecotox	1.0E-03	Aquatic Habitat Goal
Dichlorodiphenyltrichloroethane (DDT)	1.7E+00	Human Health	4.0E+00	Ecotox	1.0E-03	Aquatic Habitat Goal

Summary Table A. Environmental Screening Levels (ESLs)
Shallow Soils (≤3m bgs)
Groundwater is Current or Potential Source of Drinking Water

Chemical	Shallow Soil					
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis	Groundwater (µg/L)	Basis
1,1-Dichloroethane	2.0E-01	GW Protection	2.0E-01	GW Protection	5.0E+00	Drinking Water
1,2-Dichloroethane	4.5E-03	GW Protection	4.5E-03	GW Protection	5.0E-01	Drinking Water
1,1-Dichloroethene	1.0E+00	GW Protection	1.0E+00	GW Protection	6.0E+00	Drinking Water
cis-1,2-Dichloroethene	1.9E-01	GW Protection	1.9E-01	GW Protection	6.0E+00	Drinking Water
trans-1,2-Dichloroethene	6.7E-01	GW Protection	6.7E-01	GW Protection	1.0E+01	Drinking Water
2,4-Dichlorophenol	3.0E-01	GW Protection	3.0E-01	GW Protection	3.0E-01	Ceiling Value
1,2-Dichloropropane	1.2E-01	GW Protection	1.2E-01	GW Protection	5.0E+00	Drinking Water
1,3-Dichloropropene	5.9E-02	GW Protection	5.9E-02	GW Protection	5.0E-01	Drinking Water
Dieldrin	2.3E-03	GW Protection	2.3E-03	GW Protection	1.9E-03	Aquatic Habitat Goal
Diethyl phthalate	3.5E-02	GW Protection	3.5E-02	GW Protection	1.5E+00	Aquatic Habitat Goal
Dimethyl phthalate	3.5E-02	GW Protection	3.5E-02	GW Protection	1.5E+00	Aquatic Habitat Goal
2,4-Dimethylphenol	6.7E-01	GW Protection	6.7E-01	GW Protection	1.0E+02	Drinking Water
2,4-Dinitrophenol	4.2E-02	GW Protection	4.2E-02	GW Protection	1.5E+01	Aquatic Habitat Goal
2,4-Dinitrotoluene	7.4E-04	GW Protection	7.4E-04	GW Protection	9.9E-02	Drinking Water
1,4-Dioxane	1.5E-03	GW Protection	1.5E-03	GW Protection	2.5E+00	Drinking Water
Dioxin (2,3,7,8-TCDD)	4.5E-06	Human Health	1.1E-05	Human Health	1.0E-06	Aquatic Habitat Goal
Endosulfan	4.6E-03	GW Protection	4.6E-03	GW Protection	8.7E-03	Aquatic Habitat Goal
Endrin	6.5E-04	GW Protection	6.5E-04	GW Protection	2.3E-03	Aquatic Habitat Goal
Ethylbenzene	3.3E+00	GW Protection	3.3E+00	GW Protection	3.0E+01	Ceiling Value
Fluoranthene	4.0E+01	Ecotox	4.0E+01	Ecotox	8.0E+00	Aquatic Habitat Goal
Fluorene	8.9E+00	GW Protection	8.9E+00	GW Protection	3.9E+00	Aquatic Habitat Goal
Heptachlor	1.3E-02	GW Protection	1.3E-02	GW Protection	3.6E-03	Aquatic Habitat Goal
Heptachlor epoxide	1.4E-02	GW Protection	1.4E-02	GW Protection	3.6E-03	Aquatic Habitat Goal
Hexachlorobenzene	3.1E-01	Human Health	6.0E-01	Human Health	1.0E+00	Drinking Water
Hexachlorobutadiene	4.3E+00	GW Protection	4.3E+00	GW Protection	8.6E-01	Drinking Water
γ-Hexachlorocyclohexane (Lindane)	9.8E-03	GW Protection	9.8E-03	GW Protection	1.6E-02	Aquatic Habitat Goal
Hexachloroethane	5.8E+00	GW Protection	5.8E+00	GW Protection	1.7E+00	Drinking Water
Indeno(1,2,3-c,d)pyrene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Drinking Water
Lead	8.0E+01	Human Health	3.2E+02	Human Health	2.5E+00	Aquatic Habitat Goal
Mercury (elemental)	6.7E+00	Human Health	1.0E+01	Ecotox	2.5E-02	Aquatic Habitat Goal
Methoxychlor	1.9E+01	GW Protection	1.9E+01	GW Protection	3.0E-03	Aquatic Habitat Goal
Methylene chloride	7.7E-02	GW Protection	7.7E-02	GW Protection	5.0E+00	Drinking Water
Methyl ethyl ketone	6.5E+00	GW Protection	6.5E+00	GW Protection	7.1E+03	Drinking Water
Methyl isobutyl ketone	2.8E+00	GW Protection	2.8E+00	GW Protection	1.2E+02	Drinking Water
Methyl mercury	6.1E+00	Human Health	6.2E+01	Human Health	3.0E-03	Aquatic Habitat Goal
2-Methylnaphthalene	2.5E-01	GW Protection	2.5E-01	GW Protection	2.1E+00	Aquatic Habitat Goal
tert-Butyl methyl ether	2.3E-02	GW Protection	2.3E-02	GW Protection	5.0E+00	Ceiling Value
Molybdenum	4.0E+01	Ecotox	4.0E+01	Ecotox	1.8E+02	Drinking Water
Naphthalene	1.2E+00	GW Protection	1.2E+00	GW Protection	6.2E+00	Drinking Water
Nickel	1.5E+02	Ecotox	1.5E+02	Ecotox	8.2E+00	Aquatic Habitat Goal
Pentachlorophenol	3.0E+00	Human Health	2.6E+00	Human Health	1.0E+00	Drinking Water
Perchlorate	5.5E+01	Human Health	7.2E+02	Human Health	6.0E+00	Drinking Water
Phenanthrene	1.1E+01	GW Protection	1.1E+01	GW Protection	4.6E+00	Aquatic Habitat Goal
Phenol	7.6E-02	GW Protection	7.6E-02	GW Protection	5.0E+00	Ceiling Value
Polychlorinated biphenyls (PCBs)	2.2E-01	Human Health	2.5E-01	Human Health	1.4E-02	Aquatic Habitat Goal
Pyrene	8.5E+01	GW Protection	8.5E+01	GW Protection	2.0E+00	Aquatic Habitat Goal
Selenium	1.0E+01	Ecotox	1.0E+01	Ecotox	5.0E+00	Aquatic Habitat Goal
Silver	2.0E+01	Ecotox	4.0E+01	Ecotox	1.9E-01	Aquatic Habitat Goal
Styrene	1.5E+00	GW Protection	1.5E+00	GW Protection	1.0E+01	Ceiling Value
tert-Butyl alcohol	7.5E-02	GW Protection	7.5E-02	GW Protection	1.2E+01	Drinking Water
1,1,1,2-Tetrachloroethane	9.1E-03	GW Protection	9.1E-03	GW Protection	5.1E-01	Drinking Water

Summary Table A. Environmental Screening Levels (ESLs)
Shallow Soils (≤3m bgs)
Groundwater is Current or Potential Source of Drinking Water

Chemical	Shallow Soil					
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis	Groundwater (µg/L)	Basis
1,1,2,2-Tetrachloroethane	1.8E-02	GW Protection	1.8E-02	GW Protection	1.0E+00	Drinking Water
Tetrachloroethene	5.5E-01	Human Health	7.0E-01	GW Protection	5.0E+00	Drinking Water
Thallium	7.8E-01	Human Health	1.0E+01	Human Health	2.0E+00	Drinking Water
Toluene	2.9E+00	GW Protection	2.9E+00	GW Protection	4.0E+01	Ceiling Value
Toxaphene	4.2E-04	GW Protection	4.2E-04	GW Protection	2.0E-04	Aquatic Habitat Goal
TPH (gasolines)	1.0E+02	Ceiling Value	5.0E+02	Ceiling Value	1.0E+02	Ceiling Value
TPH (middle distillates)	1.0E+02	Ceiling Value	5.0E+02	Ceiling Value	1.0E+02	Ceiling Value
TPH (residual fuels)	5.0E+02	Ceiling Value	2.5E+03	Ceiling Value	1.0E+02	Ceiling Value
1,2,4-Trichlorobenzene	1.5E+00	GW Protection	1.5E+00	GW Protection	5.0E+00	Drinking Water
1,1,1-Trichloroethane	7.8E+00	GW Protection	7.8E+00	GW Protection	6.2E+01	Aquatic Habitat Goal
1,1,2-Trichloroethane	7.0E-02	GW Protection	7.0E-02	GW Protection	5.0E+00	Drinking Water
Trichloroethene	4.6E-01	GW Protection	4.6E-01	GW Protection	5.0E+00	Drinking Water
2,4,5-Trichlorophenol	1.8E-01	GW Protection	1.8E-01	GW Protection	1.1E+01	Aquatic Habitat Goal
2,4,6-Trichlorophenol	1.2E+00	GW Protection	1.2E+00	GW Protection	3.7E+00	Drinking Water
Vanadium	2.0E+02	Ecotox	2.0E+02	Ecotox	1.5E+01	Drinking Water
Vinyl chloride	3.2E-02	Human Health	8.5E-02	GW Protection	5.0E-01	Drinking Water
Xylenes	2.3E+00	GW Protection	2.3E+00	GW Protection	2.0E+01	Ceiling Value
Zinc	6.0E+02	Ecotox	6.0E+02	Ecotox	8.1E+01	Aquatic Habitat Goal

Notes:
Shallow soils defined as soils less than or equal to 3 meters (approximately 10 feet) below ground surface.
Residential Land Use generally considered adequate for other sensitive uses.
Groundwater values assume potential discharge of groundwater into a freshwater, marine, or estuary surface water system.
Soil ESLs intended to address direct-exposure, groundwater protection, urban ecological receptors, and nuisance concerns.
Groundwater ESLs intended to address drinking water, surface water, indoor-air, and nuisance concerns.
Aquatic habitat goals for bioaccumulation concerns not considered in selection of groundwater goals.
TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.).

Summary Table B. Environmental Screening Levels (ESLs)
Shallow Soils (≤3 m bgs)
Groundwater is not a Current or Potential Source of Drinking Water

Chemical	Shallow Soil				Groundwater (ug/L)	Basis
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis		
Acenaphthene	1.9E+01	GW Protection	1.9E+01	GW Protection	2.3E+01	Aquatic Habitat Goal
Acenaphthylene	1.3E+01	GW Protection	1.3E+01	GW Protection	3.0E+01	Aquatic Habitat Goal
Acetone	5.0E-01	GW Protection	5.0E-01	GW Protection	1.5E+03	Aquatic Habitat Goal
Aldrin	3.2E-02	Human Health	6.4E-02	Human Health	1.3E-01	Aquatic Habitat Goal
Anthracene	2.8E+00	GW Protection	2.8E+00	GW Protection	7.3E-01	Aquatic Habitat Goal
Antimony	2.0E+01	Ecotox	4.0E+01	Ecotox	3.0E+01	Aquatic Habitat Goal
Arsenic	3.9E-01	Human Health	9.6E-01	Human Health	3.6E+01	Aquatic Habitat Goal
Barium	7.5E+02	Ecotox	1.5E+03	Ecotox	1.0E+03	Aquatic Habitat Goal
Benzene	7.4E-01	Human Health	1.2E+00	GW Protection	2.7E+01	Vapor Intrusion
Benzo(a)anthracene	3.8E-01	Human Health	4.5E-01	Human Health	2.7E-02	Aquatic Habitat Goal
Benzo(b)fluoranthene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Aquatic Habitat Goal
Benzo(k)fluoranthene	3.8E-01	Human Health	4.5E-01	Human Health	4.0E-01	Ceiling Value
Benzo(g,h,i)perylene	2.7E+01	GW Protection	2.7E+01	GW Protection	1.0E-01	Aquatic Habitat Goal
Benzo(a)pyrene	3.8E-02	Human Health	4.5E-02	Human Health	1.4E-02	Aquatic Habitat Goal
Beryllium	4.0E+00	Ecotox	8.0E+00	Ecotox	5.3E-01	Aquatic Habitat Goal
1,1-Biphenyl	6.5E+00	GW Protection	6.5E+00	GW Protection	5.0E+00	Ceiling Value
Bis(2-chloroethyl) ether	1.1E-01	Human Health	1.6E-01	GW Protection	1.2E+01	Aquatic Habitat Goal
Bis(2-chloroisopropyl) ether	1.3E-01	GW Protection	1.3E-01	GW Protection	1.2E+01	Aquatic Habitat Goal
Bis(2-ethylhexyl) phthalate	1.6E+02	Human Health	2.2E+02	Human Health	3.2E+01	Aquatic Habitat Goal
Boron	1.6E+00	Ecotox	2.0E+00	Ecotox	1.6E+00	Aquatic Habitat Goal
Bromodichloromethane	4.8E-01	Human Health	2.4E+00	Human Health	1.1E+03	Aquatic Habitat Goal
Bromoform (Tribromomethane)	2.4E+01	GW Protection	2.4E+01	GW Protection	1.1E+03	Aquatic Habitat Goal
Bromomethane	6.4E+00	GW Protection	6.4E+00	GW Protection	1.6E+02	Aquatic Habitat Goal
Cadmium (water)	No Value	No Value	No Value	Human Health	2.5E-01	Aquatic Habitat Goal
Cadmium (soil)	1.2E+01	Ecotox	1.2E+01	No Value	No Value	No Value
Carbon tetrachloride	1.2E-01	Human Health	5.8E-01	Human Health	4.8E+00	Vapor Intrusion
Chlordane	4.4E-01	Human Health	9.5E-01	Human Health	4.0E-03	Aquatic Habitat Goal
p-Chloroaniline	5.3E-02	GW Protection	5.3E-02	GW Protection	5.0E+00	Aquatic Habitat Goal
Chlorobenzene	1.5E+00	GW Protection	1.5E+00	GW Protection	2.5E+01	Aquatic Habitat Goal
Chloroethane	1.1E+00	GW Protection	1.1E+00	GW Protection	1.6E+01	Aquatic Habitat Goal
Chloroform	1.1E+00	Human Health	5.0E+00	GW Protection	1.7E+02	Vapor Intrusion
Chloromethane	1.0E+02	Ceiling Value	1.7E+02	GW Protection	1.1E+03	Aquatic Habitat Goal
2-Chlorophenol	1.2E-01	GW Protection	1.2E-01	GW Protection	1.8E+00	Ceiling Value
Chromium (total)		Ecotox		Ecotox	1.8E+02	Aquatic Habitat Goal
Chromium III	7.5E+02	Ecotox	7.5E+02	Ecotox	1.8E+02	Aquatic Habitat Goal
Chromium VI	8.0E+00	Ecotox	8.0E+00	Ecotox	1.1E+01	Aquatic Habitat Goal
Chrysene	3.8E+00	Human Health	4.5E+00	Human Health	3.5E-01	Aquatic Habitat Goal
Cobalt	2.3E+01	Human Health	8.0E+01	Ecotox	3.0E+00	Aquatic Habitat Goal
Copper	2.3E+02	Ecotox	2.3E+02	Ecotox	3.1E+00	Aquatic Habitat Goal
Cyanide	3.6E-03	GW Protection	3.6E-03	GW Protection	1.0E+00	Aquatic Habitat Goal
Dibenz(a,h)anthracene	1.1E-01	Human Health	1.3E-01	Human Health	2.5E-01	Ceiling Value
Dibromochloromethane	7.6E+00	Human Health	3.4E+01	Human Health	1.1E+03	Aquatic Habitat Goal
1,2-dibromo-3-chloropropane	4.5E-03	GW Protection	4.5E-03	GW Protection	2.0E-01	Aquatic Habitat Goal
1,2-Dibromoethane	1.1E-01	Human Health	5.1E-01	GW Protection	7.7E+01	Vapor Intrusion
1,2-Dichlorobenzene	1.6E+00	GW Protection	1.6E+00	GW Protection	1.4E+01	Aquatic Habitat Goal
1,3-Dichlorobenzene	7.4E+00	GW Protection	7.4E+00	GW Protection	6.5E+01	Aquatic Habitat Goal
1,4-Dichlorobenzene	1.8E+00	GW Protection	1.8E+00	GW Protection	1.5E+01	Aquatic Habitat Goal
3,3-Dichlorobenzidine	5.3E-01	Human Health	2.4E+00	Human Health	2.5E+02	Aquatic Habitat Goal
Dichlorodiphenyldichloroethane (DDD)	2.4E+00	Human Health	6.0E+00	Human Health	1.0E-03	Aquatic Habitat Goal
Dichlorodiphenyldichloroethene (DDE)	1.7E+00	Human Health	4.0E+00	Ecotox	1.0E-03	Aquatic Habitat Goal
Dichlorodiphenyltrichloroethane (DDT)	1.7E+00	Human Health	4.0E+00	Ecotox	1.0E-03	Aquatic Habitat Goal
1,1-Dichloroethane	1.9E+00	GW Protection	1.9E+00	GW Protection	4.7E+01	Aquatic Habitat Goal
1,2-Dichloroethane	4.4E-01	Human Health	9.1E-01	GW Protection	1.0E+02	Vapor Intrusion

Summary Table B. Environmental Screening Levels (ESLs)
Shallow Soils (≤3 m bgs)
Groundwater is not a Current or Potential Source of Drinking Water

Chemical	Shallow Soil				Groundwater (ug/L)	Basis
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis		
1,1-Dichloroethene	4.3E+00	GW Protection	4.3E+00	GW Protection	2.5E+01	Aquatic Habitat Goal
cis-1,2-Dichloroethene	1.8E+01	GW Protection	1.8E+01	GW Protection	5.9E+02	Aquatic Habitat Goal
trans-1,2-Dichloroethene	3.9E+01	GW Protection	3.9E+01	GW Protection	5.9E+02	Aquatic Habitat Goal
2,4-Dichlorophenol	3.0E+00	GW Protection	3.0E+00	GW Protection	3.0E+00	Ceiling Value
1,2-Dichloropropane	8.2E-01	Human Health	2.5E+00	GW Protection	1.0E+02	Ceiling Value
1,3-Dichloropropene	2.7E-01	Human Health	1.3E+00	Human Health	2.4E+01	Aquatic Habitat Goal
Dieldrin	2.3E-03	GW Protection	2.3E-03	GW Protection	1.9E-03	Aquatic Habitat Goal
Diethyl phthalate	3.5E-02	GW Protection	3.5E-02	GW Protection	1.5E+00	Aquatic Habitat Goal
Dimethyl phthalate	3.5E-02	GW Protection	3.5E-02	GW Protection	1.5E+00	Aquatic Habitat Goal
2,4-Dimethylphenol	7.4E-01	GW Protection	7.4E-01	GW Protection	1.1E+02	Aquatic Habitat Goal
2,4-Dinitrophenol	4.2E-02	GW Protection	4.2E-02	GW Protection	1.5E+01	Aquatic Habitat Goal
2,4-Dinitrotoluene	8.6E-01	GW Protection	8.6E-01	GW Protection	1.2E+02	Aquatic Habitat Goal
1,4-Dioxane	2.4E+01	Human Health	3.0E+01	GW Protection	5.0E+04	Ceiling Value
Dioxin (2,3,7,8-TCDD)	4.5E-06	Human Health	1.1E-05	Human Health	1.0E-06	Aquatic Habitat Goal
Endosulfan	4.6E-03	GW Protection	4.6E-03	GW Protection	8.7E-03	Aquatic Habitat Goal
Endrin	6.5E-04	GW Protection	6.5E-04	GW Protection	2.3E-03	Aquatic Habitat Goal
Ethylbenzene	4.7E+00	GW Protection	4.7E+00	GW Protection	4.3E+01	Aquatic Habitat Goal
Fluoranthene	4.0E+01	Ecotox	4.0E+01	Ecotox	8.0E+00	Aquatic Habitat Goal
Fluorene	8.9E+00	GW Protection	8.9E+00	GW Protection	3.9E+00	Aquatic Habitat Goal
Heptachlor	1.3E-02	GW Protection	1.3E-02	GW Protection	3.6E-03	Aquatic Habitat Goal
Heptachlor epoxide	1.4E-02	GW Protection	1.4E-02	GW Protection	3.6E-03	Aquatic Habitat Goal
Hexachlorobenzene	3.1E-01	Human Health	6.0E-01	Human Health	3.7E+00	Aquatic Habitat Goal
Hexachlorobutadiene	4.6E+00	GW Protection	4.6E+00	GW Protection	9.3E-01	Aquatic Habitat Goal
γ-Hexachlorocyclohexane (Lindane)	9.8E-03	GW Protection	9.8E-03	GW Protection	1.6E-02	Aquatic Habitat Goal
Hexachloroethane	1.2E+01	Human Health	1.7E+01	Human Health	1.2E+01	Aquatic Habitat Goal
Indeno(1,2,3-c,d)pyrene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Aquatic Habitat Goal
Lead	8.0E+01	Human Health	3.2E+02	Human Health	2.5E+00	Aquatic Habitat Goal
Mercury (elemental)	6.7E+00	Human Health	1.0E+01	Ecotox	2.5E-02	Aquatic Habitat Goal
Methoxychlor	1.9E+01	GW Protection	1.9E+01	GW Protection	3.0E-03	Aquatic Habitat Goal
Methylene chloride	9.9E+00	Human Health	3.4E+01	GW Protection	2.2E+03	Aquatic Habitat Goal
Methyl ethyl ketone	1.3E+01	GW Protection	1.3E+01	GW Protection	1.4E+04	Aquatic Habitat Goal
Methyl isobutyl ketone	3.9E+00	GW Protection	3.9E+00	GW Protection	1.7E+02	Aquatic Habitat Goal
Methyl mercury	6.1E+00	Human Health	6.2E+01	Human Health	3.0E-03	Aquatic Habitat Goal
2-Methylnaphthalene	2.5E-01	GW Protection	2.5E-01	GW Protection	2.1E+00	Aquatic Habitat Goal
tert-Butyl methyl ether	8.4E+00	GW Protection	8.4E+00	GW Protection	1.8E+03	Ceiling Value
Molybdenum	4.0E+01	Ecotox	4.0E+01	Ecotox	2.4E+02	Aquatic Habitat Goal
Naphthalene	3.1E+00	Human Health	4.8E+00	GW Protection	2.4E+01	Aquatic Habitat Goal
Nickel	1.5E+02	Ecotox	1.5E+02	Ecotox	8.2E+00	Aquatic Habitat Goal
Pentachlorophenol	3.0E+00	Human Health	2.6E+00	Human Health	7.9E+00	Aquatic Habitat Goal
Perchlorate	5.5E+01	Human Health	7.2E+02	Human Health	6.0E+02	Aquatic Habitat Goal
Phenanthrene	1.1E+01	GW Protection	1.1E+01	GW Protection	4.6E+00	Aquatic Habitat Goal
Phenol	3.9E+00	GW Protection	3.9E+00	GW Protection	2.6E+02	Aquatic Habitat Goal
Polychlorinated biphenyls (PCBs)	2.2E-01	Human Health	2.5E-01	Human Health	1.4E-02	Aquatic Habitat Goal
Pyrene	8.5E+01	GW Protection	8.5E+01	GW Protection	2.0E+00	Aquatic Habitat Goal
Selenium	1.0E+01	Ecotox	1.0E+01	Ecotox	5.0E+00	Aquatic Habitat Goal
Silver	2.0E+01	Ecotox	4.0E+01	Ecotox	1.9E-01	Aquatic Habitat Goal
Styrene	1.5E+01	GW Protection	1.5E+01	GW Protection	1.0E+02	Aquatic Habitat Goal
tert-Butyl alcohol	1.0E+02	Ceiling Value	1.1E+02	GW Protection	1.8E+04	Aquatic Habitat Goal
1,1,1,2-Tetrachloroethane	3.8E+00	Human Health	1.6E+01	GW Protection	9.3E+02	Aquatic Habitat Goal
1,1,2,2-Tetrachloroethane	4.7E-01	Human Health	2.3E+00	Human Health	2.4E+02	Aquatic Habitat Goal
Tetrachloroethene	5.5E-01	Human Health	2.6E+00	Human Health	6.3E+01	Vapor Intrusion
Thallium	7.8E-01	Human Health	1.0E+01	Human Health	4.0E+00	Aquatic Habitat Goal
Toluene	9.3E+00	GW Protection	9.3E+00	GW Protection	1.3E+02	Aquatic Habitat Goal

Summary Table B. Environmental Screening Levels (ESLs)
Shallow Soils (≤3 m bgs)
Groundwater is not a Current or Potential Source of Drinking Water

Chemical	Shallow Soil				Groundwater (ug/L)	Basis
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis		
Toxaphene	4.2E-04	GW Protection	4.2E-04	GW Protection	2.0E-04	Aquatic Habitat Goal
TPH (gasolines)	1.0E+02	Ceiling Value	5.0E+02	Ceiling Value	5.0E+02	Aquatic Habitat Goal
TPH (middle distillates)	1.0E+02	Ceiling Value	5.0E+02	Ceiling Value	6.4E+02	Aquatic Habitat Goal
TPH (residual fuels)	5.0E+02	Ceiling Value	2.5E+03	Ceiling Value	6.4E+02	Aquatic Habitat Goal
1,2,4-Trichlorobenzene	7.6E+00	GW Protection	7.6E+00	GW Protection	2.5E+01	Aquatic Habitat Goal
1,1,1-Trichloroethane	7.8E+00	GW Protection	7.8E+00	GW Protection	6.2E+01	Aquatic Habitat Goal
1,1,2-Trichloroethane	8.8E-01	Human Health	4.4E+00	Human Health	9.4E+02	Aquatic Habitat Goal
Trichloroethene	1.7E+00	Human Health	8.3E+00	Human Health	1.3E+02	Vapor Intrusion
2,4,5-Trichlorophenol	1.8E-01	GW Protection	1.8E-01	GW Protection	1.1E+01	Aquatic Habitat Goal
2,4,6-Trichlorophenol	7.8E+00	Human Health	1.0E+01	Ecotox	9.7E+01	Aquatic Habitat Goal
Vanadium	2.0E+02	Ecotox	2.0E+02	Ecotox	1.9E+01	Aquatic Habitat Goal
Vinyl chloride	3.2E-02	Human Health	1.6E-01	Human Health	1.8E+00	Vapor Intrusion
Xylenes	1.1E+01	GW Protection	1.1E+01	GW Protection	1.0E+02	Aquatic Habitat Goal
Zinc	6.0E+02	Ecotox	6.0E+02	Ecotox	8.1E+01	Aquatic Habitat Goal

Notes:
Shallow soils defined as soils less than or equal to 3 meters (approximately 10 feet) below ground surface.
Residential Land Use generally considered adequate for other sensitive uses.
Groundwater values assume potential discharge of groundwater into a freshwater, marine, or estuary surface water system.
Soil ESLs intended to address direct-exposure, groundwater protection, urban ecological receptors, and nuisance concerns.
Groundwater ESLs intended to address drinking water, surface water, indoor-air, and nuisance concerns.
Aquatic habitat goals for bioaccumulation concerns not considered in selection of groundwater goals.
TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.).

Summary Table C. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
Groundwater is a Current or Potential Source of Drinking Water

	Deep Soil					
Chemical	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis	Groundwater (ug/L)	Basis
Acenaphthene	1.6E+01	GW Protection	1.6E+01	GW Protection	2.0E+01	Ceiling Value
Acenaphthylene	1.3E+01	GW Protection	1.3E+01	GW Protection	3.0E+01	Aquatic Habitat Goal
Acetone	5.0E-01	GW Protection	5.0E-01	GW Protection	1.5E+03	Aquatic Habitat Goal
Aldrin	3.2E-02	Human Health	6.4E-02	Human Health	2.0E-03	Drinking Water
Anthracene	2.8E+00	GW Protection	2.8E+00	GW Protection	7.3E-01	Aquatic Habitat Goal
Antimony	3.1E+01	Human Health	4.1E+02	Human Health	6.0E+00	Drinking Water
Arsenic	3.9E-01	Human Health	9.6E-01	Human Health	1.0E+01	Drinking Water
Barium	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	1.0E+03	Drinking Water
Benzene	4.4E-02	GW Protection	4.4E-02	GW Protection	1.0E+00	Drinking Water
Benzo(a)anthracene	3.8E-01	Human Health	4.5E-01	Human Health	2.7E-02	Aquatic Habitat Goal
Benzo(b)fluoranthene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Drinking Water
Benzo(k)fluoranthene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Drinking Water
Benzo(g,h,i)perylene	2.7E+01	GW Protection	2.7E+01	GW Protection	1.0E-01	Aquatic Habitat Goal
Benzo(a)pyrene	3.8E-02	Human Health	4.5E-02	Human Health	1.4E-02	Aquatic Habitat Goal
Beryllium	1.6E+02	Human Health	2.0E+03	Human Health	5.3E-01	Aquatic Habitat Goal
1,1-Biphenyl	6.5E-01	GW Protection	6.5E-01	GW Protection	5.0E-01	Ceiling Value
Bis(2-chloroethyl) ether	7.0E-05	GW Protection	7.0E-05	GW Protection	5.5E-03	Drinking Water
Bis(2-chloroisopropyl) ether	1.3E-01	GW Protection	1.3E-01	GW Protection	1.2E+01	Aquatic Habitat Goal
Bis(2-ethylhexyl) phthalate	1.6E+02	Human Health	2.2E+02	Human Health	4.0E+00	Drinking Water
Boron	1.6E+04	Human Health	2.0E+05	Human Health	1.6E+00	Aquatic Habitat Goal
Bromodichloromethane	4.8E-01	Human Health	1.9E+00	GW Protection	1.0E+02	Drinking Water
Bromoform (Tribromomethane)	2.2E+00	GW Protection	2.2E+00	GW Protection	1.0E+02	Drinking Water
Bromomethane	3.5E-01	GW Protection	3.5E-01	GW Protection	8.7E+00	Drinking Water
Cadmium (water)	No Value	No Value	No Value	No Value	2.5E-01	Aquatic Habitat Goal
Cadmium (soil)	7.8E+01	Human Health	1.0E+03	Human Health	No Value	No Value
Carbon tetrachloride	1.1E-01	GW Protection	1.1E-01	GW Protection	5.0E-01	Drinking Water
Chlordane	4.4E-01	Human Health	9.5E-01	Human Health	4.0E-03	Aquatic Habitat Goal
p-Chloroaniline	5.3E-02	GW Protection	5.3E-02	GW Protection	5.0E+00	Aquatic Habitat Goal
Chlorobenzene	1.5E+00	GW Protection	1.5E+00	GW Protection	2.5E+01	Aquatic Habitat Goal
Chloroethane	1.1E+00	GW Protection	1.1E+00	GW Protection	1.6E+01	Ceiling Value
Chloroform	1.1E+00	Human Health	2.1E+00	GW Protection	7.0E+01	Drinking Water
Chloromethane	2.4E+01	GW Protection	2.4E+01	GW Protection	1.6E+02	Drinking Water
2-Chlorophenol	1.2E-02	GW Protection	1.2E-02	GW Protection	1.8E-01	Ceiling Value
Chromium (total)	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	5.0E+01	Drinking Water
Chromium III	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	1.8E+02	Aquatic Habitat Goal
Chromium VI	2.1E+01	Human Health	1.1E+02	Human Health	1.1E+01	Aquatic Habitat Goal
Chrysene	3.8E+00	Human Health	4.5E+00	Human Health	3.5E-01	Aquatic Habitat Goal
Cobalt	2.3E+01	Human Health	3.0E+02	Human Health	3.0E+00	Aquatic Habitat Goal
Copper	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	3.1E+00	Aquatic Habitat Goal
Cyanide	3.6E-03	GW Protection	3.6E-03	GW Protection	1.0E+00	Aquatic Habitat Goal
Dibenz(a,h)anthracene	1.1E-01	Human Health	1.3E-01	Human Health	1.6E-02	Drinking Water
Dibromochloromethane	7.6E+00	Human Health	8.3E+00	GW Protection	1.0E+02	Drinking Water
1,2-dibromo-3-chloropropane	4.5E-03	GW Protection	4.5E-03	GW Protection	2.0E-01	Drinking Water
1,2-Dibromoethane	3.3E-04	GW Protection	3.3E-04	GW Protection	5.0E-02	Drinking Water
1,2-Dichlorobenzene	1.1E+00	GW Protection	1.1E+00	GW Protection	1.0E+01	Ceiling Value
1,3-Dichlorobenzene	7.4E+00	GW Protection	7.4E+00	GW Protection	6.5E+01	Aquatic Habitat Goal
1,4-Dichlorobenzene	5.9E-01	GW Protection	5.9E-01	GW Protection	5.0E+00	Ceiling Value
3,3-Dichlorobenzidine	1.5E-02	GW Protection	1.5E-02	GW Protection	5.6E-02	Drinking Water
Dichlorodiphenyldichloroethane (DDD)	2.4E+00	Human Health	6.0E+00	Human Health	1.0E-03	Aquatic Habitat Goal
Dichlorodiphenyldichloroethene (DDE)	1.7E+00	Human Health	4.2E+00	Human Health	1.0E-03	Aquatic Habitat Goal
Dichlorodiphenyltrichloroethane (DDT)	1.7E+00	Human Health	4.2E+00	Human Health	1.0E-03	Aquatic Habitat Goal

Summary Table C. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
Groundwater is a Current or Potential Source of Drinking Water

	Deep Soil					
Chemical	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis	Groundwater (ug/L)	Basis
1,1-Dichloroethane	2.0E-01	GW Protection	2.0E-01	GW Protection	5.0E+00	Drinking Water
1,2-Dichloroethane	4.5E-03	GW Protection	4.5E-03	GW Protection	5.0E-01	Drinking Water
1,1-Dichloroethene	1.0E+00	GW Protection	1.0E+00	GW Protection	6.0E+00	Drinking Water
cis-1,2-Dichloroethene	1.9E-01	GW Protection	1.9E-01	GW Protection	6.0E+00	Drinking Water
trans-1,2-Dichloroethene	6.7E-01	GW Protection	6.7E-01	GW Protection	1.0E+01	Drinking Water
2,4-Dichlorophenol	3.0E-01	GW Protection	3.0E-01	GW Protection	3.0E-01	Ceiling Value
1,2-Dichloropropane	1.2E-01	GW Protection	1.2E-01	GW Protection	5.0E+00	Drinking Water
1,3-Dichloropropene	5.9E-02	GW Protection	5.9E-02	GW Protection	5.0E-01	Drinking Water
Dieldrin	2.3E-03	GW Protection	2.3E-03	GW Protection	1.9E-03	Aquatic Habitat Goal
Diethyl phthalate	3.5E-02	GW Protection	3.5E-02	GW Protection	1.5E+00	Aquatic Habitat Goal
Dimethyl phthalate	3.5E-02	GW Protection	3.5E-02	GW Protection	1.5E+00	Aquatic Habitat Goal
2,4-Dimethylphenol	6.7E-01	GW Protection	6.7E-01	GW Protection	1.0E+02	Drinking Water
2,4-Dinitrophenol	4.2E-02	GW Protection	4.2E-02	GW Protection	1.5E+01	Aquatic Habitat Goal
2,4-Dinitrotoluene	7.4E-04	GW Protection	7.4E-04	GW Protection	9.9E-02	Drinking Water
1,4-Dioxane	1.5E-03	GW Protection	1.5E-03	GW Protection	2.5E+00	Drinking Water
Dioxin (2,3,7,8-TCDD)	4.5E-06	Human Health	1.1E-05	Human Health	1.0E-06	Aquatic Habitat Goal
Endosulfan	4.6E-03	GW Protection	4.6E-03	GW Protection	8.7E-03	Aquatic Habitat Goal
Endrin	6.5E-04	GW Protection	6.5E-04	GW Protection	2.3E-03	Aquatic Habitat Goal
Ethylbenzene	3.3E+00	GW Protection	3.3E+00	GW Protection	3.0E+01	Ceiling Value
Fluoranthene	6.0E+01	GW Protection	6.0E+01	GW Protection	8.0E+00	Aquatic Habitat Goal
Fluorene	8.9E+00	GW Protection	8.9E+00	GW Protection	3.9E+00	Aquatic Habitat Goal
Heptachlor	1.3E-02	GW Protection	1.3E-02	GW Protection	3.6E-03	Aquatic Habitat Goal
Heptachlor epoxide	1.4E-02	GW Protection	1.4E-02	GW Protection	3.6E-03	Aquatic Habitat Goal
Hexachlorobenzene	3.1E-01	Human Health	6.0E-01	Human Health	1.0E+00	Drinking Water
Hexachlorobutadiene	4.3E+00	GW Protection	4.3E+00	GW Protection	8.6E-01	Drinking Water
γ-Hexachlorocyclohexane (Lindane)	9.8E-03	GW Protection	9.8E-03	GW Protection	1.6E-02	Aquatic Habitat Goal
Hexachloroethane	5.8E+00	GW Protection	5.8E+00	GW Protection	1.7E+00	Drinking Water
Indeno(1,2,3-c,d)pyrene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Drinking Water
Lead	8.0E+01	Human Health	3.2E+02	Human Health	2.5E+00	Aquatic Habitat Goal
Mercury (elemental)	6.7E+00	Human Health	8.8E+01	Human Health	2.5E-02	Aquatic Habitat Goal
Methoxychlor	1.9E+01	GW Protection	1.9E+01	GW Protection	3.0E-03	Aquatic Habitat Goal
Methylene chloride	7.7E-02	GW Protection	7.7E-02	GW Protection	5.0E+00	Drinking Water
Methyl ethyl ketone	6.5E+00	GW Protection	6.5E+00	GW Protection	7.1E+03	Drinking Water
Methyl isobutyl ketone	2.8E+00	GW Protection	2.8E+00	GW Protection	1.2E+02	Drinking Water
Methyl mercury	6.1E+00	Human Health	6.2E+01	Human Health	3.0E-03	Aquatic Habitat Goal
2-Methylnaphthalene	2.5E-01	GW Protection	2.5E-01	GW Protection	2.1E+00	Aquatic Habitat Goal
tert-Butyl methyl ether	2.3E-02	GW Protection	2.3E-02	GW Protection	5.0E+00	Ceiling Value
Molybdenum	3.9E+02	Human Health	5.0E+03	Ceiling Value	1.8E+02	Drinking Water

Summary Table C. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
Groundwater is a Current or Potential Source of Drinking Water

	Deep Soil					
Chemical	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis	Groundwater (ug/L)	Basis
Naphthalene	1.2E+00	GW Protection	1.2E+00	GW Protection	6.2E+00	Drinking Water
Nickel	1.5E+03	Human Health	5.0E+03	Ceiling Value	8.2E+00	Aquatic Habitat Goal
Pentachlorophenol	3.0E+00	Human Health	2.6E+00	Human Health	1.0E+00	Drinking Water
Perchlorate	5.5E+01	Human Health	7.2E+02	Human Health	6.0E+00	Drinking Water
Phenanthrene	1.1E+01	GW Protection	1.1E+01	GW Protection	4.6E+00	Aquatic Habitat Goal
Phenol	7.6E-02	GW Protection	7.6E-02	GW Protection	5.0E+00	Ceiling Value
Polychlorinated biphenyls (PCBs)	2.2E-01	Human Health	2.5E-01	Human Health	1.4E-02	Aquatic Habitat Goal
Pyrene	8.5E+01	GW Protection	8.5E+01	GW Protection	2.0E+00	Aquatic Habitat Goal
Selenium	3.9E+02	Human Health	5.0E+03	Ceiling Value	5.0E+00	Aquatic Habitat Goal
Silver	3.9E+02	Human Health	5.0E+03	Ceiling Value	1.9E-01	Aquatic Habitat Goal
Styrene	1.5E+00	GW Protection	1.5E+00	GW Protection	1.0E+01	Ceiling Value
tert-Butyl alcohol	7.5E-02	GW Protection	7.5E-02	GW Protection	1.2E+01	Drinking Water
1,1,1,2-Tetrachloroethane	9.1E-03	GW Protection	9.1E-03	GW Protection	5.1E-01	Drinking Water
1,1,2,2-Tetrachloroethane	1.8E-02	GW Protection	1.8E-02	GW Protection	1.0E+00	Drinking Water
Tetrachloroethene	5.5E-01	Human Health	7.0E-01	GW Protection	5.0E+00	Drinking Water
Thallium	7.8E-01	Human Health	1.0E+01	Human Health	2.0E+00	Drinking Water
Toluene	2.9E+00	GW Protection	2.9E+00	GW Protection	4.0E+01	Ceiling Value
Toxaphene	4.2E-04	GW Protection	4.2E-04	GW Protection	2.0E-04	Aquatic Habitat Goal
TPH (gasolines)	4.9E+02	Human Health	5.8E+02	GW Protection	1.0E+02	Ceiling Value
TPH (middle distillates)	2.4E+02	Human Health	5.3E+02	GW Protection	1.0E+02	Ceiling Value
TPH (residual fuels)	5.0E+03	Ceiling Value	5.0E+03	Ceiling Value	1.0E+02	Ceiling Value
1,2,4-Trichlorobenzene	1.5E+00	GW Protection	1.5E+00	GW Protection	5.0E+00	Drinking Water
1,1,1-Trichloroethane	7.8E+00	GW Protection	7.8E+00	GW Protection	6.2E+01	Aquatic Habitat Goal
1,1,2-Trichloroethane	7.0E-02	GW Protection	7.0E-02	GW Protection	5.0E+00	Drinking Water
Trichloroethene	4.6E-01	GW Protection	4.6E-01	GW Protection	5.0E+00	Drinking Water
2,4,5-Trichlorophenol	1.8E-01	GW Protection	1.8E-01	GW Protection	1.1E+01	Aquatic Habitat Goal
2,4,6-Trichlorophenol	1.2E+00	GW Protection	1.2E+00	GW Protection	3.7E+00	Drinking Water
Vanadium	3.9E+02	Human Health	5.0E+03	Ceiling Value	1.5E+01	Drinking Water
Vinyl chloride	3.2E-02	Human Health	8.5E-02	GW Protection	5.0E-01	Drinking Water
Xylenes	2.3E+00	GW Protection	2.3E+00	GW Protection	2.0E+01	Ceiling Value
Zinc	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	8.1E+01	Aquatic Habitat Goal

Notes:
Shallow soils defined as soils less than or equal to 3 meters (approximately 10 feet) below ground surface.
Residential Land Use generally considered adequate for other sensitive uses.
Groundwater values assume potential discharge of groundwater into a freshwater, marine, or estuary surface water system.
Soil ESLs intended to address direct-exposure, groundwater protection, urban ecological receptors, and nuisance concerns under noted land-use scenarios. Soil gas data should be collected for additional evaluation of potential indoor-air concerns at sites with areas of VOC-contaminated soil.
Groundwater ESLs intended to address drinking water, surface water, indoor-air, and nuisance concerns. Use in conjunction with soil gas screening levels to more closely evaluate potential indoor-air concerns if groundwater screening levels for this concern approached or exceeded.
Aquatic habitat goals for bioaccumulation concerns not considered in selection of groundwater goals.
TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.).

Summary Table D. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
Groundwater is not a Current or Potential Source of Drinking Water

Chemical	Deep Soil				Groundwater (µg/L)	Basis
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis		
Acenaphthene	1.9E+01	GW Protection	1.9E+01	GW Protection	2.3E+01	Aquatic Habitat Goal
Acenaphthylene	1.3E+01	GW Protection	1.3E+01	GW Protection	3.0E+01	Aquatic Habitat Goal
Acetone	5.0E-01	GW Protection	5.0E-01	GW Protection	1.5E+03	Aquatic Habitat Goal
Aldrin	3.2E-02	Human Health	6.4E-02	Human Health	1.3E-01	Aquatic Habitat Goal
Anthracene	2.8E+00	GW Protection	2.8E+00	GW Protection	7.3E-01	Aquatic Habitat Goal
Antimony	3.1E+01	Human Health	4.1E+02	Human Health	3.0E+01	Aquatic Habitat Goal
Arsenic	3.9E-01	Human Health	9.6E-01	Human Health	3.6E+01	Aquatic Habitat Goal
Barium	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	1.0E+03	Aquatic Habitat Goal
Benzene	7.4E-01	Human Health	1.2E+00	GW Protection	2.7E+01	Vapor Intrusion
Benzo(a)anthracene	3.8E-01	Human Health	4.5E-01	Human Health	2.7E-02	Aquatic Habitat Goal
Benzo(b)fluoranthene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Aquatic Habitat Goal
Benzo(k)fluoranthene	3.8E-01	Human Health	4.5E-01	Human Health	4.0E-01	Ceiling Value
Benzo(g,h,i)perylene	2.7E+01	GW Protection	2.7E+01	GW Protection	1.0E-01	Aquatic Habitat Goal
Benzo(a)pyrene	3.8E-02	Human Health	4.5E-02	Human Health	1.4E-02	Aquatic Habitat Goal
Beryllium	1.6E+02	Human Health	2.0E+03	Human Health	5.3E-01	Aquatic Habitat Goal
1,1-Biphenyl	6.5E+00	GW Protection	6.5E+00	GW Protection	5.0E+00	Ceiling Value
Bis(2-chloroethyl) ether	1.1E-01	Human Health	1.6E-01	GW Protection	1.2E+01	Aquatic Habitat Goal
Bis(2-chloroisopropyl) ether	1.3E-01	GW Protection	1.3E-01	GW Protection	1.2E+01	Aquatic Habitat Goal
Bis(2-ethylhexyl) phthalate	1.6E+02	Human Health	2.2E+02	Human Health	3.2E+01	Aquatic Habitat Goal
Boron	1.6E+04	Human Health	2.0E+05	Human Health	1.6E+00	Aquatic Habitat Goal
Bromodichloromethane	4.8E-01	Human Health	2.4E+00	Human Health	1.1E+03	Aquatic Habitat Goal
Bromoform (Tribromomethane)	2.4E+01	GW Protection	2.4E+01	GW Protection	1.1E+03	Aquatic Habitat Goal
Bromomethane	6.4E+00	GW Protection	6.4E+00	GW Protection	1.6E+02	Aquatic Habitat Goal
Cadmium (water)	No Value	No Value	No Value	No Value	2.5E-01	Aquatic Habitat Goal
Cadmium (soil)	7.8E+01	Human Health	1.0E+03	Human Health	No Value	No Value
Carbon tetrachloride	1.2E-01	Human Health	5.8E-01	Human Health	4.8E+00	Vapor Intrusion
Chlordane	4.4E-01	Human Health	9.5E-01	Human Health	4.0E-03	Aquatic Habitat Goal
p-Chloroaniline	5.3E-02	GW Protection	5.3E-02	GW Protection	5.0E+00	Aquatic Habitat Goal
Chlorobenzene	1.5E+00	GW Protection	1.5E+00	GW Protection	2.5E+01	Aquatic Habitat Goal
Chloroethane	1.1E+00	GW Protection	1.1E+00	GW Protection	1.6E+01	Aquatic Habitat Goal
Chloroform	1.1E+00	Human Health	5.0E+00	GW Protection	1.7E+02	Vapor Intrusion
Chloromethane	1.0E+02	Human Health	1.7E+02	GW Protection	1.1E+03	Aquatic Habitat Goal
2-Chlorophenol	1.2E-01	GW Protection	1.2E-01	GW Protection	1.8E+00	Ceiling Value
Chromium (total)	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	1.8E+02	Aquatic Habitat Goal
Chromium III	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	1.8E+02	Aquatic Habitat Goal
Chromium VI	2.1E+01	Human Health	1.1E+02	Human Health	1.1E+01	Aquatic Habitat Goal
Chrysene	3.8E+00	Human Health	4.5E+00	Human Health	3.5E-01	Aquatic Habitat Goal
Cobalt	2.3E+01	Human Health	3.0E+02	Human Health	3.0E+00	Aquatic Habitat Goal
Copper	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	3.1E+00	Aquatic Habitat Goal
Cyanide	3.6E-03	GW Protection	3.6E-03	GW Protection	1.0E+00	Aquatic Habitat Goal
Dibenz(a,h)anthracene	1.1E-01	Human Health	1.3E-01	Human Health	2.5E-01	Ceiling Value
Dibromochloromethane	7.6E+00	Human Health	3.4E+01	Human Health	1.1E+03	Aquatic Habitat Goal
1,2-dibromo-3-chloropropane	4.5E-03	GW Protection	4.5E-03	GW Protection	2.0E-01	Aquatic Habitat Goal
1,2-Dibromoethane	1.1E-01	Human Health	5.1E-01	GW Protection	7.7E+01	Vapor Intrusion
1,2-Dichlorobenzene	1.6E+00	GW Protection	1.6E+00	GW Protection	1.4E+01	Aquatic Habitat Goal
1,3-Dichlorobenzene	7.4E+00	GW Protection	7.4E+00	GW Protection	6.5E+01	Aquatic Habitat Goal
1,4-Dichlorobenzene	1.8E+00	GW Protection	1.8E+00	GW Protection	1.5E+01	Aquatic Habitat Goal
3,3-Dichlorobenzidine	5.3E-01	Human Health	2.4E+00	Human Health	2.5E+02	Aquatic Habitat Goal
Dichlorodiphenyldichloroethane (DDD)	2.4E+00	Human Health	6.0E+00	Human Health	1.0E-03	Aquatic Habitat Goal
Dichlorodiphenyldichloroethene (DDE)	1.7E+00	Human Health	4.2E+00	Human Health	1.0E-03	Aquatic Habitat Goal
Dichlorodiphenyltrichloroethane (DDT)	1.7E+00	Human Health	4.2E+00	Human Health	1.0E-03	Aquatic Habitat Goal
1,1-Dichloroethane	1.9E+00	GW Protection	1.9E+00	GW Protection	4.7E+01	Aquatic Habitat Goal
1,2-Dichloroethane	4.4E-01	Human Health	9.1E-01	GW Protection	1.0E+02	Vapor Intrusion
1,1-Dichloroethene	4.3E+00	GW Protection	4.3E+00	GW Protection	2.5E+01	Aquatic Habitat Goal

Summary Table D. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
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Chemical	Deep Soil				Groundwater (µg/L)	Basis
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis		
cis-1,2-Dichloroethene	1.8E+01	GW Protection	1.8E+01	GW Protection	5.9E+02	Aquatic Habitat Goal
trans-1,2-Dichloroethene	3.9E+01	GW Protection	3.9E+01	GW Protection	5.9E+02	Aquatic Habitat Goal
2,4-Dichlorophenol	3.0E+00	GW Protection	3.0E+00	GW Protection	3.0E+00	Ceiling Value
1,2-Dichloropropane	8.2E-01	Human Health	2.5E+00	GW Protection	1.0E+02	Ceiling Value
1,3-Dichloropropene	2.7E-01	Human Health	1.3E+00	Human Health	2.4E+01	Aquatic Habitat Goal
Dieldrin	2.3E-03	GW Protection	2.3E-03	GW Protection	1.9E-03	Aquatic Habitat Goal
Diethyl phthalate	3.5E-02	GW Protection	3.5E-02	GW Protection	1.5E+00	Aquatic Habitat Goal
Dimethyl phthalate	3.5E-02	GW Protection	3.5E-02	GW Protection	1.5E+00	Aquatic Habitat Goal
2,4-Dimethylphenol	7.4E-01	GW Protection	7.4E-01	GW Protection	1.1E+02	Aquatic Habitat Goal
2,4-Dinitrophenol	4.2E-02	GW Protection	4.2E-02	GW Protection	1.5E+01	Aquatic Habitat Goal
2,4-Dinitrotoluene	8.6E-01	GW Protection	8.6E-01	GW Protection	1.2E+02	Aquatic Habitat Goal
1,4-Dioxane	2.4E+01	Human Health	3.0E+01	GW Protection	5.0E+04	Ceiling Value
Dioxin (2,3,7,8-TCDD)	4.5E-06	Human Health	1.1E-05	Human Health	1.0E-06	Aquatic Habitat Goal
Endosulfan	4.6E-03	GW Protection	4.6E-03	GW Protection	8.7E-03	Aquatic Habitat Goal
Endrin	6.5E-04	GW Protection	6.5E-04	GW Protection	2.3E-03	Aquatic Habitat Goal
Ethylbenzene	4.7E+00	GW Protection	4.7E+00	GW Protection	4.3E+01	Aquatic Habitat Goal
Fluoranthene	6.0E+01	GW Protection	6.0E+01	GW Protection	8.0E+00	Aquatic Habitat Goal
Fluorene	8.9E+00	GW Protection	8.9E+00	GW Protection	3.9E+00	Aquatic Habitat Goal
Heptachlor	1.3E-02	GW Protection	1.3E-02	GW Protection	3.6E-03	Aquatic Habitat Goal
Heptachlor epoxide	1.4E-02	GW Protection	1.4E-02	GW Protection	3.6E-03	Aquatic Habitat Goal
Hexachlorobenzene	3.1E-01	Human Health	6.0E-01	Human Health	3.7E+00	Aquatic Habitat Goal
Hexachlorobutadiene	4.6E+00	GW Protection	4.6E+00	GW Protection	9.3E-01	Aquatic Habitat Goal
γ-Hexachlorocyclohexane (Lindane)	9.8E-03	GW Protection	9.8E-03	GW Protection	1.6E-02	Aquatic Habitat Goal
Hexachloroethane	1.2E+01	Human Health	1.7E+01	Human Health	1.2E+01	Aquatic Habitat Goal
Indeno(1,2,3-c,d)pyrene	3.8E-01	Human Health	4.5E-01	Human Health	5.6E-02	Aquatic Habitat Goal
Lead	8.0E+01	Human Health	3.2E+02	Human Health	2.5E+00	Aquatic Habitat Goal
Mercury (elemental)	6.7E+00	Human Health	8.8E+01	Human Health	2.5E-02	Aquatic Habitat Goal
Methoxychlor	1.9E+01	GW Protection	1.9E+01	GW Protection	3.0E-03	Aquatic Habitat Goal
Methylene chloride	9.9E+00	Human Health	3.4E+01	GW Protection	2.2E+03	Aquatic Habitat Goal
Methyl ethyl ketone	1.3E+01	GW Protection	1.3E+01	GW Protection	1.4E+04	Aquatic Habitat Goal
Methyl isobutyl ketone	3.9E+00	GW Protection	3.9E+00	GW Protection	1.7E+02	Aquatic Habitat Goal
Methyl mercury	6.1E+00	Human Health	6.2E+01	Human Health	3.0E-03	Aquatic Habitat Goal
2-Methylnaphthalene	2.5E-01	GW Protection	2.5E-01	GW Protection	2.1E+00	Aquatic Habitat Goal
tert-Butyl methyl ether	8.4E+00	GW Protection	8.4E+00	GW Protection	1.8E+03	Ceiling Value
Molybdenum	3.9E+02	Human Health	5.0E+03	Ceiling Value	2.4E+02	Aquatic Habitat Goal

Summary Table D. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
Groundwater is not a Current or Potential Source of Drinking Water

Chemical	Deep Soil				Groundwater (µg/L)	Basis
	Residential Land Use (mg/kg)	Basis	Commercial/ Industrial Land Use (mg/kg)	Basis		
Naphthalene	3.1E+00	Human Health	4.8E+00	GW Protection	2.4E+01	Aquatic Habitat Goal
Nickel	1.5E+03	Human Health	5.0E+03	Ceiling Value	8.2E+00	Aquatic Habitat Goal
Pentachlorophenol	3.0E+00	Human Health	2.6E+00	Human Health	7.9E+00	Aquatic Habitat Goal
Perchlorate	5.5E+01	Human Health	7.2E+02	Human Health	6.0E+02	Aquatic Habitat Goal
Phenanthrene	1.1E+01	GW Protection	1.1E+01	GW Protection	4.6E+00	Aquatic Habitat Goal
Phenol	3.9E+00	GW Protection	3.9E+00	GW Protection	2.6E+02	Aquatic Habitat Goal
Polychlorinated biphenyls (PCBs)	2.2E-01	Human Health	2.5E-01	Human Health	1.4E-02	Aquatic Habitat Goal
Pyrene	8.5E+01	GW Protection	8.5E+01	GW Protection	2.0E+00	Aquatic Habitat Goal
Selenium	3.9E+02	Human Health	5.0E+03	Ceiling Value	5.0E+00	Aquatic Habitat Goal
Silver	3.9E+02	Human Health	5.0E+03	Ceiling Value	1.9E-01	Aquatic Habitat Goal
Styrene	1.5E+01	GW Protection	1.5E+01	GW Protection	1.0E+02	Aquatic Habitat Goal
tert-Butyl alcohol	1.1E+02	GW Protection	1.1E+02	GW Protection	1.8E+04	Aquatic Habitat Goal
1,1,1,2-Tetrachloroethane	3.8E+00	Human Health	1.6E+01	GW Protection	9.3E+02	Aquatic Habitat Goal
1,1,2,2-Tetrachloroethane	4.7E-01	Human Health	2.3E+00	Human Health	2.4E+02	Aquatic Habitat Goal
Tetrachloroethene	5.5E-01	Human Health	2.6E+00	Human Health	6.3E+01	Vapor Intrusion
Thallium	7.8E-01	Human Health	1.0E+01	Human Health	4.0E+00	Aquatic Habitat Goal
Toluene	9.3E+00	GW Protection	9.3E+00	GW Protection	1.3E+02	Aquatic Habitat Goal
Toxaphene	4.2E-04	GW Protection	4.2E-04	GW Protection	2.0E-04	Aquatic Habitat Goal
TPH (gasolines)	4.9E+02	Human Health	2.4E+03	Human Health	5.0E+02	Aquatic Habitat Goal
TPH (middle distillates)	2.4E+02	Human Health	1.1E+03	Human Health	6.4E+02	Aquatic Habitat Goal
TPH (residual fuels)	5.0E+03	Ceiling Value	5.0E+03	Ceiling Value	6.4E+02	Aquatic Habitat Goal
1,2,4-Trichlorobenzene	7.6E+00	GW Protection	7.6E+00	GW Protection	2.5E+01	Aquatic Habitat Goal
1,1,1-Trichloroethane	7.8E+00	GW Protection	7.8E+00	GW Protection	6.2E+01	Aquatic Habitat Goal
1,1,2-Trichloroethane	8.8E-01	Human Health	4.4E+00	Human Health	9.4E+02	Aquatic Habitat Goal
Trichloroethene	1.7E+00	Human Health	8.3E+00	Human Health	1.3E+02	Vapor Intrusion
2,4,5-Trichlorophenol	1.8E-01	GW Protection	1.8E-01	GW Protection	1.1E+01	Aquatic Habitat Goal
2,4,6-Trichlorophenol	7.8E+00	Human Health	3.2E+01	GW Protection	9.7E+01	Aquatic Habitat Goal
Vanadium	3.9E+02	Human Health	5.0E+03	Ceiling Value	1.9E+01	Aquatic Habitat Goal
Vinyl chloride	3.2E-02	Human Health	1.6E-01	Human Health	1.8E+00	Vapor Intrusion
Xylenes	1.1E+01	GW Protection	1.1E+01	GW Protection	1.0E+02	Aquatic Habitat Goal
Zinc	2.5E+03	Ceiling Value	5.0E+03	Ceiling Value	8.1E+01	Aquatic Habitat Goal

Notes:
Shallow soils defined as soils less than or equal to 3 meters (approximately 10 feet) below ground surface.
Residential Land Use generally considered adequate for other sensitive uses.
Groundwater values assume potential discharge of groundwater into a freshwater, marine, or estuary surface water system.
Soil ESLs intended to address direct-exposure, groundwater protection, urban ecological receptors, and nuisance concerns.
Soil gas data should be collected for evaluation of potential indoor-air concerns at sites with VOC-contaminated soil.
Groundwater ESLs intended to address drinking water, surface water, indoor-air, and nuisance concerns. Use in conjunction with soil gas screening levels to more closely evaluate potential indoor-air concerns if groundwater screening levels for this concern approached or exceeded.
Aquatic habitat goals for bioaccumulation concerns not considered in selection of groundwater goals.
TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.).

Summary Table E. Environmental Screening Levels (ESLs)
Indoor Air and Soil Gas
(Vapor Intrusion Concerns)

Chemical	Indoor Air			Soil Gas		
	Residential Land Use ($\mu g/m^3$)	Commercial/Industrial Land Use ($\mu g/m^3$)	Odor Threshold* ($\mu g/m^3$)	Residential Land Use ($\mu g/m^3$)	Commercial/Industrial Land Use ($\mu g/m^3$)	Ceiling Level** ($\mu g/m^3$)
Acenaphthene	No Value	No Value	5.1E+02	No Value	No Value	2.6E+05
Acenaphthylene	No Value	No Value	No Value	No Value	No Value	No Value
Acetone	3.2E+04	1.4E+05	3.1E+04	1.6E+07	1.4E+08	1.5E+07
Aldrin	5.0E-04	2.5E-03	2.6E+02	No Value	No Value	1.3E+05
Anthracene	No Value	No Value	No Value	No Value	No Value	No Value
Antimony	No Value	No Value	No Value	No Value	No Value	No Value
Arsenic	5.7E-04	2.9E-03	No Value	No Value	No Value	No Value
Barium	5.2E-01	2.2E+00	No Value	No Value	No Value	No Value
Benzene	8.4E-02	4.2E-01	4.9E+03	4.2E+01	4.2E+02	2.4E+06
Benzo(a)anthracene	2.2E-02	1.1E-01	No Value	No Value	No Value	No Value
Benzo(b)fluoranthene	2.2E-02	1.1E-01	No Value	No Value	No Value	No Value
Benzo(k)fluoranthene	2.2E-02	1.1E-01	No Value	No Value	No Value	No Value
Benzo(g,h,i)perylene	No Value	No Value	No Value	No Value	No Value	No Value
Benzo(a)pyrene	2.2E-03	1.1E-02	No Value	No Value	No Value	No Value
Beryllium	1.0E-03	5.1E-03	No Value	No Value	No Value	No Value
1,1-Biphenyl	No Value	No Value	6.0E+01	No Value	No Value	3.0E+04
Bis(2-chloroethyl) ether	3.4E-03	1.7E-02	2.9E+02	1.7E+00	1.7E+01	1.4E+05
Bis(2-chloroisopropyl) ether	No Value	No Value	2.2E+03	No Value	No Value	1.1E+06
Bis(2-ethylhexyl) phthalate	1.0E+00	5.1E+00	No Value	No Value	No Value	No Value
Boron	No Value	No Value	No Value	No Value	No Value	No Value
Bromodichloromethane	6.6E-02	3.3E-01	1.1E+07	3.3E+01	3.3E+02	5.5E+09
Bromoform (Tribromomethane)	2.2E+00	1.1E+01	1.3E+04	No Value	No Value	6.7E+06
Bromomethane	5.2E+00	2.2E+01	8.0E+04	2.6E+03	2.2E+04	4.0E+07
Cadmium (water)	5.8E-04	2.9E-03	No Value	No Value	No Value	No Value
Cadmium (soil)	5.8E-04	2.9E-03	No Value	No Value	No Value	No Value
Carbon tetrachloride	5.8E-02	2.9E-01	6.3E+04	2.9E+01	2.9E+02	3.2E+07
Chlordane	7.2E-03	3.6E-02	8.4E+00	No Value	No Value	4.2E+03
p-Chloroaniline	No Value	No Value	No Value	No Value	No Value	No Value
Chlorobenzene	1.0E+03	4.4E+03	1.0E+03	5.2E+05	4.4E+06	5.0E+05
Chloroethane	3.1E+04	1.3E+05	3.8E+05	1.6E+07	1.3E+08	1.9E+08
Chloroform	4.6E-01	2.3E+00	4.2E+05	2.3E+02	2.3E+03	2.1E+08
Chloromethane	9.4E+01	3.9E+02	No Value	4.7E+04	3.9E+05	No Value
2-Chlorophenol	No Value	No Value	1.9E+01	No Value	No Value	9.5E+03
Chromium (total)	No Value	No Value	No Value	No Value	No Value	No Value
Chromium III	No Value	No Value	No Value	No Value	No Value	No Value
Chromium VI	1.6E-05	8.2E-05	No Value	No Value	No Value	No Value
Chrysene	2.2E-01	1.1E+00	No Value	No Value	No Value	No Value
Cobalt	2.7E-04	1.4E-03	No Value	No Value	No Value	No Value
Copper	No Value	No Value	No Value	No Value	No Value	No Value
Cyanide	No Value	No Value	6.5E+02	No Value	No Value	3.3E+05
Dibenz(a,h)anthracene	2.0E-03	1.0E-02	No Value	No Value	No Value	No Value
Dibromochloromethane	No Value	No Value	No Value	No Value	No Value	No Value
1,2-dibromo-3-chloropropane	1.2E-03	6.1E-03	No Value	6.1E-01	6.1E+00	No Value
1,2-Dibromoethane	3.4E-02	1.7E-01	2.0E+05	1.7E+01	1.7E+02	1.0E+08
1,2-Dichlorobenzene	2.1E+02	8.8E+02	3.1E+05	1.0E+05	8.8E+05	1.5E+08
1,3-Dichlorobenzene	No Value	No Value	No Value	No Value	No Value	No Value
1,4-Dichlorobenzene	2.2E-01	1.1E+00	1.1E+03	1.1E+02	1.1E+03	5.5E+05
3,3-Dichlorobenzidine	8.1E-03	4.1E-02	No Value	No Value	No Value	No Value
Dichlorodiphenyldichloroethane (DDD)	3.5E-02	1.8E-01	No Value	No Value	No Value	No Value
Dichlorodiphenyldichloroethene (DDE)	2.5E-02	1.3E-01	No Value	No Value	No Value	No Value
Dichlorodiphenyltrichloroethane (DDT)	2.5E-02	1.3E-01	No Value	No Value	No Value	No Value
1,1-Dichloroethane	1.5E+00	7.7E+00	1.3E+05	7.6E+02	7.7E+03	6.3E+07
1,2-Dichloroethane	1.2E-01	5.8E-01	2.4E+03	5.8E+01	5.8E+02	1.2E+06
1,1-Dichloroethene	2.1E+02	8.8E+02	2.0E+06	1.0E+05	8.8E+05	1.0E+09
cis-1,2-Dichloroethene	No Value	No Value	No Value	No Value	No Value	No Value
trans-1,2-Dichloroethene	6.3E+01	2.6E+02	6.7E+04	3.1E+04	2.6E+05	3.4E+07
2,4-Dichlorophenol	No Value	No Value	1.4E+03	No Value	No Value	7.0E+05
1,2-Dichloropropane	2.4E-01	1.2E+00	1.2E+03	1.2E+02	1.2E+03	6.0E+05
1,3-Dichloropropene	1.5E-01	7.7E-01	4.2E+03	7.6E+01	7.7E+02	2.1E+06
Dieldrin	5.3E-04	2.7E-03	No Value	No Value	No Value	No Value
Diethyl phthalate	No Value	No Value	No Value	No Value	No Value	No Value
Dimethyl phthalate	No Value	No Value	No Value	No Value	No Value	No Value
2,4-Dimethylphenol	No Value	No Value	1.0E+00	No Value	No Value	5.0E+02
2,4-Dinitrophenol	No Value	No Value	No Value	No Value	No Value	No Value
2,4-Dinitrotoluene	2.7E-02	1.4E-01	No Value	No Value	No Value	No Value
1,4-Dioxane	3.2E-01	1.6E+00	6.1E+05	No Value	No Value	3.1E+08

Summary Table E. Environmental Screening Levels (ESLs)
Indoor Air and Soil Gas
(Vapor Intrusion Concerns)

Chemical	Indoor Air			Soil Gas		
	Residential Land Use ($\mu g/m^3$)	Commercial/Industrial Land Use ($\mu g/m^3$)	Odor Threshold* ($\mu g/m^3$)	Residential Land Use ($\mu g/m^3$)	Commercial/Industrial Land Use ($\mu g/m^3$)	Ceiling Level** ($\mu g/m^3$)
Dioxin (2,3,7,8-TCDD)	6.4E-08	3.2E-07	No Value	No Value	No Value	No Value
Endosulfan	No Value	No Value	No Value	No Value	No Value	No Value
Endrin	No Value	No Value	No Value	No Value	No Value	No Value
Ethylbenzene	9.7E-01	4.9E+00	2.0E+03	4.9E+02	4.9E+03	1.0E+06
Fluoranthene	No Value	No Value	No Value	No Value	No Value	No Value
Fluorene	No Value	No Value	No Value	No Value	No Value	No Value
Heptachlor	2.1E-03	1.0E-02	3.0E+02	No Value	No Value	1.5E+05
Heptachlor epoxide	9.4E-04	4.7E-03	3.0E+02	No Value	No Value	1.5E+05
Hexachlorobenzene	4.8E-03	2.4E-02	No Value	No Value	No Value	No Value
Hexachlorobutadiene	No Value	No Value	1.2E+04	No Value	No Value	6.0E+06
γ-Hexachlorocyclohexane (Lindane)	No Value	No Value	No Value	No Value	No Value	No Value
Hexachloroethane	2.2E-01	1.1E+00	No Value	No Value	No Value	No Value
Indeno(1,2,3-c,d)pyrene	2.2E-02	1.1E-01	No Value	No Value	No Value	No Value
Lead	No Value	No Value	No Value	No Value	No Value	No Value
Mercury (elemental)	3.1E-02	1.3E-01	No Value	1.6E+01	1.3E+02	No Value
Methoxychlor	No Value	No Value	No Value	No Value	No Value	No Value
Methylene chloride	5.2E+00	2.6E+01	5.6E+05	2.6E+03	2.6E+04	2.8E+08
Methyl ethyl ketone	5.2E+03	2.2E+04	3.2E+04	2.6E+06	2.2E+07	1.6E+07
Methyl isobutyl ketone	3.1E+03	1.3E+04	4.2E+02	1.6E+06	1.3E+07	2.1E+05
Methyl mercury	No Value	No Value	No Value	No Value	No Value	No Value
2-Methylnaphthalene	No Value	No Value	6.8E+01	No Value	No Value	3.4E+04
tert-Butyl methyl ether	9.4E+00	4.7E+01	5.3E+02	4.7E+03	4.7E+04	2.7E+05
Molybdenum	No Value	No Value	No Value	No Value	No Value	No Value
Naphthalene	7.2E-02	3.6E-01	4.4E+02	3.6E+01	3.6E+02	2.2E+05
Nickel	5.2E-02	2.2E-01	No Value	No Value	No Value	No Value
Pentachlorophenol	4.8E-01	2.4E+00	No Value	No Value	No Value	No Value
Perchlorate	No Value	No Value	No Value	No Value	No Value	No Value
Phenanthrene	No Value	No Value	5.5E+01	No Value	No Value	2.8E+04
Phenol	No Value	No Value	1.6E+02	No Value	No Value	7.8E+04
Polychlorinated biphenyls (PCBs)	2.4E-02	1.2E-01	No Value	No Value	No Value	No Value
Pyrene	No Value	No Value	No Value	No Value	No Value	No Value
Selenium	No Value	No Value	No Value	No Value	No Value	No Value
Silver	No Value	No Value	No Value	No Value	No Value	No Value
Styrene	9.4E+02	3.9E+03	1.4E+03	4.7E+05	3.9E+06	6.8E+05
tert-Butyl alcohol	No Value	No Value	No Value	No Value	No Value	No Value
1,1,1,2-Tetrachloroethane	3.2E-01	1.6E+00	No Value	1.6E+02	1.6E+03	No Value
1,1,2,2-Tetrachloroethane	4.2E-02	2.1E-01	1.0E+04	2.1E+01	2.1E+02	5.2E+06
Tetrachloroethene	4.1E-01	2.1E+00	3.2E+04	2.1E+02	2.1E+03	1.6E+07
Thallium	No Value	No Value	No Value	No Value	No Value	No Value
Toluene	3.1E+02	1.3E+03	3.0E+04	1.6E+05	1.3E+06	1.5E+07
Toxaphene	7.2E-03	3.6E-02	No Value	No Value	No Value	No Value
TPH (gasolines)	2.9E+02	1.2E+03	1.0E+02	1.5E+05	1.2E+06	5.0E+04
TPH (middle distillates)	1.4E+02	5.7E+02	1.0E+03	6.8E+04	5.7E+05	5.0E+05
TPH (residual fuels)	No Value	No Value	No Value	No Value	No Value	No Value
1,2,4-Trichlorobenzene	4.2E+00	1.8E+01	2.2E+04	2.1E+03	1.8E+04	1.1E+07
1,1,1-Trichloroethane	5.2E+03	2.2E+04	6.5E+04	2.6E+06	2.2E+07	3.3E+07
1,1,2-Trichloroethane	1.5E-01	7.7E-01	No Value	7.6E+01	7.7E+02	No Value
Trichloroethene	5.9E-01	3.0E+00	1.4E+06	3.0E+02	3.0E+03	6.8E+08
2,4,5-Trichlorophenol	No Value	No Value	No Value	No Value	No Value	No Value
2,4,6-Trichlorophenol	7.8E-01	4.0E+00	3.0E-01	No Value	No Value	1.5E+02
Vanadium	No Value	No Value	No Value	No Value	No Value	No Value
Vinyl chloride	3.1E-02	1.6E-01	7.7E+05	1.6E+01	1.6E+02	3.9E+08
Xylenes	1.0E+02	4.4E+02	4.4E+02	5.2E+04	4.4E+05	2.2E+05
Zinc	No Value	No Value	No Value	No Value	No Value	No Value

Notes:

* The odor threshold is applicable for indoor air and other scenarios, such as a trench worker, where receptors may be directly exposed to vapors.

** The ceiling value for soil gas is the odor threshold with an attenuation factor comparable to that used for residential land use.

Residential Land Use generally considered adequate for other sensitive uses.

TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.).

Summary Table F. Environmental Screening Levels (ESLs)
Surface Water Bodies

Chemical	Surface Water Screening Levels					Basis
	Freshwater (µg/L)	Basis	Marine (µg/L)	Basis	Estuarine (µg/L)	
Acenaphthene	2.0E+01	Ceiling Value	2.0E+01	Ceiling Level	2.0E+01	Ceiling Level
Acenaphthylene	3.0E+01	Aquatic Habitat	3.0E+01	Aquatic Habitat Goal	3.0E+01	Aquatic Habitat Goal
Acetone	1.5E+03	Aquatic Habitat Goal	1.5E+03	Aquatic Habitat Goal	1.5E+03	Aquatic Habitat Goal
Aldrin	1.4E-04	Bioaccumulation/Human Consumption	1.4E-04	Bioaccum/Human Consum	1.4E-04	Bioaccum/Human Consum
Anthracene	7.3E-01	Aquatic Habitat Goal	7.3E-01	Aquatic Habitat Goal	7.3E-01	Aquatic Habitat Goal
Antimony	6.0E+00	Drinking Water Toxicity	5.0E+02	Aquatic Habitat Goal	3.0E+01	Aquatic Habitat Goal
Arsenic	1.4E-01	Bioaccumulation/Human Consumption	1.4E-01	Bioaccum/Human Consum	1.4E-01	Bioaccum/Human Consum
Barium	1.0E+03	Drinking Water Toxicity	1.0E+03	Aquatic Habitat Goal	1.0E+03	Aquatic Habitat Goal
Benzene	1.0E+00	Drinking Water Toxicity	7.1E+01	Bioaccum/Human Consum	4.6E+01	Aquatic Habitat Goal
Benzo(a)anthracene	2.7E-02	Aquatic Habitat Goal	2.7E-02	Aquatic Habitat Goal	2.7E-02	Aquatic Habitat Goal
Benzo(b)fluoranthene	4.9E-02	Bioaccumulation/Human Consumption	4.9E-02	Bioaccum/Human Consum	4.9E-02	Bioaccum/Human Consum
Benzo(k)fluoranthene	4.9E-02	Bioaccumulation/Human Consumption	4.9E-02	Bioaccum/Human Consum	4.9E-02	Bioaccum/Human Consum
Benzo(g,h,i)perylene	1.0E-01	Aquatic Habitat Goal	1.0E-01	Aquatic Habitat Goal	1.0E-01	Aquatic Habitat Goal
Benzo(a)pyrene	1.4E-02	Aquatic Habitat Goal	1.4E-02	Aquatic Habitat Goal	1.4E-02	Aquatic Habitat Goal
Beryllium	2.7E+00	Aquatic Habitat Goal	5.3E-01	Aquatic Habitat Goal	5.3E-01	Aquatic Habitat Goal
1,1-Biphenyl	5.0E-01	Ceiling Value	5.0E-01	Ceiling Level	5.0E-01	Ceiling Level
Bis(2-chloroethyl) ether	5.5E-03	Drinking Water Toxicity	1.4E+00	Bioaccum/Human Consum	1.4E+00	Bioaccum/Human Consum
Bis(2-chloroisopropyl) ether	6.1E+01	Aquatic Habitat Goal	1.2E+01	Aquatic Habitat Goal	1.2E+01	Aquatic Habitat Goal
Bis(2-ethylhexyl) phthalate	4.0E+00	Drinking Water Toxicity	5.9E+00	Bioaccum/Human Consum	5.9E+00	Bioaccum/Human Consum
Boron	1.6E+00	Aquatic Habitat Goal	1.6E+00	Aquatic Habitat Goal	1.6E+00	Aquatic Habitat Goal
Bromodichloromethane	1.0E+02	Drinking Water Toxicity	3.2E+03	Aquatic Habitat Goal	1.1E+03	Aquatic Habitat Goal
Bromoform (Tribromomethane)	1.0E+02	Drinking Water Toxicity	3.6E+02	Bioaccum/Human Consum	3.6E+02	Bioaccum/Human Consum
Bromomethane	8.7E+00	Drinking Water Toxicity	3.2E+03	Aquatic Habitat Goal	1.6E+02	Aquatic Habitat Goal
Cadmium (water)	2.5E-01	Aquatic Habitat Goal	9.3E+00	Aquatic Habitat Goal	2.5E-01	Aquatic Habitat Goal
Carbon tetrachloride	5.0E-01	Drinking Water Toxicity	4.4E+00	Bioaccum/Human Consum	4.4E+00	Bioaccum/Human Consum
Chlordane	5.9E-04	Bioaccumulation/Human Consumption	5.9E-04	Bioaccum/Human Consum	5.9E-04	Bioaccum/Human Consum
p-Chloroaniline	5.0E+00	Aquatic Habitat Goal	5.0E+00	Aquatic Habitat Goal	5.0E+00	Aquatic Habitat Goal
Chlorobenzene	2.5E+01	Aquatic Habitat Goal	5.0E+01	Ceiling Level	2.5E+01	Aquatic Habitat Goal
Chloroethane	1.6E+01	Ceiling Value	1.6E+01	Ceiling Level	1.6E+01	Ceiling Level
Chloroform	7.0E+01	Drinking Water Toxicity	4.7E+02	Bioaccum/Human Consum	4.7E+02	Bioaccum/Human Consum
Chloromethane	1.6E+02	Drinking Water Toxicity	3.2E+03	Aquatic Habitat Goal	1.1E+03	Aquatic Habitat Goal
2-Chlorophenol	1.8E-01	Ceiling Value	1.8E-01	Ceiling Level	1.8E-01	Ceiling Level
Chromium (total)	5.0E+01	Drinking Water Toxicity	1.8E+02	Aquatic Habitat Goal	1.8E+02	Aquatic Habitat Goal
Chromium III	1.8E+02	Aquatic Habitat Goal	1.0E+03	Aquatic Habitat Goal	1.8E+02	Aquatic Habitat Goal
Chromium VI	1.1E+01	Aquatic Habitat Goal	5.0E+01	Aquatic Habitat Goal	1.1E+01	Aquatic Habitat Goal
Chrysene	4.9E-02	Bioaccumulation/Human Consumption	4.9E-02	Bioaccum/Human Consum	4.9E-02	Bioaccum/Human Consum
Cobalt	3.0E+00	Aquatic Habitat Goal	3.0E+00	Aquatic Habitat Goal	3.0E+00	Aquatic Habitat Goal
Copper	9.0E+00	Aquatic Habitat Goal	3.1E+00	Aquatic Habitat Goal	3.1E+00	Aquatic Habitat Goal
Cyanide	5.2E+00	Aquatic Habitat Goal	1.0E+00	Aquatic Habitat Goal	1.0E+00	Aquatic Habitat Goal
Dibenz(a,h)anthracene	1.6E-02	Drinking Water Toxicity	4.9E-02	Bioaccum/Human Consum	4.9E-02	Bioaccum/Human Consum
Dibromochloromethane	4.6E+01	Bioaccumulation/Human Consumption	4.6E+01	Bioaccum/Human Consum	4.6E+01	Bioaccum/Human Consum
1,2-dibromo-3-chloropropane	2.0E-01	Drinking Water Toxicity	2.0E-01	Aquatic Habitat Goal	2.0E-01	Aquatic Habitat Goal
1,2-Dibromoethane	5.0E-02	Drinking Water Toxicity	1.4E+03	Aquatic Habitat Goal	1.4E+03	Aquatic Habitat Goal
1,2-Dichlorobenzene	1.0E+01	Ceiling Value	1.0E+01	Ceiling Level	1.0E+01	Ceiling Level
1,3-Dichlorobenzene	7.1E+01	Aquatic Habitat Goal	6.5E+01	Aquatic Habitat Goal	6.5E+01	Aquatic Habitat Goal
1,4-Dichlorobenzene	5.0E+00	Ceiling Value	1.1E+01	Ceiling Level	1.1E+01	Ceiling Level
3,3-Dichlorobenzidine	5.6E-02	Drinking Water Toxicity	7.7E-02	Bioaccum/Human Consum	7.7E-02	Bioaccum/Human Consum
Dichlorodiphenyldichloroethane (DDD)	8.4E-04	Bioaccumulation/Human Consumption	8.4E-04	Bioaccum/Human Consum	8.4E-04	Bioaccum/Human Consum
Dichlorodiphenyldichloroethene (DDE)	5.9E-04	Bioaccumulation/Human Consumption	5.9E-04	Bioaccum/Human Consum	5.9E-04	Bioaccum/Human Consum
Dichlorodiphenyltrichloroethane (DDT)	5.9E-04	Bioaccumulation/Human Consumption	5.9E-04	Bioaccum/Human Consum	5.9E-04	Bioaccum/Human Consum
1,1-Dichloroethane	5.0E+00	Drinking Water Toxicity	4.7E+01	Aquatic Habitat Goal	4.7E+01	Aquatic Habitat Goal
1,2-Dichloroethane	5.0E-01	Drinking Water Toxicity	9.9E+01	Bioaccum/Human Consum	9.9E+01	Bioaccum/Human Consum
1,1-Dichloroethene	3.2E+00	Bioaccumulation/Human Consumption	3.2E+00	Bioaccum/Human Consum	3.2E+00	Bioaccum/Human Consum
cis-1,2-Dichloroethene	6.0E+00	Drinking Water Toxicity	2.2E+04	Aquatic Habitat Goal	5.9E+02	Aquatic Habitat Goal
trans-1,2-Dichloroethene	1.0E+01	Drinking Water Toxicity	2.6E+02	Ceiling Level	2.6E+02	Ceiling Level
2,4-Dichlorophenol	3.0E-01	Ceiling Value	3.0E-01	Ceiling Level	3.0E-01	Ceiling Level
1,2-Dichloropropane	5.0E+00	Drinking Water Toxicity	1.0E+01	Ceiling Level	1.0E+01	Ceiling Level
1,3-Dichloropropene	5.0E-01	Drinking Water Toxicity	2.4E+01	Aquatic Habitat Goal	2.4E+01	Aquatic Habitat Goal
Dieldrin	1.4E-04	Bioaccumulation/Human Consumption	1.4E-04	Bioaccum/Human Consum	1.4E-04	Bioaccum/Human Consum
Diethyl phthalate	1.5E+00	Aquatic Habitat Goal	1.7E+00	Aquatic Habitat Goal	1.5E+00	Aquatic Habitat Goal
Dimethyl phthalate	1.5E+00	Aquatic Habitat Goal	1.7E+00	Aquatic Habitat Goal	1.5E+00	Aquatic Habitat Goal
2,4-Dimethylphenol	1.0E+02	Drinking Water Toxicity	1.1E+02	Aquatic Habitat Goal	1.1E+02	Aquatic Habitat Goal
2,4-Dinitrophenol	7.3E+01	Drinking Water Toxicity	1.5E+01	Aquatic Habitat Goal	1.5E+01	Aquatic Habitat Goal
2,4-Dinitrotoluene	9.9E-02	Drinking Water Toxicity	9.1E+00	Bioaccum/Human Consum	9.1E+00	Bioaccum/Human Consum
1,4-Dioxane	2.5E+00	Drinking Water Toxicity	5.0E+04	Ceiling Level	5.0E+04	Ceiling Level
Dioxin (2,3,7,8-TCDD)	1.4E-08	Bioaccumulation/Human Consumption	1.4E-08	Bioaccum/Human Consum	1.4E-08	Bioaccum/Human Consum
Endosulfan	5.6E-02	Aquatic Habitat Goal	8.7E-03	Aquatic Habitat Goal	8.7E-03	Aquatic Habitat Goal
Endrin	3.6E-02	Aquatic Habitat Goal	2.3E-03	Aquatic Habitat Goal	2.3E-03	Aquatic Habitat Goal

Summary Table F. Environmental Screening Levels (ESLs)
Surface Water Bodies

Chemical	Surface Water Screening Levels					Basis
	Freshwater (µg/L)	Basis	Marine (µg/L)	Basis	Estuarine (µg/L)	
Ethylbenzene	3.0E+01	Ceiling Value	3.0E+01	Ceiling Level	3.0E+01	Ceiling Level
Fluoranthene	8.1E+00	Aquatic Habitat Goal	8.0E+00	Aquatic Habitat Goal	8.0E+00	Aquatic Habitat Goal
Fluorene	3.9E+00	Aquatic Habitat Goal	3.0E+01	Aquatic Habitat Goal	3.9E+00	Aquatic Habitat Goal
Heptachlor	2.1E-04	Bioaccumulation/Human Consumption	2.1E-04	Bioaccum/Human Consum	2.1E-04	Bioaccum/Human Consum
Heptachlor epoxide	1.1E-04	Bioaccumulation/Human Consumption	1.1E-04	Bioaccum/Human Consum	1.1E-04	Bioaccum/Human Consum
Hexachlorobenzene	7.7E-04	Bioaccumulation/Human Consumption	7.7E-04	Bioaccum/Human Consum	7.7E-04	Bioaccum/Human Consum
Hexachlorobutadiene	8.6E-01	Drinking Water Toxicity	9.3E-01	Aquatic Habitat Goal	9.3E-01	Aquatic Habitat Goal
γ-Hexachlorocyclohexane (Lindane)	6.3E-02	Bioaccumulation/Human Consumption	1.6E-02	Aquatic Habitat Goal	1.6E-02	Aquatic Habitat Goal
Hexachloroethane	1.7E+00	Drinking Water Toxicity	8.9E+00	Bioaccum/Human Consum	8.9E+00	Bioaccum/Human Consum
Indeno(1,2,3-c,d)pyrene	4.9E-02	Bioaccumulation/Human Consumption	4.9E-02	Bioaccum/Human Consum	4.9E-02	Bioaccum/Human Consum
Lead	2.5E+00	Aquatic Habitat Goal	8.1E+00	Aquatic Habitat Goal	2.5E+00	Aquatic Habitat Goal
Mercury (elemental)	2.5E-02	Aquatic Habitat Goal	2.5E-02	Aquatic Habitat Goal	2.5E-02	Aquatic Habitat Goal
Methoxychlor	1.9E-02	Aquatic Habitat Goal	3.0E-03	Aquatic Habitat Goal	3.0E-03	Aquatic Habitat Goal
Methylene chloride	5.0E+00	Drinking Water Toxicity	1.6E+03	Bioaccum/Human Consum	1.6E+03	Bioaccum/Human Consum
Methyl ethyl ketone	7.1E+03	Drinking Water Toxicity	8.4E+03	Ceiling Level	8.4E+03	Ceiling Level
Methyl isobutyl ketone	1.2E+02	Drinking Water Toxicity	1.7E+02	Aquatic Habitat Goal	1.7E+02	Aquatic Habitat Goal
Methyl mercury	3.0E-03	Aquatic Habitat Goal	3.0E-03	Aquatic Habitat Goal	3.0E-03	Aquatic Habitat Goal
2-Methylnaphthalene	2.1E+00	Aquatic Habitat Goal	1.0E+01	Ceiling Level	2.1E+00	Aquatic Habitat Goal
tert-Butyl methyl ether	5.0E+00	Ceiling Value	1.8E+02	Ceiling Level	1.8E+02	Ceiling Level
Molybdenum	1.8E+02	Drinking Water	2.4E+02	Aquatic Habitat Goal	2.4E+02	Aquatic Habitat Goal
Naphthalene	6.2E+00	Drinking Water	2.1E+01	Ceiling Level	2.1E+01	Ceiling Level
Nickel	5.2E+01	Aquatic Habitat	8.2E+00	Aquatic Habitat Goal	8.2E+00	Aquatic Habitat Goal
Pentachlorophenol	1.0E+00	Drinking Water	7.9E+00	Aquatic Habitat Goal	7.9E+00	Aquatic Habitat Goal
Perchlorate	6.0E+00	Drinking Water	6.0E+02	Aquatic Habitat Goal	6.0E+02	Aquatic Habitat Goal
Phenanthrene	6.3E+00	Aquatic Habitat	4.6E+00	Aquatic Habitat Goal	4.6E+00	Aquatic Habitat Goal
Phenol	5.0E+00	Ceiling Value	2.6E+02	Aquatic Habitat Goal	2.6E+02	Aquatic Habitat Goal
Polychlorinated biphenyls (PCBs)	1.7E-04	Bioacc/Human Consum	1.7E-04	Bioaccum/Human Consum	1.7E-04	Bioaccum/Human Consum
Pyrene	2.0E+00	Aquatic Habitat	2.0E+00	Aquatic Habitat Goal	2.0E+00	Aquatic Habitat Goal
Selenium	5.0E+00	Aquatic Habitat	7.1E+01	Aquatic Habitat Goal	5.0E+00	Aquatic Habitat Goal
Silver	3.4E-01	Aquatic Habitat Goal	1.9E-01	Aquatic Habitat Goal	1.9E-01	Aquatic Habitat Goal
Styrene	1.0E+01	Ceiling Value	1.1E+01	Ceiling Level	1.1E+01	Ceiling Level
tert-Butyl alcohol	1.2E+01	Drinking Water Toxicity	1.8E+04	Aquatic Habitat Goal	1.8E+04	Aquatic Habitat Goal
1,1,1,2-Tetrachloroethane	5.1E-01	Drinking Water Toxicity	9.3E+02	Aquatic Habitat Goal	9.3E+02	Aquatic Habitat Goal
1,1,2,2-Tetrachloroethane	1.0E+00	Drinking Water Toxicity	1.1E+01	Bioaccum/Human Consum	1.1E+01	Bioaccum/Human Consum
Tetrachloroethene	5.0E+00	Drinking Water Toxicity	8.9E+00	Bioaccum/Human Consum	8.9E+00	Bioaccum/Human Consum
Thallium	2.0E+00	Drinking Water Toxicity	4.0E+00	Aquatic Habitat Goal	4.0E+00	Aquatic Habitat Goal
Toluene	4.0E+01	Ceiling Value	4.0E+01	Ceiling Level	4.0E+01	Ceiling Level
Toxaphene	2.0E-04	Aquatic Habitat Goal	2.0E-04	Aquatic Habitat Goal	2.0E-04	Aquatic Habitat Goal
TPH (gasolines)	1.0E+02	Ceiling Value	3.7E+03	Aquatic Habitat Goal	5.0E+02	Aquatic Habitat Goal
TPH (middle distillates)	1.0E+02	Ceiling Value	6.4E+02	Aquatic Habitat Goal	6.4E+02	Aquatic Habitat Goal
TPH (residual fuels)	1.0E+02	Ceiling Value	6.4E+02	Aquatic Habitat Goal	6.4E+02	Aquatic Habitat Goal
1,2,4-Trichlorobenzene	5.0E+00	Drinking Water Toxicity	6.5E+01	Aquatic Habitat Goal	2.5E+01	Aquatic Habitat Goal
1,1,1-Trichloroethane	6.2E+01	Aquatic Habitat Goal	3.1E+03	Aquatic Habitat Goal	6.2E+01	Aquatic Habitat Goal
1,1,2-Trichloroethane	5.0E+00	Drinking Water Toxicity	4.2E+01	Bioaccum/Human Consum	4.2E+01	Bioaccum/Human Consum
Trichloroethene	5.0E+00	Drinking Water Toxicity	8.1E+01	Bioaccum/Human Consum	8.1E+01	Bioaccum/Human Consum
2,4,5-Trichlorophenol	6.3E+01	Aquatic Habitat Goal	1.1E+01	Aquatic Habitat Goal	1.1E+01	Aquatic Habitat Goal
2,4,6-Trichlorophenol	3.7E+00	Drinking Water Toxicity	6.5E+00	Bioaccum/Human Consum	6.5E+00	Bioaccum/Human Consum
Vanadium	1.5E+01	Drinking Water Toxicity	1.9E+01	Aquatic Habitat Goal	1.9E+01	Aquatic Habitat Goal
Vinyl chloride	5.0E-01	Drinking Water Toxicity	5.3E+02	Bioaccum/Human Consum	5.3E+02	Bioaccum/Human Consum
Xylenes	2.0E+01	Ceiling Value	1.0E+02	Aquatic Habitat Goal	1.0E+02	Aquatic Habitat Goal
Zinc	1.2E+02	Aquatic Habitat Goal	8.1E+01	Aquatic Habitat Goal	8.1E+01	Aquatic Habitat Goal

Notes:

Surface water screening levels lowest of drinking water goal (freshwater only), chronic aquatic habitat goal, bioaccumulation in aquatic organisms and subsequent consumption by humans, and general, and nuisance goals (odors, etc.).

Estuarine screening levels lowest of freshwater and marine screening levels.

TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (PAHs, oxidizers, etc.).

APPENDIX B
REVISED SECTION 4.2, AIR QUALITY

4.2 AIR QUALITY

INTRODUCTION

This section evaluates the potential air quality impacts of the proposed project. The analysis considers both operational and construction effects. The primary focus of the air quality analysis is the evaluation of future project-related emissions on regional air quality as well as existing sources of air pollution near the project sites that could affect the new sensitive receptors. A refined health risk analysis was also conducted for emissions from temporary construction at both sites. This analysis was conducted following guidance provided by the Bay Area Air Quality Management District (BAAQMD, 2011a).

ENVIRONMENTAL SETTING

SAN FRANCISCO BAY AIR BASIN

The California Air Resources Board (CARB) divides the state into air basins that share similar meteorological and topographical features. Sunnyvale is located in the San Francisco Bay Area Air Basin (SFBAAB) composed of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara counties. The SFBAAB is affected by a Mediterranean climate of warm, dry summers and cool, damp winters.

Sunnyvale is located in the northern portion of the Santa Clara Valley sub-region. The northwest-southeast oriented Santa Clara Valley is bounded by the Santa Cruz Mountains to the west, the Diablo Range to the east, San Francisco Bay to the north, and the convergence of the Gabilan Range and the Diablo Range to the south. Temperatures are warm in summer, under mostly clear skies, although a relatively large diurnal range results in cool nights. Winter temperatures are mild, except for very cool but generally frostless mornings. At the northern end of the Santa Clara Valley, the San Jose Airport mean maximum temperatures range from the high 70s to the low 80s during the summer to the high 50s to low 60s during the winter, and mean minimum temperatures range from the high 50s during the summer to the low 40s during the winter. Sunnyvale's annual average rainfall is about 15 inches per year (WRCC, 2012, as measured at Santa Clara University). The wind patterns in the valley are influenced greatly by the terrain, resulting in a prevailing flow roughly parallel to the valley's northwest-southeast axis with a north-northwesterly sea breeze extending up the valley during the afternoon and early evening and a light south-southeasterly drainage flow occurring during the late evening and early morning.

The air pollution potential of the Santa Clara Valley is high. The valley has a large population and the largest complex of mobile sources in the Bay Area, making it a major source of carbon monoxide, particulate, and photochemical air pollution. In addition, photochemical precursors from San Francisco, San Mateo, and Alameda counties can be carried along by the prevailing winds to the Santa Clara Valley, making it also a major ozone receptor.

AIR POLLUTANTS OF CONCERN AND HEALTH EFFECTS

The most problematic pollutants in the Sunnyvale area include ozone and particulate matter. The health effects and major sources of these pollutants, as well as other key pollutants, are described below. Toxic air contaminants are a separate class of pollutants and are discussed later in this section.

Ozone

Ground-level ozone (O_3), commonly referred to as smog, is greatest on warm, windless, sunny days. O_3 is not emitted directly into the air, but is formed through a complex series of chemical reactions between reactive organic gases (ROG) and nitrogen oxides (NO_X). These reactions occur over time in the presence of sunlight. O_3 formation can occur in a matter of hours under ideal conditions. The time required for O_3 formation allows the reacting compounds to spread over a large area, producing a regional pollution concern. Once formed, O_3 can remain in the atmosphere for one or two days.

O_3 is also a public health concern because it is a respiratory irritant that increases susceptibility to respiratory infections and diseases, and because it can harm lung tissue at high concentrations. In addition, O_3 can cause substantial damage to leaf tissues of crops and natural vegetation and can damage many natural and manmade materials by acting as a chemical oxidizing agent. The principal sources of the O_3 precursors (ROG and NO_X) are the combustion of fuels and the evaporation of solvents, paints, and fuels.

Particulate Matter

Particulate matter (PM) can be divided into several size fractions. Coarse particles (PM_{10}) are smaller than 10 microns in diameter and arise primarily from natural processes, such as wind-blown dust or soil. Fine particles ($PM_{2.5}$) are less than 2.5 microns in diameter and are produced mostly from combustion or burning activities. Fuel burned in cars and trucks, power plants, factories, fireplaces, and wood stoves produces fine particles. $PM_{2.5,}$ and to some extent $PM_{10,}$ contains particles formed in the air from primary gaseous emissions. Examples include sulfates formed from sulfur dioxide (SO_2) emissions from power plants and industrial facilities, nitrates formed from NOx emissions from power plants, automobiles, and other combustion sources, and carbon formed from organic gas emissions from automobiles and industrial facilities.

The level of $PM_{2.5}$ in the air is a public health concern because it can bypass the body's natural filtration system more easily than larger particles and can lodge deep in the lungs. The health effects vary depending on a variety of factors, including the type and size of particles. Research has demonstrated a correlation between high PM concentrations and increased mortality rates. Elevated PM concentrations can also aggravate chronic respiratory illnesses such as bronchitis and asthma.

Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless gas that is formed by the incomplete combustion of fuels. Motor vehicle emissions are the dominant source of CO in the SFBAAB. At high concentrations, CO reduces the oxygen-carrying capacity of the blood and can cause dizziness,

headaches, unconsciousness, and even death. CO can also aggravate cardiovascular disease. Relatively low concentrations of CO can significantly affect the amount of oxygen in the bloodstream because CO binds to hemoglobin 220 to 245 times more strongly than oxygen.

CO emissions and ambient concentrations have decreased significantly in recent years. These improvements are due largely to the introduction of cleaner-burning motor vehicles and motor vehicle fuels. CO is still a pollutant that must be closely monitored, however, due to its severe effect on human health.

Elevated CO concentrations are usually localized and are often the result of a combination of high traffic volumes and traffic congestion. Elevated CO levels develop primarily during winter periods of light winds or calm conditions combined with the formation of ground-level temperature inversions. Wintertime CO concentrations are higher because of reduced dispersion of vehicle emissions and because CO emission rates from motor vehicles increase as temperature decreases.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a brownish, highly reactive gas that is present in all urban environments. The major human-made sources of NO_2 are combustion devices such as boilers, gas turbines, and mobile and stationary reciprocating internal combustion engines. Construction devices emit primarily nitric oxide (NO), which reacts through oxidation in the atmosphere to form NO_2. The combined emissions of NO and NO_2 are referred to as NO_X. Because NO_2 is formed and depleted by reactions associated with O_3, the NO_2 concentration in a particular geographic area may not be representative of the local NO_X emission sources.

Inhalation is the most common route of exposure to NO_2. Because NO_2 has relatively low solubility in water, the principal site of toxicity is in the lower respiratory tract. The severity of adverse health effects depends primarily on the concentration inhaled rather than the duration of the exposure. Exposure can result in a variety of acute symptoms, including coughing, difficulty with breathing, vomiting, headache, and eye irritation. Symptoms that are more significant may include chemical pneumonitis or pulmonary edema with breathing abnormalities, cyanosis, chest pain, and rapid heartbeat.

Sulfur Dioxide

Sulfur dioxide (SO_2) is produced by such stationary sources as coal and oil combustion, steel mills, refineries, and pulp and paper mills. The major adverse health effects associated with exposure to SO_2 pertain to the upper respiratory tract. SO_2 is a respiratory irritant, with constriction of the bronchioles occurring with inhalation of SO_2 at 5 parts per million (ppm) or more. On contact with the moist mucous membranes, SO_2 produces sulfurous acid, which is a direct irritant. Similar to NO_2, the severity of adverse health effects depends primarily on the concentration inhaled rather than the duration of the exposure. Exposure to high concentrations of SO_2 may result in edema of the lungs or glottis and respiratory paralysis.

Toxic Air Contaminants

In addition to the criteria pollutants discussed above, toxic air contaminants (TACs) are another group of pollutants of concern. TACs are considered either carcinogenic or noncarcinogenic based on the nature of the health effects associated with exposure to the pollutant. For regulatory purposes, carcinogenic TACs are assumed to have no safe threshold below which health impacts would not occur, and cancer risk is expressed as excess cancer cases per one million exposed individuals. Noncarcinogenic TACs differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis.

There are many different types of TACs, with varying degrees of toxicity. Sources of TACs include industrial processes such as petroleum refining and chrome plating operations, commercial operations such as gasoline stations and dry cleaners, and motor vehicle exhaust. Public exposure to TACs can result from emissions from normal operations, as well as from accidental releases of hazardous materials during upset conditions. The health effects of TACs include cancer, birth defects, neurological damage, and death.

Diesel particulate matter (DPM) is a TAC of growing concern in California. According to the California Almanac of Emissions and Air Quality (CARB, 2009), the majority of the estimated health risk from TACs can be attributed to relatively few compounds, the most important being DPM. In 1998, after a 10-year scientific assessment process, CARB identified DPM as a TAC. DPM differs from other TACs in that it is not a single substance but rather a complex mixture of hundreds of substances. The exhaust from diesel engines contains hundreds of different gaseous and particulate components, many of which are toxic. Many of these compounds adhere to the particles, and because diesel particles are so small, they penetrate deep into the lungs. DPM has been identified as a human carcinogen. Mobile sources, such as trucks, buses, automobiles, trains, ships, and farm equipment, are by far the largest source of diesel emissions. Studies show that DPM concentrations are much higher near heavily traveled highways and intersections.

Although DPM is emitted by diesel-fueled internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emission control system is present. No ambient monitoring data are available for DPM because no routine measurement method currently exists. However, CARB has made preliminary concentration estimates based on a PM exposure method. This method uses CARB's emissions inventory PM_{10} database, ambient PM_{10} monitoring data, and the results from several studies to estimate concentrations of DPM. In addition to DPM, benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene pose the greatest existing ambient risk, for which data are available, in California. However, DPM poses the greatest health risk among the ten TACs mentioned. Since 1990, the health risk from DPM has been reduced by 52 percent. Overall, levels of most TACs have decreased since 1990 except for para-dichlorobenzene and formaldehyde (CARB, 2009).

Unlike criteria pollutants like carbon monoxide, TACs do not have ambient air quality standards. Since no safe levels of TACs can be determined, there are no air quality standards for TACs. Instead, TAC impacts are evaluated by calculating the health risks associated with a given exposure. Two types of risk are usually assessed: chronic non-cancer risk and acute non-cancer

risk. DPM has been identified as a carcinogenic material but is not considered to have acute non-cancer risks. The State of California has begun a program of identifying and reducing risks associated with DPM. The plan consists of new regulatory standards for all new on-road, off-road, and stationary diesel-fueled engines and vehicles, new retrofit requirements for existing on-road, off-road, and stationary diesel-fueled engines and vehicles, and new diesel fuel regulations to reduce the sulfur content of diesel fuel as required by advanced diesel emission control systems. Land uses where individuals could be exposed to high levels of diesel exhaust include:

- Railroad operations
- Warehouses
- Schools with a high volume of bus traffic
- High-volume highways
- High-volume arterials and local roadways with a high level of diesel traffic

WOOD SMOKE

Wood smoke has long been identified as a significant source of pollutants in urban and suburban areas. Wood smoke contributes to particulate matter and CO concentrations, reduces visibility, and contains numerous TACs. Present controls on this source include the adoption of emission standards for wood stoves and fireplace inserts. In 2008, the Bay Area Air Quality Management District (BAAQMD) adopted Regulation 6, Rule 3: Wood-burning Devices, to reduce the harmful emissions that come from wood smoke. The new rule includes the following:

- Restricts wood burning when air quality is unhealthy and a Spare the Air Advisory is issued
- Places limits on excessive smoke (exceeding 20 percent opacity)
- Requires only cleaner-burning Environmental Protection Agency (EPA)-certified stoves and inserts be sold
- Requires only cleaner-burning EPA-certified stoves and inserts in new construction or remodels
- Prohibits the burning of garbage and other harmful materials
- Requires labeling on firewood and solid fuels sold within the Bay Area

SENSITIVE RECEPTORS

There are groups of people who are more affected by air pollution than others. CARB has identified the following persons who are most likely to be affected by air pollution: children under 14, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks.

REGULATORY FRAMEWORK

Air quality in the SFBAAB is addressed through the efforts of various federal, state, regional, and local government agencies. These agencies work jointly, as well as individually, to improve air

quality through legislation, regulations, planning, policy-making, education, and a variety of programs. The agencies primarily responsible for improving the air quality in Sunnyvale are discussed below along with their individual responsibilities.

AMBIENT AIR QUALITY STANDARDS

Both the U.S. Environmental Protection Agency (U.S. EPA) and CARB established ambient air quality standards for common air pollutants. These ambient air quality standards are levels of contaminants that represent safe levels that avoid specific adverse health effects associated with each pollutant. The ambient air quality standards cover what are called "criteria" pollutants because the health and other effects of each pollutant are described in criteria documents. The federal and California ambient air quality standards for important pollutants are summarized in **Table 4.2-1.** The federal and state ambient standards were developed independently with differing purposes and methods, although both processes attempted to avoid health-related effects. As a result, federal and state standards differ in some cases. In general, California standards are more stringent. This is particularly true for nitrogen dioxide (NO_2) and coarse particulate matter (PM_{10}).

Table 4.2-1 Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	Federal Primary Standard	State Standard
Ozone (O_3)	1-Hour	--	0.09 ppm
	8-Hour	0.075 ppm	0.07 ppm
Coarse Particulate Matter (PM_{10})	24-Hour	150 µg/m3	50 µg/m3
	Annual Average	–	20 µg/m3
Fine Particulate Matter ($PM_{2.5}$)	24-Hour	35 µg/m3	–
	Annual Average	12µg/m3	12 µg/m3
Carbon Monoxide (CO)	1-Hour	35 ppm	20 ppm
	8-Hour	9.0 ppm	9.0 ppm
Nitrogen Dioxide (NO_2)	1-Hour	0.100 ppm	0.18 ppm
	Annual Average	0.053 ppm	0.03 ppm
Sulfur Dioxide (SO_2)	1-Hour	0.075 ppm	0.25 ppm
	24-Hour	0.14 ppm	0.04 ppm
	Annual Average	0.03 ppm	--

Notes: ppm = parts per million; µg/m3 = micrograms per cubic meter.
Source: BAAQMD, 2012a; U.S. EPA, 2013.

Ambient Air Quality Monitoring

CARB maintains several air quality monitoring sites in the SFBAAB, including a site in Cupertino at 22601 Voss Avenue, which is the closest monitoring site to the project sites. **Table 4.2-2** shows historical occurrences of pollutant levels exceeding state and federal ambient air quality standards for the three-year period of 2009 through 2011. The number of days that each standard was exceeded is shown.

Table 4.2-2 Ambient Air Quality Monitoring Data for Sunnyvale

Pollutant Standards	2009	2010	2011
Ozone – *Measured in Cupertino*			
Max 1-hour concentration (ppm)	***0.127***	0.086	0.083
Max 8-hour concentration (ppm)	***0.092***	0.067	0.066
Number of Days Standard Exceeded			
State 1-hour standard	1	0	0
Federal 8-hour standard	1	0	0
State 8-hour standard	3	0	0
Coarse Particulate Matter (PM_{10}) – *Measured in Cupertino*			
Max 24-hour concentration (µg/m3) (federal/state)	28	29	42
Annual average concentration (µg/m3) (federal/state)	ND	14.2	13.5
Number of Measurement Days Standard Exceeded			
Federal 24-hour standard	0	0	0
State 24-hour standard	0	0	0
Fine Particulate Matter ($PM_{2.5}$) – *Measured in San Jose*			
Max 24-hour concentration (µg/m3) (federal/state)	42	51	38
Annual average concentration (µg/m3) (federal/state)	8.8	9.9	9.1
Number of Measurement Days Standard Exceeded			
Federal 24-hour standard	3	3	2
Carbon Monoxide (CO) – *Measured in Cupertino*			
Max 1-hour concentration (ppm)	0.93	1.2	1.9
Max 8-hour concentration (ppm)		1.0	0.8
Number of Days Standard Exceeded			
Federal 8-hour standard	0	0	0
State 8-hour standard	0	0	0
Nitrogen Dioxide (NO_2) – *Measured in Cupertino*			
Max 1-hour concentration (ppm)	0.049	0.043	0.045
Annual Average Concentration (ppm)	ND	0.009	0.008
Number of Days Standard Exceeded			
State 1-hour standard	0	0	0
Sulfur Dioxide (SO_2) – *Measured in Cupertino*			
Max 24-hour concentration (ppm)	0.003	0.035	0.028
Annual Average Concentration (ppm)	ND	0.007	0.003

Notes: ND = No Data; ppm = parts per million; µg/m3 = micrograms per cubic meter .
Values reported in ***bold italic*** exceeded ambient air quality standard. An exceedance is not necessarily a violation.
Source: BAAQMD, 2013c.

Ambient Air Quality Attainment Status

Table 4.2-3 shows the federal and state attainment status for the SFBAAB. The region is nonattainment for federal ozone and $PM_{2.5}$ standards, and nonattainment for state ozone and PM_{10} and $PM_{2.5}$ standards.

Table 4.2-3 Federal and State Ambient Air Quality Monitoring Attainment Status for San Francisco Bay Area Air Basin

Pollutant	Federal	State
1-hour Ozone (O3)	–	Nonattainment
8-hour Ozone (O3)	Nonattainment	Nonattainment
Coarse Particulate Matter (PM10)	Unclassified	Nonattainment
Fine Particulate Matter (PM2.5)	Nonattainment	Nonattainment
Carbon Monoxide (CO)	Attainment	Attainment
Nitrogen Dioxide (NO2)	Attainment	Attainment
Sulfur Dioxide (SO2)	Attainment	Attainment

Source: Ilingworth & Rodkin, Inc., 2013.

Areas with air quality that exceed adopted air quality standards are designated as “nonattainment” areas for the relevant air pollutants. Nonattainment areas are sometimes further classified by degree (marginal, moderate, serious, severe, and extreme for ozone, and moderate and serious for carbon monoxide and PM_{10}) or status (“nonattainment-transitional”). Areas that comply with air quality standards are designated as “attainment” areas for the relevant air pollutants. “Unclassified” areas are those with insufficient air quality monitoring data to support a designation of attainment or nonattainment, but are generally presumed to comply with the ambient air quality standard. State Implementation Plans must be prepared by states for areas designated as federal nonattainment areas to demonstrate how the area will come into attainment of the exceeded federal ambient air quality standard.

As detailed in the discussion below, both CARB and the U.S. EPA have established air pollution standards in an effort to protect human health and welfare. Geographic areas are designated attainment if these standards are met and nonattainment if they are not met. In addition, each agency has several levels of classifications based on severity of the problem.

FEDERAL REGULATIONS

The U.S. EPA is responsible for enforcing the federal Clean Air Act and the 1990 amendments to it, as well as the national ambient air quality standards (federal standards) that the U.S. EPA establishes. These standards identify levels of air quality for six criteria pollutants, which are considered the maximum levels of ambient (background) air pollutants considered safe, with an

adequate margin of safety, to protect public health and welfare. The six criteria pollutants are O_3, CO, NO_2, SO_2, PM_{10}, and lead. The U.S. EPA also has regulatory and enforcement jurisdiction over emission sources beyond state waters (outer continental shelf) and sources that are under the exclusive authority of the federal government, such as aircraft, locomotives, and interstate trucking.

As part of its enforcement responsibilities, the U.S. EPA requires each state with nonattainment areas to prepare and submit a State Implementation Plan (SIP) that demonstrates the means to attain the federal standards. The SIP must integrate federal, state, and local plan components and regulations to identify specific measures to reduce pollution in nonattainment areas, using a combination of performance standards and market-based programs.

STATE OF CALIFORNIA REGULATIONS

California Air Resources Board

CARB, a department of the California Environmental Protection Agency, oversees air quality planning and control throughout California. It is primarily responsible for ensuring implementation of the 1989 amendments to the California Clean Air Act (CCAA), responding to the federal CAAA requirements, and regulating emissions from motor vehicles and consumer products within the state. CARB has established emission standards for vehicles sold in California and for various types of equipment available commercially. It also sets fuel specifications to further reduce vehicular emissions.

The amendments to the CCAA establish ambient air quality standards for the state (state standards) and a legal mandate to achieve these standards by the earliest practical date. These standards apply to the same six criteria pollutants as the federal CAA and also include sulfate, visibility, hydrogen sulfide, and vinyl chloride. They are more stringent than the federal standards and, in the case of PM_{10} and NO_2, far more stringent.

DPM emissions in California are projected to decrease in the future and are reflected in the EMFAC2011 emissions data. New CARB regulations require on-road diesel trucks to be retrofitted with particulate matter controls or replaced to meet new 2010 engine standards that have much lower DPM and $PM_{2.5}$ emissions. This regulation will substantially reduce these emissions between 2013 and 2023, with the greatest reductions occurring in 2013 through 2015. While new trucks and buses will meet strict federal standards, this measure is intended to accelerate the rate at which the fleet either turns over so there are more cleaner vehicles on the road or retrofitted to meet similar standards. With this regulation, older, more polluting trucks would be removed from the roads much quicker. CARB anticipates a 68-percent reduction in $PM_{2.5}$ (including DPM) emission from trucks in 2014 with this regulation.

Tanner Air Toxics Act and Air Toxics "Hot Spots" Information and Assessment Act

California regulates TACs primarily through the Tanner Air Toxics Act (Tanner Act) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (Assembly Bill 2588).

The Tanner Act sets forth a formal procedure for CARB to designate substances as TACs. This includes research, public participation, and scientific peer review before CARB can designate a substance as a TAC. Once a TAC is identified, CARB then adopts an Airborne Toxics Control

Measure (ATCM) for sources that emit that particular TAC. If there is a safe threshold for a substance at which there is no toxic effect, the control measure must reduce exposure below that threshold. If there is no safe threshold, the measure must incorporate best available control technology (BACT) to minimize emissions.

In 1987, the California Legislature established the Air Toxics "Hot Spots" Information and Assessment Act of 1987, Assembly Bill (AB) 2588 (Health and Safety Code Sections 44300-44394). AB 2588 requires that existing facilities that emit toxic substances above a specified level (1) prepare a toxic-emission inventory, (2) prepare a risk assessment if emissions are significant, (3) notify the public of significant risk levels, and (4) prepare and implement risk reduction measures. CARB has adopted diesel exhaust control measures and more stringent emission standards for various on-road mobile sources of emissions, including transit buses and off-road diesel equipment (e.g., tractors, generators). In 1992, the "Hot Spots" Act was amended by Senate Bill (SB) 1731, which required facilities that pose a significant health risk to the community to reduce their risk through a risk management plan.

Senate Bill 656

In 2003, the California Legislature enacted SB 656 to reduce public exposure to PM_{10} and $PM_{2.5}$. In 2004, CARB approved a list of the most readily available, feasible, and cost-effective control measures that can be employed by air districts to reduce PM_{10} and $PM_{2.5}$ (collectively referred to as PM). The list is based on rules, regulations, and programs existing in California as of January 1, 2004, for stationary, area-wide, and mobile sources. In 2005, air districts adopted implementation schedules for selected measures from the list. The implementation schedules identify the appropriate subset of measures and the dates for final adoption, implementation, and the sequencing of selected control measures. In developing the implementation schedules, each air district prioritized measures based on the nature and severity of the PM problem in their area and cost-effectiveness. Consideration was also given to ongoing programs such as measures being adopted to meet national air quality standards or the state ozone planning process.

REGIONAL REGULATIONS

In 1955, the California Legislature created the Bay Area Air Quality Management District (BAAQMD). The agency is primarily responsible for assuring that the federal and state ambient air quality standards are attained and maintained in the Bay Area. The BAAQMD regulates air quality within Sunnyvale. The BAAQMD is responsible for many other activities, including:

- Adopting and enforcing rules and regulations concerning air pollutant sources
- Issuing permits for stationary sources of air pollutants
- Inspecting stationary sources of air pollutants
- Responding to citizen complaints
- Monitoring ambient air quality and meteorological conditions
- Awarding grants to reduce motor vehicle emissions
- Conducting public education campaigns

BAAQMD Rules and Regulations

The BAAQMD regulates the demolition of buildings and structures that may contain asbestos. Asbestos is a fibrous mineral that occurs naturally in ultramafic rock—a rock type commonly found in California—and was used in the past as a processed component of building materials. Because asbestos has been proven to cause serious adverse health effects, such as asbestosis and lung cancer, it is strictly regulated. The relevant local regulations are found in BAAQMD Regulation 11, Rule 2: Hazardous Materials; Asbestos Demolition, Renovation and Manufacturing.

In addition, the BAAQMD adopted Regulation 6, Rule 3, to control particulate matter emissions from wood-burning devices. The rule restricts operation of any indoor or outdoor fireplace, fire pit, wood or pellet stove, masonry heater, or fireplace insert on days during the winter when air quality conditions are forecasted to exceed the national ambient air quality standard (NAAQS) for $PM_{2.5}$. The rule also limits excess visible emissions from wood-burning devices and requires clean burning technology for wood-burning devices that are sold, resold, or installed in the Bay Area.

The BAAQMD's Regulation 7 limits odors from many different sources, excluding restaurants and agricultural practices. The requirements of this regulation become applicable when the BAAQMD receives odor complaints from 10 or more complainants within a 90-day period, alleging that a source has caused odors perceived at or beyond the property line of the source and deemed to be objectionable.

BAAQMD Air Quality Guidelines

In May 2011, the BAAQMD updated its guidelines to evaluate air quality impacts from projects (BAAQMD, 2011a). These guidelines included evaluation criteria for siting new sensitive receptors near sources of toxic air contaminants and air pollutants, as well as criteria for evaluating potential odor impacts. "Sensitive receptors" are defined as facilities where sensitive population groups, such as children, the elderly, the acutely ill, and the chronically ill, are likely to be located. These land uses include residences, schools, playgrounds, childcare centers, retirement homes, convalescent homes, hospitals, and medical clinics.

The guidelines recommend that plans identify special overlay zones around existing and proposed sources of toxic air contaminants, and that these overlay zones should be included in General Plans as well as other land use plans. The purpose of the overlay zones is to reduce exposures of sensitive land uses to unhealthy levels of toxic air contaminants, including $PM_{2.5}$, from substantial nearby sources. The BAAQMD's new guidelines rely on the guidance from CARB's *Air Quality and Land Use Handbook* (CARB, 2005), described above. In Sunnyvale, the primary overlay zones would likely be along U.S. Highway 101 (Highway 101) and State Routes (SR) 237 and 85. The BAAQMD has also recommended that lead agencies include the effects of major roadways and permitted stationary sources of air pollutants, which could affect the planning area.

The BAAQMD's guidelines also provide methods for analyzing the impacts of TAC sources to develop more refined overlay zones. These methods rely on modeling specific emissions from the roadways or sources, using emission factor models, dispersion modeling, and health risk criteria to determine where such sources result in significant exposures. These guidelines provide criteria for judging source-specific and cumulative impacts. The guidelines also recommend screening distances for various types of odor sources.

BAAQMD CARE Program

The BAAQMD initiated its Community Air Risk Evaluation (CARE) program in 2004 to evaluate and reduce health risks associated with exposures to outdoor TACs in the Bay Area. The program examines TAC emissions from point sources; area sources; on-road mobile sources, such as cars and trucks; and off-road mobile sources, such as construction equipment, trains, and aircraft. The CARE program focuses on DPM emissions, which is the major contributor to airborne health risk in California. Its goal is to identify areas with high emissions of TACs that have sensitive populations nearby, then reduce exposure to TACs through new regulations, incentive funding, and other programs.

In Phase I of the program, a 2-kilometer-by-2-kilometer gridded inventory of TAC emissions was developed for the year 2000. The data were then updated to include 2005 emission data. This emissions inventory was risk-weighted to reflect the differences in potency of the various TACs. For example, benzene has far higher cancer potency than many other compounds, such as methyl tertiary buytl ether (MTBE). In contrast, while DPM is not as potent as benzene, DPM emissions are much more prevalent. The Phase I study identifies diesel emissions from heavy-duty trucks as a major source of TAC emissions and identifies programs available to reduce these emissions.

In Phase II of the CARE program, the BAAQMD is performing regional and local-scale modeling to determine the significant sources of DPM and other TAC emissions locally in priority communities, as well as for the entire Bay Area. The BAAQMD has partnered with CARB, the Port of Oakland, the Pacific Institute, the West Oakland Environmental Indicators Project, and major railroads to prepare specific health risk assessments.

One highlight of the CARE program is the development of a Mitigation Action Plan, in which risk reduction activities are focused on the most at-risk communities. This plan identified six different at-risk communities that would benefit from targeted mitigation, based on TAC emissions and presence of sensitive land uses. Sunnyvale is not located in any of these at-risk communities.

In Phase III, the BAAQMD plans to conduct an extensive exposure assessment to identify and rank the communities as to their potential TAC exposures and determine the types of activities that place in the communities at highest risk. The BAAQMD will also pursue additional mitigations and attempt to develop a metric to measure the effectiveness of these efforts. The new BAAQMD CEQA Guidelines (BAAQMD, 2011a) included new significance thresholds for community risk and hazards that originated from this process. These new thresholds address both project (single-source) and cumulative exposures.

Air Quality Plans

To protect public health, the BAAQMD has adopted plans to achieve ambient air quality standards. The BAAQMD must continuously monitor its progress in implementing attainment plans and must periodically report to CARB and the U.S. EPA. It must also periodically revise its attainment plans to reflect new conditions and requirements.

In 1991, the BAAQMD, Metropolitan Transportation Commission (MTC), and Association of Bay Area Governments (ABAG) prepared the Bay Area 1991 Clean Air Plan. This air quality plan addresses the California Clean Air Act. Updates to this plan are developed approximately every

three years. The plans are meant to demonstrate progress toward meeting the more stringent 1-hour ozone California ambient air quality standard (AAQS). In 2010, the BAAQMD adopted the Bay Area 2010 Clean Air Plan (BAAQMD, 2010b). This Clean Air Plan updates the most recent ozone plan, the 2005 Ozone Strategy. Unlike previous Bay Area Clean Air Plans, the 2010 Clean Air Plan is a multi-pollutant air quality plan addressing four categories of air pollutants:

- Ground-level ozone and the key ozone precursor pollutants (reactive organic gases and NO_X), as required by state law.
- Particulate matter, primarily $PM_{2.5}$, as well as the precursors to secondary $PM_{2.5}$.
- Toxic air contaminant.
- Greenhouse gases (GHGs).

While previous Clean Air Plans have relied upon a combination of stationary and transportation control measures, the 2010 Clean Air Plan adds two new types of control measures: (1) Land Use and Local Impact Measures, and (2) Energy and Climate Measures. These types of measures would indirectly reduce air pollutant and GHG emissions through reductions in vehicle use and energy usage. In addition, the plan includes Further Study Measures, which will be evaluated as potential control measures.

The Bay Area 2010 Clean Air Plan proposes expanded implementation of transportation control measures (TCMs) and includes public outreach programs designed to educate the public about air pollution in the Bay Area and promote individual behavior changes that improve air quality. New measures in the Clean Air Plan are aimed at helping guide land use policies that would indirectly reduce air pollutant emissions. Some of these measures or programs rely on local governments for implementation. The clean air planning efforts for O_3 also will reduce PM_{10} and $PM_{2.5}$, as a substantial amount of particulate matter comes from combustion emissions such as vehicle exhaust. Conversely, strategies to reduce O_3 precursor emissions will reduce secondary formation of $PM_{2.5}$ and PM_{10}.

While the Clean Air Plan addresses state requirements, it will also provide the basis for developing future control plans to meet federal requirements (NAAQS) for ozone and $PM_{2.5}$. The U.S. EPA recently issued formal designations for O_3 under the most recent NAAQS. These new standards will trigger new planning requirements for the Bay Area and possibly more stringent federally enforceable control measures.

The Bay Area 2001 Ozone Attainment Plan was prepared to achieve the 1-hour NAAQS for ozone. Since that plan was submitted, the region was designated as a marginal nonattainment area for the 8-hour ozone NAAQS, and the 1-hour ozone NAAQS was revoked. This plan was a proposed revision to the Bay Area part of California's plan (State Implementation Plan, or SIP) to achieve the 1-hour ozone NAAQS. The plan was prepared in response to the U.S. EPA's partial approval and partial disapproval of the Bay Area's 1999 Ozone Attainment Plan. The U.S. EPA plans to designate the Bay Area as nonattainment with respect to the new 2008 8-hour ozone NAAQS. This would require the region to develop a new Ozone Attainment Plan to meet this standard. A new plan would likely contain many of the components listed in the 2010 Clean Air Plan described above, since that plan addresses the more stringent state ozone standards.

There is no formal clean air plan addressing PM_{10}. However, the clean air planning efforts for ozone will also reduce PM_{10} and $PM_{2.5}$, since a substantial amount of this air pollutant comes from

combustion emissions such as vehicle exhaust. In addition, the BAAQMD adopts and enforces rules to reduce particulate matter emissions and develops public outreach programs to educate the public to reduce PM_{10} and $PM_{2.5}$ emissions. One such program is the Winter Spare the Air program, which is similar to the standard Spare the Air program but focuses on $PM_{2.5}$ emissions that result from the use of fireplaces and wood stoves.

In addition, California's SB 656 (SB 656, Sher, 2003), which amended Section 39614 of the Health and Safety Code, required further action by CARB and air districts to reduce public exposure to PM_{10} and $PM_{2.5}$. Efforts identified by the BAAQMD in response to SB 656 are primarily targeting reductions in wood smoke emissions, adopting new rules to further reduce NO_X and particulate matter from internal combustion engines, and reducing particulate matter from commercial charbroiling activities.

Because the U.S. EPA designated the Bay Area nonattainment for the 24-hour $PM_{2.5}$ standard, CARB and the BAAQMD will have to develop a plan for meeting the standard by December 2014. CARB requested that the U.S. EPA make a determination that the Bay Area has attained the 2006 $PM_{2.5}$ NAAQS and determine that attainment-related SIP submittal requirements are not applicable for as long as the area continues to attain the standard. A determination of whether an area's air quality currently meets the $PM_{2.5}$ NAAQS is generally based upon the most recent three years of complete, quality-assured data. On October 29, 2012, the U.S. EPA proposed to determine that the San Francisco Bay Area has attained the $PM_{2.5}$ NAAQS. This proposed determination is based on ambient air monitoring data showing that this area has monitored attainment of the $PM_{2.5}$ NAAQS based on the 2009–2011 monitoring period. If the U.S. EPA finalizes this determination of attainment, the only SIP requirements would include an updated emission inventory for primary $PM_{2.5}$, as well as precursor pollutants that contribute to formation of secondary particulate matter and amendments to BAAQMD's New Source Review (NSR) to address $PM_{2.5.}$ (These amendments were adopted in 2009.) The Bay Area's $PM_{2.5}$ emission inventory was submitted to the U.S. EPA on January 14, 2013.

CITY OF SUNNYVALE GENERAL PLAN

The City of Sunnyvale General Plan includes the following goal and policy relevant to the air quality impacts of the proposed projects:

GOAL EM-11 – Improved Air Quality: Improve Sunnyvale's air quality and reduce the exposure of its citizens to air pollutants.

Policy EM-11.3: Require all new development to utilize site planning to protect citizens from unnecessary exposure to air pollutants.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

Per Appendix G of the California Environmental Quality Act (CEQA) Guidelines and BAAQMD recommendations, air quality impacts are considered significant if implementation of the proposed projects would:

- Conflict with or obstruct implementation of an applicable air quality plan;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

The BAAQMD provides lead agencies in the Bay Area with guidance in assessing impacts. In June 2010, the BAAQMD adopted thresholds of significance to assist in the review of projects under CEQA. These thresholds were designed to establish the level at which the BAAQMD believed air pollution emissions would cause significant environmental impacts under CEQA. They were posted on the BAAQMD's website and included in the BAAQMD's updated CEQA Guidelines (updated May 2011). The significance thresholds identified by the BAAQMD and used in this analysis are summarized in **Table 4.2-4.**

The BAAQMD's adoption of the thresholds was called into question by an order issued March 5, 2012, in California Building Industry Association v. BAAQMD (Alameda Superior Court Case No. RGI0548693). The trial court order ~~requires~~ required the BAAQMD to set aside its approval of the thresholds until it has conducted environmental review under CEQA. The ruling made in the case concerned the environmental impacts of adopting the thresholds and how the thresholds would indirectly affect land use development patterns. Those issues were not relevant to the scientific basis of the BAAQMD's analysis of what levels of pollutants should be deemed significant. In August 2013, the First District Court of Appeal reversed the trial court judgment that had invalidated the BAAQMD's adoption of the thresholds. The Court of Appeal held that the BAAQMD's adoption of the CEQA Air Quality Guidelines, including the thresholds of significance, is not itself a "project" subject to CEQA review. The court also found that the BAAQMD's thresholds were supported by substantial evidence. In November 2013, the California Supreme Court granted a focused review of the circumstances, if any, under which CEQA requires an analysis of how existing environmental conditions will affect future residents or users (receptors) of a proposed project.

This analysis considers the science informing the thresholds as being supported by substantial evidence. Scientific information supporting the thresholds was documented in the BAAQMD's proposed thresholds of significance analysis (BAAQMD, 2009). Moreover, the thresholds will not cause any indirect impact in terms of land use development patterns insofar as these projects are concerned, because the proposals to construct the projects are not influenced by the BAAQMD guidelines. Accordingly, the analysis herein uses the thresholds and methodologies from the BAAQMD's May 2011 CEQA Air Quality Guidelines to determine the potential impacts of the projects on the existing environment.

Table 4.2-4 ~~Federal and State Ambient Air Quality Monitoring Attainment Status for San Francisco Bay Area Air Basin~~BAAQMD Significance Thresholds

Pollutant	Construction Thresholds Average Daily Emissions (pounds/day)	Operational Thresholds: Average Daily Emissions (pounds/day)	Operational Thresholds: Annual Average Emissions (tons/year)
Criteria Air Pollutants			
ROG	54	54	10
NO_x	54	54	10
PM_{10}	82	82	15
$PM_{2.5}$	54	54	10
CO	Not Applicable	9.0 ppm (8-hour average) or 20.0 ppm (1-hour average)	
Fugitive Dust	Construction Best Management Practices	Not Applicable	
Health Risks and Hazards for New Sources			
Excess Cancer Risk	10 per one million	10 per one million	
Chronic or Acute Hazard Index	1.0	1.0	
Incremental annual average $PM_{2.5}$	0.3 µg/m^3	0.3 µg/m^3	
Health Risks and Hazards for Sensitive Receptors (Cumulative from all Sources within 1,000-Foot Zone of Influence) and Cumulative Thresholds for New Sources			
Excess Cancer Risk	100 per one million		
Chronic Hazard Index	10.0		
Annual Average $PM_{2.5}$	0.8 µg/m^3		

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM10 = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, ppm = parts per million, µg/m^3 = micrograms per cubic meter.
Source: Illingworth & Rodkin, Inc., 2013.

PROJECT IMPACTS

Impact AIR-1: The projects would not conflict with or obstruct implementation of the applicable air quality plan. (LTS)

The most recent clean air plan is the *Bay Area 2010 Clean Air Plan* that was adopted by the BAAQMD in September 2010. The proposed projects would not conflict with the latest Clean Air planning efforts since (1) the projects would have emissions below the BAAQMD thresholds (see Impact AIR-2), (2) development of the project sites would be considered urban "infill," (3) development would occur near employment centers, and (4) development would be in proximity to

existing transit with regional connections. The projects are too small to incorporate project-specific transportation control measures listed in the latest Clean Air Plan (i.e., *Bay Area 2010 Clean Air Plan*).

Sares Regis Applicant Proposed Scenario. See above discussion.

Sares Regis Full Buildout Scenario. See above discussion.

Raintree Applicant Proposed Scenario. See above discussion.

Raintree Full Buildout Scenario. See above discussion.

Mitigation Measure AIR-1: No mitigation would be necessary. (LTS)

- Applies to Sares Regis Applicant Proposed Scenario: ☒
- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☒
- Applies to Raintree Full Buildout Scenario: ☒

Impact AIR-2: Construction of the Full Buildout Scenarios could result in a cumulatively considerable net increase of a criteria pollutant for which the project region is nonattainment under an applicable national or state ambient air quality standard. (S)

The Bay Area is considered a nonattainment area for ground-level ozone and $PM_{2.5}$ under both the federal Clean Air Act and the California Clean Air Act. The area is also considered nonattainment for PM_{10} under the California Clean Air Act, but not the federal Clean Air Act. The area has attained both state and federal ambient air quality standards for carbon monoxide. As part of an effort to attain and maintain ambient air quality standards for ozone, $PM_{2.5}$ and PM_{10}, the BAAQMD has established the thresholds discussed above under "Significance Criteria."

The California Emissions Estimator Model Version ~~2011.1.1~~2013.2.2 (CalEEMod) was used to predict emissions from construction and operation of the site for ~~both~~ the Applicant Proposed Scenario and operation of the Full Buildout Scenario of both projects. The project land use types and size, trip generation rate, and other project-specific information were input to the model. The use of this model for evaluating air pollutant emissions from land use projects is recommended by the BAAQMD.

Existing Emissions

The Sares Regis site is currently developed with one 62,442-square-foot industrial facility and ancillary facilities that are vacant. These facilities were assumed to result in no existing emissions. The Raintree site is currently developed with multiple light-manufacturing and office buildings that total about 183,000 square feet. These buildings are currently occupied and generate emissions from on-site activities and vehicle travel. Emissions from this existing use were modeled in CalEEMod assuming default inputs for Santa Clara County along with the trip generation rate of 6.97 trips per 1,000 square feet forecasted by TJKM transportation consultants. Emissions were computed for existing conditions, assumed to be 2013, and future conditions with complete build-out at 2017.

Construction Emissions

Annual and average daily emissions for construction were calculated, including both on-site and off-site activities. On-site activities would consist of the operation of off-road construction equipment, as well as on-site truck travel (e.g., haul trucks, water trucks, and concrete trucks). ~~Emissions from off-road equipment were calculated by using emission factors from the CARB OFFROAD model for off-road construction equipment and the project construction schedule. On- and off-site vehicle emissions were computed using emission factors from CARB's EMFAC2011 mobile source emissions model.~~ Both on- and off-site emissions were computed using the CalEEMod model.

Each applicant provided a schedule and equipment list that included phase start and end dates, equipment type, quantity, number of days, hours per day, horsepower, and load factor. These data were input to the CalEEMod model. Phase durations last longer than the number of days that various pieces of equipment are anticipated to be used. Therefore, the average hours per day for each piece of equipment during a phase were computed by multiplying the number of days and hours per day and dividing by the total number of days for that phase.

The applicants also provided the estimated number of truck trips. These included trips to remove demolition material, excess soil, and cement. CalEEMod was used to estimate the number of worker and vendor trips. The number of vendor trips was estimated based on the CalEEMod default rate The total number of cement truck trips was provided by the applicants.

Sares Regis Land Use Descriptions

The proposed project land uses include 205 mid-rise apartments and a 331-space parking structure under the Applicant Proposed Scenario. These land uses were input into CalEEMod. Project residential and parking square footages were based on the project description.

Raintree Land Use Descriptions

The proposed project land uses include 465 mid-rise apartments and a 790-space parking structure under the Applicant Proposed Scenario. These land uses were input into CalEEMod. The total project residential and parking square footages were based on the project description. Since a breakdown of residential and parking structure square footages was not available, it was assumed that the Raintree project would have the same relative breakdown as the Sares Regis project (i.e., 32 percent of the square footage would be for the parking structure).

Sares Regis Construction Schedule, Phases, and Equipment

It is anticipated that the Sares Regis project would be constructed over 21 months, from early 2014 through late 2015. Assuming about 22 construction days per month, there would be approximately 462 work days. Construction of the Sares Regis project is also assumed to include the 10-inch-diameter sewer main upsizing along North Fair Oaks Avenue. This was modeled based on the construction information provided. Based on information provided by City's Department of Public Works staff, it was assumed that the sewer line work would be constructed within 2 weeks. The construction schedule, estimated hauling truck volumes to remove demolition material and soil, and anticipated on-site construction equipment used for the CalEEMod emission ~~calculations~~ modeling

are shown in Appendix D. Anticipated demolition and soil hauling volumes, and trips from cement trucks are also shown in Appendix D.

Raintree Construction Schedule, Phases, and Equipment

It is anticipated that the Raintree project would be constructed over 24 months, from late 2014 through late 2016. Construction of the Raintree project is also assumed to include the 10-inch-diameter sewer main upsizing along North Fair Oaks Avenue. Assuming about 22 construction days per month, there would be approximately 528 work days. The construction schedule, estimated hauling volumes, and anticipated on-site construction equipment used for the emission calculations are shown in Appendix D. Anticipated demolition and soil hauling volumes, and trips from cement trucks are also shown in Appendix D.

Off-Site Construction Emissions

Construction of either the Sares Regis or Raintree project would also upgrade the sewer main along North Fair Oaks Avenue with a 10-inch-diameter pipe. Since it is not known which project would construct this replacement sewer main, the emissions associated with this construction were included with those for each project. The sewer main construction emissions were modeled based on the construction information provided. This sewer main project is anticipated to be constructed within 2 weeks.

Emissions from haul trips, vendor trips, cement truck trips, and construction worker trips were ~~estimated using emission factors from EMFAC2011 and the estimated number of trips and trip lengths. Vendor, worker, and haul truck one-way trip lengths were estimated at 7.3 miles, 12.4 miles, and 20 miles, respectively~~ conservatively calculated using~~. These are the default trip lengths assumed in~~ the CalEEMod model. The number of haul trucks needed for construction of the projects was based on the amount of material to be hauled away during demolition and from excavation and grading activities at the site and was provided by the project applicants. The number of concrete trucks needed was also based on estimates provided by the project applicants. Demolition truck trips were assumed to be 10 miles, soil haul truck trips were assumed at 20 miles, and cement trips were assumed at 7.3 miles. These trips were all assumed to be made by heavy heavy-duty trucks. Vendor and worker trip generation was computed by CalEEMod. Vendor trip lengths were assumed to be 7.3 miles and made by a mix of medium-duty and heavy-heavy-duty trucks. Worker trips were assumed to be 12.4 miles and made by a mix of light-duty autos and light-duty trucks.

On-Site Construction Emission Computations

On-site emissions from off-road construction equipment were calculated using ~~emission rates~~CalEEMod ~~from the OFFROAD model~~based on~~and~~ the number and types of construction equipment needed, along with the anticipated length of their use for different phases of construction based on the site-specific construction activity schedules (see Appendix D). These construction schedules included the estimated number of days the equipment would operate for each phase and the average number of hours per day of operation. Off-road equipment horsepower estimates and load factors were based on the defaults used by CalEEMod, if available, or provided by the project applicants. ~~Emission rates for construction equipment representative of U.S. EPA Tier 2 engine emission standards were assumed (a model year 2006 construction~~

~~equipment fleet). Equipment load factors were based on the latest OFFROAD model guidance provided by CARB.~~ Construction of the projects is anticipated to occur during the weekdays from 7:00 AM to 6:00 PM and 8:00 AM to 5:00 PM on Saturdays.

Emissions from water trucks export haul trucks, cement trucks and vendor trucks associated with construction activities while traveling on or near the site were calculated using ~~emission factors from CARB's EMFAC2011 mobile source emissions~~ the CalEEMod model . ~~While traveling on-site, these trucks were assumed to travel a 10 miles per hour (mph). Additionally, haul trucks and vendor trucks were assumed to idle on-site for 10 minutes (5 minutes per trip) and concrete trucks were assumed to idle for one hour (60 minutes per truck).~~

In addition, CalEEmod was used to estimate reactive organic gases (ROG) emissions due to architectural coatings during construction (i.e., painting). Architectural coating emission inputs were adjusted to account for volatile organic compound (VOC) paint content that was provided by the applicants. For the Sares Regis and Raintree projects, the applicants propose to obtain a minimum of 110 points on the Green Point Rated Checklist. One of the elements to meet this requirement would be the inclusion of low VOC paints and adhesives. Paint VOC content was based on the Sherwin-Williams specification provided by the applicants (see Appendix D). These include paint VOC content ranging from 47 to 96 grams per liter. These were input to the CalEEMod model for construction paint emissions. Neither applicant proposes to paint the parking structures. ~~BAAQMD regulations that reduce the volatile organic compound content in paints to about 150 grams per liter for typical paints used in this type of construction.~~

The refined emissions modeling of $PM_{2.5}$ exhaust from of on-site activities was predicted as part of the construction health risk assessment addressed later in this report.

Construction Emissions by Scenario

Sares Regis Applicant Proposed Scenario. **Table 4.2-5** shows annual and average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ exhaust during construction of the Sares Regis project. Daily emissions were computed from total emissions and dividing the number of construction days. Total emissions were the sum of the annual emissions. The number of construction days was computed at 462, assuming 22 days per month and 21 months of construction. As indicated in **Table 4.2-5**, predicted average daily emissions would not exceed the BAAQMD thresholds. The impact associated with construction-period emissions is considered *less than significant* for the Applicant Proposed scenarios, but could be significant for the Full Buildout scenarios. Construction emission computations are provided in Appendix D.

Sares Regis Full Buildout Scenario. Since construction techniques, equipment usage, and schedules have not been identified for the Full Buildout Scenario, construction emissions cannot be calculated at this time. Thus, mitigation measures have been recommended to ensure that construction-related emissions for the Full Buildout Scenario would be less than significant.

Raintree Applicant Proposed Scenario. **Table 4.2-6** shows annual and average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ exhaust during construction of the project. Daily emissions were computed from total emissions and dividing the number of construction days.

Table 4.2-5 Sares Regis Project Unmitigated Construction Emissions

	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
~~Off-Road Equipment (tons)~~	~~0.2~~	~~2.7~~	~~0.1~~	~~0.1~~
~~On-Road Vehicles (tons)~~	~~0.1~~	~~0.3~~	~~0.1~~	~~0.0~~
~~Evaporative Emissions (tons)~~	~~3.6~~	~~--~~	~~--~~	~~--~~
Total Sares Regis Emissions both On- and Off-Site based on CalEEMod (tons)	~~3.9~~ 2.27	~~3.0~~ 5.26	~~0.2~~ 0.25	~~0.1~~ 0.23
Emissions from Sewer Main Replacement based on CalEEMod (tons)	0.01	0.05	<0.01	<0.01
Average Emissions (pounds/day) based on 462 construction days	~~16.9~~ 9.9	~~13.0~~ 23.0	~~0.9~~ 1.1	~~0.4~~ 1.0
BAAQMD Thresholds (pounds/day)	*54*	*54*	*82*	*54*
Exceed Threshold?	*No*	*No*	*No*	*No*

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM_{10} = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, $PM_{2.5}$ = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, BAAQMD = Bay Area Air Quality Management District ,
Source: Illingworth & Rodkin, Inc., 2013.

Table 4.2-6 Raintree Project Unmitigated Construction Emissions

	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
~~Off-Road Equipment (tons)~~	~~0.6~~	~~7.7~~	~~0.4~~	~~0.4~~
~~On-Road Vehicles (tons)~~	~~0.3~~	~~0.8~~	~~0.2~~	~~0.1~~
~~Evaporative Emissions (tons)~~	~~8.5~~	~~--~~	~~--~~	~~--~~
Existing 2013 Operational Emissions based on CalEEMod (tons/year)	1.70	2.39	1.10	0.33
Average Daily Emissions (pounds/day)	9.3	13.1	6.0	1.8
Total Emissions both On- and Off-Site based on CalEEMod (tons)	~~9.4~~ 5.03	~~8.5~~ 12.35	~~0.6~~ 0.60	~~0.5~~ 0.56
Total Emissions both On- and Off-Site based on CalEEMod (tons)	~~9.4~~ 4.22	~~8.5~~ 12.35	~~0.6~~ 0.60	~~0.5~~ 0.56
Emissions from Sewer Main Replacement based on CalEEMod (tons)	0.01	0.05	<0.01	<0.01
Average Emissions (pounds/day) based on 528 Construction Days	~~35.6~~ 19.1	~~32.2~~ 47.0	~~2.3~~ 2.3	~~1.9~~ 2.1
Average Emissions (pounds/day) based on 528 Construction Days	~~35.6~~ 16.0	~~32.2~~ 46.8	~~2.3~~ 2.3	~~1.9~~ 2.1
BAAQMD Thresholds (pounds/day)	*54*	*54*	*82*	*54*
Exceed Threshold?	*No*	*No*	*No*	*No*

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM_{10} = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, $PM_{2.5}$ = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, BAAQMD = Bay Area Air Quality Management District ,
Source: Illingworth & Rodkin, Inc., 2013.

Total emissions were the sum of the annual emissions. The number of construction days was computed at 528, assuming 22 days per month and 24 months of construction. As indicated in **Table 4.2-6**, predicted average daily emissions would not exceed the BAAQMD thresholds. The impact associated with construction-period emissions is considered *less than significant*. Construction emission computations are provided in Appendix D.

Raintree Full Buildout Scenario. Since construction techniques, equipment usage, and schedule have not been identified for the Full Buildout Scenario, construction emissions cannot be calculated at this time. Thus, mitigation measures have been recommended to ensure that construction-related emissions for the Full Buildout Scenario would be less than significant.

Operational Emissions

The CalEEMod model, along with the projects' vehicle trip generation rates and estimates, were used to predict daily emissions associated with operation of the Applicant Proposed Scenarios and Full Buildout Scenarios under both projects. Adjustments to the modeling are described below. The CalEEMod operational emissions modeling output is also provided in Appendix D.

Sares Regis Land Use Descriptions

The proposed project land uses were input into CalEEMod, which included 205 mid-rise apartments and a ~~331~~ 348-space parking structure under the Applicant Proposed Scenario and 259 mid-rise apartments and a ~~419~~ 436-space parking structure under the Full Buildout Scenario.

Raintree Land Use Descriptions

The proposed project land uses were input into CalEEMod, which included 465 mid-rise apartments and a 790-space parking structure under the Applicant Proposed Scenario and 679 mid-rise apartments and a 1,165-space parking structure under the Full Buildout Scenario.

Sares Regis Year of Analysis

Emissions associated with vehicle travel depend on the year of analysis because emission control technology requirements are phased in over time. Therefore, the earlier the year analyzed in the model, the higher the emission rates CalEEMod uses. The earliest full year the Applicant Proposed Scenario could be possibly constructed and fully operated was assumed to be 2016. Use of this early date is considered conservative, as emissions associated with buildout later than 2016 would be lower. The earliest full year that the Full Buildout Scenario could be possibly constructed and fully operated was assumed to be 2018.

Raintree Year of Analysis

The earliest full year the Applicant Proposed Scenario could be possibly constructed and fully operated was assumed to be 2017. The earliest full year that the Full Buildout Scenario could be possibly constructed and fully operated was assumed to be 2019.

Sares Regis Trip Generation Rates

CalEEMod allows the user to enter specific trip generation rates. TJKM transportation consultants provided trip generation rates for the projects by land use type (TJKM, 2013). Under the Applicant Proposed Scenario, the daily rate is 6.66 trips per dwelling unit, and under the Full Buildout Scenario, the daily rate is 6.54 trips per dwelling unit. (Trip generation rates are based on ITE equations for multi-family residences and are dependent on the size of the project.) Adjustments to the CalEEMod weekend rate were not made, since the trip rate provided was assumed to be representative of weekday operation.

Raintree Trip Generation Rates

For the existing operating land use, TJKM transportation consultants provided a trip generation rate of 6.97 trips per 1,000 square feet. Under the Applicant Proposed Scenario, the daily rate is 6.32 trips per dwelling unit, and under the Full Buildout Scenario, the daily rate is 6.24 trips per dwelling unit. (Trip generation rates are based on ITE equations for multi-family residences and are dependent on the size of the project.) Adjustments to the CalEEMod weekend rate were not made, since the trip rate provided was assumed to be representative of weekday.

Area Sources

Minor adjustments were made to the area source inputs of CalEEMod. These include an adjustment that no residences would use wood-burning stoves or fireplaces. All fireplaces were assumed to be natural-gas fired. ~~Also, the model was adjusted to account for current BAAQMD regulations pertaining to architectural coatings (Reg. 8, Rule 3), which limits most paints to less than 150 grams of volatile organic compounds per liter.~~

Energy-Efficiency Measures

Energy-efficiency measures, such as exceeding 2008 California Title 24 standards by 15 percent or more, installing energy-efficient lighting and appliances, and using water-efficient landscaping~~,~~ are proposed as part of the project and were included in the model runs. For a full list of these measures see Chapter 3, Project Description, and Chapter 4.4, Greenhouse Gas Emissions.

Operational Emissions by Scenario

Sares Regis Applicant Proposed Scenario. Project emissions are presented in **Table 4.2-7**. As shown in **Table 4.2-7**, average daily emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$ associated with project operation would not exceed the BAAQMD significance thresholds. Therefore, the impact is considered *less than significant*.

Sares Regis Full Buildout Scenario. Project emissions are presented in **Table 4.2-7**. As shown in **Table 4.2-7**, average daily emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$ associated with project operation would not exceed the BAAQMD significance thresholds. Therefore, the impact is considered *less than significant*.

Raintree Applicant Proposed Scenario. Existing emissions and ~~P~~project emissions are presented in **Table 4.2-8**. As shown in **Table 4.2-8**, net average daily emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$

Table 4.2-7 Sares Regis Project Unmitigated Operational Emissions

	ROG	NOx	PM_{10}	$PM_{2.5}$
Applicant Proposed Scenario – 2016				
Emissions in tons per year	~~3.1~~ 2.78	~~1.9~~ 1.87	~~1.6~~ 1.17	~~0.2~~ 0.34
Emissions in average pounds per day	~~17~~ 15.2	~~10~~ 10.2	~~9~~ 6.4	~~1~~ 1.9
Full Buildout Scenario – 2018				
Emissions in tons per year	~~3.6~~ 3.29	~~2.0~~ 1.99	~~2.0~~ 1.45	~~0.1~~ 0.42
Emissions in average pounds per day	18.0	~~11~~ 10.9	~~11~~ 7.9	~~1~~ 2.3
BAAQMD Thresholds (tons per year)	*10*	*10*	*15*	*10*
Significant?	***No***	***No***	***No***	***No***
BAAQMD Thresholds (pounds per day)	*54*	*54*	*82*	*54*
Significant?	***No***	***No***	***No***	***No***

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM10 = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, BAAQMD = Bay Area Air Quality Management District ,
Source: Illingworth & Rodkin, Inc., 2013.

Table 4.2-8 Raintree Project Unmitigated Operational Emissions

	ROG	NOx	PM_{10}	$PM_{2.5}$
Existing Uses – 2013				
Existing 2013 Operational Emissions based on CalEEMod (tons/year)	1.70	2.39	1.10	0.33
Average Emissions (pounds/day)	9.3	13.1	6.0	1.8
Applicant Proposed Scenario – 2017				
Emissions in tons per year	~~6.7~~ 5.91	~~3.9~~ 3.79	~~3.6~~ 2.55	~~0.3~~ 0.74
Net Emissions in tons per year	*4.21*	*1.40*	*1.45*	*0.41*
Emissions in average pounds per day	~~37~~ 32.4	~~21~~ 20.8	~~20~~ 14.0	~~2~~ 4.1
Net Emissions in average pounds per day	~~22.3~~ 23.1	7.70	8.0	2.3
Full Buildout Scenario – 2019				
Emissions in tons per year	~~9.4~~ 8.29	~~4.9~~ 4.71	~~5.2~~ 3.68	~~0.3~~ 1.06
Net Emissions in tons per year	*6.59*	*2.32*	*2.58*	*0.73*
Emissions in average pounds per day	~~52~~ 45.4	~~27~~ 25.8	~~28~~ 20.2	~~2~~ 5.8
Net Emissions in average pounds per day	*36.1*	*12.7*	*14.2*	*4.0*
BAAQMD Thresholds (tons per year)	*10*	*10*	*15*	*10*
Significant?	***No***	***No***	***No***	***No***
BAAQMD Thresholds (pounds per day)	*54*	*54*	*82*	*54*
Significant?	***No***	***No***	***No***	***No***

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM10 = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, BAAQMD = Bay Area Air Quality Management District ,
Source: Illingworth & Rodkin, Inc., 2013.

associated with project operation would not exceed the BAAQMD significance thresholds. Therefore, the impact is considered *less than significant*.

Raintree Full Buildout Scenario. Existing emissions and ~~P~~project emissions are presented in **Table 4.2-8**. As shown in **Table 4.2-8**, net annual and average daily emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$ associated with project operation would not exceed the BAAQMD significance thresholds. Therefore, the impact is considered *less than significant.*

> *Mitigation Measure AIR-2: When construction information is available for the Full Buildout Scenarios, a complete air emissions analysis for construction emissions shall be completed by the project applicants to address annual and average daily construction emissions of reactive organic gases (ROG), nitrogen oxides (NO_X), coarse particulate matter (PM_{10}) exhaust, and fine particulate matter ($PM_{2.5}$) exhaust during construction of the Sares Regis and Raintree projects. Average daily emissions shall be computed from total emissions. Total emissions shall be the sum of the annual emissions. If predicted average daily emissions would exceed the Bay Area Air Quality Management District (BAAQMD) thresholds, the applicants shall identify mitigation measures that would reduce construction-related emissions to below the BAAQMD thresholds. Such measures may include:*
>
> - *Phasing of the project to reduce daily emissions;*
> - *Use of newer or retrofitted construction equipment that has low emission rates; and*
> - *Use of alternatively fueled equipment; and modification of construction techniques to avoid use of diesel-powered equipment.*
>
> *Compliance with thresholds shall be verified by the City prior to issuance of any building permits. This measure would reduce the air quality impact to a less-than-significant level. (LTS)*
>
> - Applies to Sares Regis Applicant Proposed Scenario: ☐
> - Applies to Sares Regis Full Buildout Scenario: ☒
> - Applies to Raintree Applicant Proposed Scenario: ☐
> - Applies to Raintree Full Buildout Scenario: ☒

Impact AIR-3: The projects would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. (LTS)

As discussed under Impact AIR-2, project operations would have emissions less than the significance thresholds adopted by the BAAQMD for evaluating impacts of ozone and particulate matter. Therefore, the projects would not contribute substantially to existing or projected violations of those standards. Carbon monoxide emissions from traffic generated by the project would be the pollutant of greatest concern at the local level. Congested intersections with a large volume of traffic have the greatest potential to cause high localized concentrations of carbon monoxide. Air pollutant monitoring data indicate that carbon monoxide levels have been at healthy levels (i.e., below state and federal standards) in the Bay Area since the early 1990s. As a result, the region has been designated as attainment for the standard. There is an ambient air quality monitoring station in Cupertino that measures carbon monoxide concentrations. The highest measured level over any 8-hour averaging period during the last 3 years is less than 1.0 part per million (ppm), compared to the ambient air quality standard of 9.0 ppm. BAAQMD screening guidance indicates

that a project would have a less-than-significant impact with respect to carbon monoxide levels if project traffic projections indicate traffic levels would not increase at any affected intersection to more than 44,000 vehicles per hour. Because cumulative traffic volumes at all intersections affected by the projects together would be far less, the projects would have a *less-than-significant impact* with respect to carbon monoxide.

Sares Regis Applicant Proposed Scenario. See above discussion.

Sares Regis Full Buildout Scenario. See above discussion.

Raintree Applicant Proposed Scenario. See above discussion.

Raintree Full Buildout Scenario. See above discussion.

Mitigation Measure AIR-3: No mitigation would be necessary. (LTS)

- Applies to Sares Regis Applicant Proposed Scenario: ☒
- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☒
- Applies to Raintree Full Buildout Scenario: ☒

Impact AIR-4: Sensitive receptors that are part of the proposed projects could be exposed to substantial pollutant concentrations. (S)

The projects would place sensitive receptors near potential sources of TAC emissions. The operation of the projects is not expected to cause any localized emissions that could expose sensitive receptors to unhealthy air pollutant levels. However, construction activities would generate dust and equipment exhaust on a temporary basis that could affect nearby land uses (see Impact AIR-5 below).

The proposed projects would locate new residences near Highway 101, North Fair Oaks Avenue, and several stationary sources that emit TACs. Proximity to busy streets and railroads is also associated with exposure to source of TACs or $PM_{2.5}$, predominantly from diesel exhaust emissions. The BAAQMD has identified significance thresholds for exposure to TACs and $PM_{2.5}$ as part of its CEQA Air Quality Guidelines (Guidelines) that were recently vacated. The BAAQMD Guidelines include thresholds to evaluate single source and cumulative source impacts of TACs and $PM_{2.5}$ on existing sensitive receptors and proposed sensitive receptors.

TAC Impacts from Roadways

A review of nearby roadways and traffic information indicates two roadways within 1,000 feet of the project sites with average daily traffic in excess of 10,000 average daily trips (ADT) or having a high percentage of heavy duty truck traffic: Highway 101 with 154,000 ADT (Caltrans, 2012a) and North Fair Oaks Avenue with and estimated at about 21,003 ADT (City of Sunnyvale, 2013).

Due to the nearby roadways with substantial traffic volumes, potential health risks and $PM_{2.5}$ concentrations from traffic emissions were evaluated in this assessment. According to the BAAQMD CEQA Air Quality Guidelines (BAAQMD, 2011a), a refined analysis is necessary to

appropriately identify the impacts of nearby traffic emissions upon the project. The refined analysis for roadways takes into account local traffic conditions, site-specific meteorology (using the most representative BAAQMD hourly meteorological data set), and roadway emissions that take into account future year exposures.

BAAQMD Google Earth Screening Tool

The proposed projects could develop residences within 100 feet of Highway 101 and North Fair Oaks Avenue. The BAAQMD provides a Google Earth Highway Screening Analysis Tool that can be used to identify screening level impacts from State highways (BAAQMD, 2011b). This tool identified community risk levels as shown in **Table 4.2-9.**

Table 4.2-9 Screening Roadway Health Impacts

Roadway/Setback	Daily Traffic	Cancer Risk (per million)	$PM_{2.5}$ Concentration ($\mu g/m^3$)	Acute Hazard (HI)	Chronic Hazard (HI)
Highway 101 (100 feet)	154,000	55.1	0.38	0.05	0.05
North Fair Oaks Avenue (100 feet)	21,003	3.9	0.15	<0.1	<0.1

Note: PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, µg/m3 = micrograms per cubic meter
Source: Illingworth & Rodkin, Inc., 2013.

Since screening cancer risks and annual $PM_{2.5}$ concentrations from Highway 101 are above the BAAQMD community risk thresholds, a refined analysis of the impacts on the sites were modeled using refined emissions and dispersion modeling techniques. This refined analysis was focused only on Highway 101, since North Fair Oaks Avenue traffic would not have significant effects.

This analysis involved the development of DPM, organic TAC, and $PM_{2.5}$ emissions for traffic on Highway 101 and associated on- and off-ramps near the project sites using the latest version of CARB's emission factor model and traffic mix developed from Caltrans data. EMFAC2011 is the most recent version of the CARB motor vehicle emission factor model. Roadway and receptor coordinates, meteorological data, traffic volumes, and the emission factors were used with the CAL3QHCR roadway dispersion model to predict annual concentrations of TACs and $PM_{2.5}$ from roadway traffic. Traffic TAC concentrations are combined with risk factors to predict lifetime cancer risks at the project sites. **Figure 4.2-1** shows the project sites and the modeled line-sources and receptors.

Traffic Emissions

DPM emissions in California are projected to decrease in the future and are reflected in the EMFAC2011 emissions data. A new CARB regulation requires on-road diesel trucks to be retrofitted with particulate matter controls or replaced to meet new 2010 engine standards that have much lower DPM and $PM_{2.5}$ emissions. This regulation will substantially reduce these emissions between 2013 and 2023, with the greatest reductions occurring in 2013 through 2015. While new trucks and buses will meet strict federal standards, this measure is intended to