4.5 HAZARDS AND HAZARDOUS MATERIALS

This section of the EIR describes the existing setting relevant to hazards and hazardous materials conditions within the project area, including the sites of Coaches Field and Blair Park. The description is followed by an evaluation of potential impacts resulting from the implementation of the proposed project including the possible creation of hazards or hazardous conditions that could affect the public or the environment, release of hazardous wastes or emissions, interference with an emergency response or evacuation plan, and exposure to risks from proximity to airport facilities and wildland fires.

4.5.1 Existing Setting

Historical Land Use. The Blair Park site consists of about 5.6 acres of undeveloped land within Moraga Canyon and the Cemetery Creek watershed. The area appears to have been part of a 75-acre amusement park in Moraga Canyon built by Walter Blair in the latter part of the 19th century.[113] More recently, the property has been used as a linear City park, designated as an off-leash dog walking area. There are two small areas with limited parking off Moraga Avenue. The site vegetation includes grasses and a mix of broad-leafed plants, shrubs, and trees. The soil substrate in proximity to Moraga Avenue consists of artificial fill with a depth ranging from 13 to 23 feet.[114] The fill "...generally consists of a heterogeneous mix of sand, clay, sandy clay, and clayey sand, with varying amounts of gravel and debris, that includes brick and charcoal."[115] No hazardous materials testing of the fill was conducted and none was reported present in the fill as part of the boring. Utilities, including electrical lines, storm drains, and water and sanitary lines are located within the property.

The 1.98-acre Coaches Field site was originally part of undeveloped land owned by the Mountain View Cemetery that was leased and subsequently purchased by the City for the development of sports facilities. Vegetation, prior to the construction of the sports field, consisted of disturbed annual grassland, and the adjacent hillside to the north supported dense scrub vegetation and scattered woodland. The City Corporation Yard was, and still is, located adjacent to the site. Artificial non-engineered fill, comprised of "assorted materials and boulders," was located across the relatively level portions of the site.[116] The property was developed in 1994 as Coaches Field.

Current Site Conditions. The present Blair Park conditions have been described above under the Historical Land Use subsection. The park site remains undeveloped.

Coaches Field is currently used for youth sports. It includes a 58,600-square foot natural turf field with a sand base that is used for youth baseball and for soccer, bleachers, a backstop, a 13-space paved parking lot, a restroom, and security lighting. The site is fenced and field access is restricted through a lockable gate. Additional parking for 31 vehicles is located in a lot east of the main gate and at the City Corporation Yard.

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[113] City of Piedmont, 2010. City of Piedmont Website. Available online at: http://www.ci.piedmont.ca.us. Accessed April 1, 2010.
[114] Treadwell & Rollo Environmental and Geotechnical Consultants, 2009. Geotechnical Investigation and Geologic Hazard Evaluation, Blair Park Playing Fields, Piedmont, California. Prepared for the City of Piedmont. August 27.
[115] Ibid.
[116] Larry Seeman Associates, January 31, 1986. Draft Environmental Impact Report: Moraga Sports Field Corporation Yard Relocation. Prepared for the City of Piedmont.

The natural turf surface is watered, and fertilizer, pesticides, and herbicides, along with mowing and field repairs, are required to maintain the usability of the field.

Emergency Response. The City developed an emergency response program to prepare and carry out measures for the protection of persons and property within the community in the event of a disaster or an emergency. The program is managed through the police, fire and public works departments and coordinates functions (e.g., mutual aid) with other public agencies, corporations, organizations, and affected private persons.

Wildland Fires. The California Department of Forestry and Fire Protection has designated the area of Moraga Canyon that includes Blair Park and Coaches Field as having a moderate severity rating for wildfire hazard. Located within an area of relatively steep hillsides, residential uses are within proximity to a "synthetic wildland" of native and introduced plants that present a potential fire hazard.[117]

Airport/Airstrip Facilities. From the location of Blair Park and Coaches Field, the nearest airport or airstrip is located at the Oakland International Airport, a distance of over six miles.

Disease Vectors. The term "vector" is defined as any animal capable of transmitting the causative agent of human disease, or capable of producing human discomfort or injury. Vectors include but are not limited to fleas, ticks, mites, rats, bats, flies, and other insects.[118]

These vectors can carry a variety of diseases that are transmittable to humans. All mammals can potentially carry rabies, although bats and skunks are the most common carriers in the Bay Area.[119] In addition to rabies, rodents can carry a number of diseases communicable to humans, including arenavirus, hantavirus, tularemia, Ljungan virus, and Bubonic plague (via fleas).[120] Mosquitoes can transmit West Nile virus to humans, while ticks can transmit Lyme's disease. Mites, spiders, bees and wasps do not carry any diseases communicable to humans, but can be a nuisance to humans through bites or stings.[121]

Actual human cases of any of these diseases are very low, although some of them have been fatal. Lyme's disease rates in California varied from 0.1 to 0.3 cases per 100,000 people between 2001 and 2008[122]; there were 112 cases of West Nile virus in 2009 and 445 cases in 2008 statewide, resulting in

[117] City of Piedmont. 2009. City of Piedmont General Plan. Adopted by City Council in April 2009.
[118] Alameda County Vector Control Services District (ACVCSD), 2010a. Vector Control Overview. Available online at: http://www.acvcsd.org/vector_control_overview.pdf. Accessed on May 19, 2010.
[119] Alameda County Healthcare Services Agency, Environmental Health Department, Vector Services District, 2010. Animal Rabies in Alameda County: Year/Month/Species 1995-2010. Available online at: http://www.acvcsd.org/wildlife_rabies/Alameda_County_rabies_positive1995-2010.pdf. Accessed on May 19, 2010.
[120] ACVCSD, 2008. Alameda County Vector Control Services District Area VC 1984-1, Annual Report 2008.
[121] Ibid.
[122] California Department of Public Health, 2009. Lyme Disease Yearly Summary Report 2001-2008. Center for Infectious Diseases, Division of Communicable Disease Control, Infectious Diseases Branch, Surveillance and Statistics Section. Available online at: http://www.cdph.ca.gov/data/statistics/Documents/LYME%202001-2008.pdf. Accessed on May 19, 2010.

4 and 15 fatalities, respectively[123]; between 1997 and 2006, 103 animals in Alameda County tested positive for rabies, most of which were bats and skunks[124]; and cases of arenavirus, hantavirus, Bubonic plague, and tularemia are even more rare.[125] Many of these diseases are treatable, although treatment for West Nile virus, arenavirus and hantavirus is mainly supportive, and treatment for rabies is not effective once symptoms appear.[126]

Potential vectors that could be found on the project sites include those ubiquitous in urban and urban fringe areas, such as non-native rats and mice, Eastern fox squirrels, fleas, mosquitoes, ticks, mites, spiders, bees and wasps, and other insects. In addition, common native mammal species are expected to occur in the project area. Blair Park and the wooded hillside to the south likely facilitate local movement by generalist wildlife species such as northern raccoon, black-tailed deer, Virginia opossum, and striped skunk. Coaches Field is not an important wildlife corridor component since it is developed with a sports field and related facilities. However, local wildlife likely move through the undeveloped hillside to the north as well as the canyon below (i.e., west of) the field (see Section 4.3, Biological Resources, of this EIR for more information). Rodents and other small mammals commonly found in urban areas are attracted to parks and residential areas because they provide readily available shelter and food; and fleas, ticks and mites are carried by such mammals. There are currently no existing storm water detention basins or water features on either site that could provide a breeding ground for mosquitoes.

On April 26, 2010, the ACVCSD (Alameda County Vector Control Services District) conducted a site assessment to look for indications of rodent infestations at the project sites. According to the Report of Investigation[127], there are many species of animals found in the project area and throughout the Bay Area. The ACVCSD investigator identified squirrels only. Thirteen requests for services have been generated by homeowners in the project vicinity between the years of 2006 and 2009.[128]

4.5.2 Regulatory Framework

The following section describes the regulatory framework relevant to potential hazards and hazardous materials within the project area.

Occupational Health and Safety Administration (OSHA). Under 29 CFR part 1910, the U.S. OSHA is responsible for enforcement and implementation of federal laws and regulations pertaining to worker health and safety including the regulation of hazardous materials in the workplace and training in their handling. Hazardous materials include any substance or chemical that is a "health hazard" or "physical hazard," including: chemicals which are carcinogens; toxic agents; irritants; corrosives; sensitizers; agents that act on the hematopoletic (blood-related) system; agents that

[123] California Department of Public Health, UC Davis Center for Vector Borne Diseases, Mosquito and Vector Control Association of California, California Department of Food and Agriculture, 2010. 2004-2009 West Nile Virus Activity Summary. Available online at: http://www.westnile.ca.gov/. Accessed May 19, 2010.
[124] Alameda County Healthcare Services Agency, 2010. op. cit.
[125] Ibid.
[126] Mayo Clinic, 2010. Diseases and Conditions. Available online at: http://www.mayoclinic.com/health/DiseasesIndex/DiseasesIndex. Accessed on May 19, 2010.
[127] ACVCSD, 2010b. Request for Services Report of Investigation, 800 Moraga Avenue (Request Number 2010-001121). Prepared by Gary Kunselman, Senior Vector Control Officer.
[128] Ibid.

damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, or flammable; oxidizers or pyrophorics; unstable-reactive or water-reactive substances; and chemicals that in the course of normal handling, use or storage may produce or release dusts, gases, fumes, vapors, mists or smoke that may have any of the previously mentioned characteristics.

Resource Conservation and Recovery Act (RCRA). Under RCRA (42 U.S.C. §6901 et seq. [1972]), the U.S. Environmental Protection Agency (EPA) has the authority to designate and control hazardous waste from "cradle-to-grave." The controls include the transportation, treatment, storage, and disposal of hazardous waste. The act also establishes a framework for the management of non-hazardous solid wastes and environmental problems associated with underground petroleum storage tanks and other hazardous substances.

The EPA definition of hazardous material incorporates the OSHA definition, and expands to include any item or chemical that may cause harm to people, plants, or animals when released by spills, leaks, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment.

Hazardous Waste Control Law of 1972. The Hazardous Waste Control Law established the definition of hazardous waste and the management of hazardous wastes in the State. The law is similar to the federal Resource Conservation and Recovery Act, which incorporated part of the provisions of the California legislation.

Business Plan Act (1985). The California Hazardous Materials Release Response Plans and Inventory Law of 1985, also known as the Business Plan Act, requires preparation of Hazardous Materials Business Plans and disclosure of hazardous material inventories. A Business Plan includes information such as an inventory of hazardous materials handled, storage location of hazardous materials, an emergency response plan, and provisions for employee training in safety and emergency response procedures. The State Office of Emergency Services (OES) has primary regulatory responsibility with delegation of authority to local jurisdictions. Under certain circumstances, a business must prepare a Risk Management and Prevention Plan to minimize offsite risks associated with acutely hazardous materials. This plan provides additional planning information that covers equipment and system safety, operating procedures, preventive maintenance, upset risk assessments, and safety auditing.

Senate Bill (SB 1277). Sponsored by Senator Abe Maldonado, SB 1277 became effective on January 1, 2009. The bill requires, on or before September 1, 2010, that CalRecycle (successor to the California Integrated Waste Management), in consultation with the Office of Environmental Health Hazard Assessment (OEHHA) and the State Department of Public Health, prepare a study on the effects of synthetic turf and natural turf on the environment and the health of the public and present its findings to the State legislature by September 1, 2010 for possible future action.

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. The U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC) conducts research and provides information on the prevention and control of diseases, including vector-borne diseases.

California Department of Public Health, Infectious Diseases Branch. The Infectious Diseases Branch (IDB) of the California Department of Public Health conducts investigation, surveillance, prevention, and control of general communicable diseases of public health importance that are not covered by the specific programs of the Immunization Branch, the Tuberculosis Control Branch, the Sexually Transmitted Diseases Control Branch, and the Office of HIV/AIDS. The IDB works with local health jurisdictions to prevent and control communicable diseases; collects surveillance data on communicable diseases; investigates disease outbreaks; and provides information and regulations to prevent and control communicable diseases. The Vector-Borne Disease Section of the IDB covers disease vectors.

Alameda County Vector Control Services District. The mission of the ACVCSD is to prevent human disease, injury, and discomfort to the Alameda County population by controlling insects, rodents, and other vectors along with eliminating casual environmental conditions. ACVCSD services include requests for service investigations; insect, tick and spider control and investigation; wildlife management, domestic animals and rabies control; rodent control; solid waste problems; legal enforcement; vector-borne disease surveillance and control; and public education and information. The ACVCSD serves all of Alameda County, including the project area.

City of Piedmont General Plan. The City of Piedmont General Plan (2009) contains policies pertaining to hazardous materials and emergency preparedness. Policies relevant to the proposed project include:

Policy 14.5: Landscaping. Encourage the use of landscaping to beautify the city, enhance streets and public spaces, reduce stormwater runoff, and enhance community character. To the extent possible, landscaping practices should minimize the use of pesticides and herbicides, reduce the need for pruning, and incorporate native, drought-resistant rather than exotic or invasive species. Landscaping and tree planting should also reinforce Piedmont's fire prevention and vegetation management goals.

Policy 15.5: Integrated Pest Management. To the extent feasible and appropriate, use integrated pest management techniques when maintaining City parks, medians, and public facilities. These techniques minimize the use of pesticides, herbicides, and other toxic materials that could potentially pollute surface water and groundwater.

Policy 19.1: Reducing Fire Hazards. Maintain building and development regulations that minimize the potential for damage, injury, or loss of life due to fire. Where appropriate, this should include the use of fire-resistant building materials, fire sprinklers, non-combustible roofing materials, and other fire suppression and risk-reduction measures.

Policy 19.2: Fuel Management. Implement vegetation management programs which reduce the fuel load and potential for wildfire. This should include the removal of invasive fire-prone vegetation and the use of less flammable plants for landscaping, especially on hillside sites. Public education on "defensible space" and good vegetation management practices should be strongly promoted.

Policy 20.1: Hazardous Material Handling, Storage, and Disposal. Require that the handling, storage, and disposal of hazardous materials complies with all applicable, local, county, state, and federal laws. Where appropriate, clearance from the Piedmont Fire Department should be required before business licenses are issued.

Policy 21.2: Emergency Preparedness Plan. Use the Standardized Emergency Management System as the basis for emergency planning. The City will maintain an emergency preparedness plan that identifies a chain of command and outlines the actions to be taken in the event of a disaster.

Policy 21.3: Preparedness Education and Citizen Training. Promote and coordinate public education on earthquake hazards and emergency preparedness. The City will continue to implement programs that advise the public of preparedness and post-disaster recovery measures, and will encourage volunteer citizen participation in disaster response.

Policy 21.4: Intergovernmental Preparedness Planning. Cooperate with other cities, regional organizations, and other public agencies to undertake emergency preparedness planning. Actions are identified for police and fire emergency training, periodic updates of the Multi-Hazard Functional Plan, provision of disaster containers to respond to emergencies, citizen prepared training programs and drills, and maintenance of on-street parking prohibitions where necessary to ensure adequate access to all properties by emergency vehicles.

City of Piedmont Municipal Code. The City of Piedmont Municipal Code contains ordinances relevant to hazards, as summarized below.

City Code Chapter 5A: Disasters and Emergencies. This section of the Municipal Code includes provisions for disasters and emergencies, and calls for the establishment of a Disaster Council comprised of the Mayor, Vice-mayor, City Administrator, service providers, and other individuals who may be appointed by the Council. It also sets forth the creation of the Office of Director of Emergency Services and the Office of Assistant Director of Emergency Services, positions to be held by the Mayor and the Vice-mayor.

Multi-Hazard Functional Plan. Through the City Council, an emergency plan known as the Multi-Hazard Functional Plan has been prepared. It addresses emergencies such as earthquakes, dam failure, major accidents, hazardous materials spills, other pollution events, flooding, epidemics and civil disturbances. There are no designated evacuation routes in Piedmont. In the event of an emergency the evacuation routes would be designated by the Police Chief and Public Works Director.[129] Evacuation would generally occur along nearby arterial streets such as Grand Avenue, Moraga Avenue, Oakland Avenue, and Park Boulevard.

4.5.3 Significance Criteria

The proposed project would result in a significant impact related to public health and safety if it would have any of the following effects:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;

[129] Ibid.

- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school;
- Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a safety hazard for people residing in the project area;
- Result in a safety hazard for people residing or working within an airport land use plan area, or within two miles of a public use airport;
- For a project within the vicinity of a private airstrip, result in a safety hazard for people residing or working in the project area;
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan;
- Result in an increased risk of exposure to wildland fire hazards; or
- Cause the relocation of rodent or vector species from the project sites due to site disturbance that results in a nuisance to neighboring properties, such as property damage or concern of disease vector because of quantity and/or type of species displaced.

4.5.4 Impacts and Mitigation Measures

This section describes the potential impacts of the proposed project relevant to hazardous materials and hazards. Impacts associated with the proposed project are presented and mitigation measures are identified, as appropriate. Less than significant impacts are discussed first, followed by potentially significant impacts.

Less Than Significant Hazardous Materials and Hazards Impacts. The following describes the less than significant hazards and hazardous materials impacts associated with the project.

(1) Accidental Release of Hazardous Materials into the Environment. A less than significant hazard to the public or the environment would be created through accident conditions involving the release of hazardous materials into the environment. During construction, the use of typical equipment and associated fuels and fluids would be conducted in accordance with mandatory federal, State, and local regulations for the use, storage, and disposal of products such as gasoline, diesel, paints, and solvents. Programs are in-place to address and control spills associated with hazardous materials. The post-construction operation of the project would continue to comply with applicable requirements for the use and management of hazardous materials (e.g., pesticides and herbicides used for the maintenance of natural landscaping).

(2) Hazardous Materials Near School Sites. There would be no impact to any existing or proposed schools. The closest campus is Havens Elementary School, which is over a half mile away from Blair Park and Coaches Field.

(3) Located on a Listed Hazardous Materials Site. Neither Blair Park or Coaches Field is included on a list of hazardous materials sites prepared pursuant to Government Code Section

65962.5 ("Cortese" List).[130] [131] No impacts associated with such sites would occur as a result of the proposed project.

(4) Aviation Hazards. No safety hazard would occur since the project area is not located within two miles of a public airport or public use airport, or in proximity to a private airstrip. The nearest public airport/public use airport, Oakland International, is over six miles away.

(5) Emergency Response and Emergency Evacuation Plans. The development of the proposed project would not significantly impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. As part of established procedures for updating the City's emergency plan, known as the Multi-Hazard Functional Plan, any applicable measures needed to address the proposed use of Blair Park and Coaches Field would be integrated into the document. Neither site has been identified as an emergency staging or evacuation area in the City General Plan or Municipal Code.[132] Furthermore, Moraga Avenue is not designated by the City as an emergency evacuation route, although the roadway is so identified by the City of Oakland. As described in Section 4.7, Traffic and Circulation, the proposed project is not anticipated to create any roadway capacity-related impacts to Moraga Avenue that could impair emergency response.

(6) Increased Risk of Exposure to Wildland Fire Hazards. The California Department of Forestry and Fire Protection has designated the area of Moraga Canyon that includes Blair Park and Coaches Field as having a moderate severity rating for wildfire hazard. However, a less than significant impact associated with wildland fire hazards would result from the development of the proposed project. Coaches Field is an existing athletic facility. Replacement of the current natural turf with a synthetic surface and the installation of several lights would not increase the risk of exposure. The proposed facilities at Blair Park would not involve construction of residential or commercial areas or any structures intended for permanent occupation. Removal of the existing vegetation would reduce the site's fuel load compared to current conditions. In addition, all plans would be mandatorily reviewed for compliance with relevant City Building and Fire Department standards pursuant to the Uniform Building and Fire Codes and all related City policies for vegetation management and minimizing the risk of damage and injury from wildland fires.

Potentially Significant Hazardous Materials and Hazards Impacts. Implementation of the proposed project would result in the following significant hazardous materials impacts, as discussed below.

(1) Disease Vectors. Development of the project, which includes vegetation removal and site grading, has the potential to displace rodents and other species that may carry infectious disease.

[130] California Environmental Protection Agency (Cal EPA), 2010. Cortese List Website. Available online at: www.calepa.ca.gov/sitecleanup/corteselist/SectionC.htm. Accessed on May 14, 2010.
[131] The requirements of the Cortese List mandates that the State Water Resources Board continually post and update all unauthorized hazardous materials releases from underground tanks along with registration of toxic storage facilities. According to the list, within the project sites and the watershed of Cemetery Creek, there are no Leaking Underground Tanks (LUST), clean-up sites, land disposal sites, military sites, permitted LUST facilities, monitoring ells, CA Department of Toxic Substances clean-up sites or DTSC hazardous waste permit sites.
[132] City of Piedmont, 2009. op.cit.

Impact HAZ-1: The project has the potential to displace rodents and other disease vector species. (S)

According to the ACVCSD, anytime there is site disruption, such as vegetation clearing and grading, there is the risk for displacement of wildlife and disease vectors (e.g., ants, rats, and deer).[133] Rodents nesting in undeveloped areas, particularly in ivy or other ground cover, will be dislocated during construction activities.[134] However, the ACVCSD was not aware of any recent requests for services related to construction-related activities in Alameda County.[135] Furthermore, the occurrence of disease transmitted by disease vectors in Piedmont, Oakland, and Alameda County is very rare based on the experience of the ACVCSD.[136]

LSA biologists with experience in the behavior of rodents on construction sites have considered their potential displacement and have concluded that some displacement to adjacent areas associated with vegetation clearing at Blair Park could occur. Other potential disease vectors (e.g., native mammals, such as striped skunk and opossum) could also be displaced. Displacement of rodents and other vectors could occur during vegetation removal, excavation, and grading activities associated with construction at Blair Park.

Coaches Field is currently developed with a natural turf field and associated facilities. The replacement of the natural turf with synthetic turf and the addition of field lighting is not anticipated to displace disease vectors. There is potential for vector displacement at Blair Park because the site is undeveloped and vegetation removal and earthwork is required to construct the proposed recreational facilities.

The developed portion of the Blair Park site would consist of parking, public pathways, two sports fields and landscaped plazas, with concession and restroom facilities comprising 3.29 acres, approximately 59 percent of the site's total area.

Based on the results of the recent site assessment conducted by the ACVCSD, the potential for disease vector displacement during construction activities is low, and any increase in vector numbers in adjacent areas would be short-term. It is unlikely that the potential number of rodents and other vectors displaced from the Blair Park site would constitute a notable increase in the neighborhood rodent population. Approximately 3.29 acres, or approximately 59 percent, of the Blair Park site's total area would be graded and developed. The densely vegetated western and southern (i.e., mid and upper slope) boundaries of the site would remain. Displaced rodents would move into these areas first. It is unknown whether neighbors would use preventive and control mechanisms to stop rodents and other vectors from entering their yards and houses. The project, post construction, is not anticipated to provide a significant food source that would draw large populations of rodents and other disease vectors and the amount of protective cover for these species would be reduced.

[133] Kunselman, Gary. 2010. ACVCSD Senior Vector Control Officer. Personal Communication with LSA Associates, April 21, 2010.
[134] Harrison, Allen. 2010. ACVCSD Supervising Vector Control Officer. Personal Communication with LSA Associates, May 20, 2010.
[135] Ibid.
[136] ACVCSD, 2010b. op. cit.

Implementation of Mitigation Measure HAZ-1 would minimize potential rodent or other vector displacement to residences to a less than significant level should it occur.

> **Mitigation Measure HAZ-1:** The City shall implement the following measures to minimize rodent and disease vector displacement impacts:
>
> - The City shall arrange for the Alameda County Vector Control Services District (ACVCSD) to inspect the sites prior to construction to make an assessment of any potential vector issues and recommend actions to take if there are any existing infestations.
> - At Blair Park, ground clearing and vegetation removal shall start along the rear property lines of adjacent homes and move toward the interior of the site so that suitable cover in which rodents may seek shelter would be located away from the residences.
> - During grading and construction activities, the City shall provide neighbors with a contact person/phone number from the ACVCSD to contact should issues associated with rodent dispersal occur and for advice on control methods. (LTS)

(2) Hazardous Materials Use. Synthetic turf fields have been in use since the development of "Astroturf" in the 1960s as an indoor surface, followed by subsequent improvements to enhance its performance and safety. Numerous natural turf fields have been replaced by synthetic turf fields to accommodate the demands of longer annual operational hours, use in inclement weather, and other factors. Because recycled tire materials are employed in the infill material of most synthetic field products, concerns have been raised about the safety and environmental implications from their use.

Impact HAZ-2: The possibly hazardous effects from the use of the proposed synthetic turf fields at Blair Park and Coaches Field could have a potentially significant impact on the public and the environment. (S)

Since the advent of the first synthetic turf (generally referred to as "Astroturf") during the 1960s, there has been a steady evolution to improve and enhance the playability, safety, durability, and cost savings associated with such field facilities. Efforts have made to emulate the "feel" of a natural turf field, reduce the risk and number of injuries, improve materials to prolong the life span and usefulness of synthetic surfaces compared to natural turf, and lower expenses for maintenance and operation.

The installation of synthetic turf fields has increased in the U.S. and elsewhere over the past few decades as demand has increased in response to their potential benefits (e.g., recycling of used tires; expanded recreational facilities; minimization of water and herbicide, fertilizer, and pesticide use; and increased opportunities for physical activity and fitness) and improvement and enhancement of the product. Athletic fields now used by many college and professional sports teams employ synthetic turf. In addition, as land and suitable sites within urban environments, such as large cities, have become either unavailable or too costly to acquire, and demand for recreational facilities has increased, the installation of synthetic fields has been viewed as an option that provides expanded use capabilities and decreased long-term capital and operating expenditures compared to natural turf surfaces, which require more maintenance. Natural turf surfaces must be maintained by mowing,

watering, reseeding, and chemical application (e.g., fertilizers, herbicides and pesticides), and requires additional care, including the need to periodically "rest" the field due to damage to grass roots and subsurface soils, and to allow newly planted grass to mature. In addition, natural turf fields are susceptible to inclement weather, which further limits its usability during parts of the year.

Since its introduction in about 1997, recycled rubber has been used almost exclusively as the component material of the infill (i.e., the approximately one and one-half-inch deep layer of material underlying the artificial grass blade surface material) of synthetic turf fields. The rubber has come almost entirely from recycled tires, with substantially smaller quantities from other sources such as shoe rubber. There are also non-rubber materials (e.g., recyclable thermoplastic known as Ecofill, and coconut husk and cork used by GeoTurf), but at this time, their use represents a relatively minor share of the U.S. market.

Because tire manufacturing uses considerable amounts of petroleum, there have been concerns about the potential effects on human health and the environment arising from the constituent materials. These concerns include the presence of substances such as heavy metals in the recycled rubber of the infill and in the color pigments of the artificial grass blades. There may be impacts on air quality (e.g., creation of urban "heat islands" and outgassing of vapors) and the presence of hazardous materials in leachate from runoff. The greater risk or severity of injuries (e.g., impacts, trauma, ligament damage, etc.) among synthetic field users has been cited as a possible issue.

At the same time that these potential health and safety and environmental concerns associated with recycled tire use in synthetic turf have been raised by members of the public, the environmental community, and public health officials, hundreds of synthetic turf athletic fields have been or are being installed in the U.S. and other parts of the world in response to a growing demand. There have been calls for scientific research to conclusively determine the safety of synthetic fields. Moratoriums have been established in some communities banning the installation of synthetic turf fields. A statewide moratorium in New York was brought before the legislature in summer 2007, which would have required further studies to ensure that synthetic fields are safe before new field facilities could be developed (the legislation was proposed but overwhelmingly voted down).[137]

To address the potential effects associated with the use of synthetic turf, research and studies have been conducted throughout the same period that the field products have been manufactured. The studies and research, several extensive literature searches, and peer reviews have been undertaken by a wide spectrum of agencies and institutions that include federal, state and local governments in the U.S. and abroad, colleges and universities, sports federations, and other independent testing of potential effects reported by the synthetic field manufacturers.

Evaluation Methodology. To examine the potential impacts of installing a synthetic field at Blair Park and Coaches Field, this section includes a review of the findings from a number of studies and related literature search materials that were conducted between approximately 2006 and the present. Studies prior to 2006 tended to focus on older research as well as older products, rather than the significantly evolved "new generation" of synthetic turf fields. The new generation of synthetic turf fields manufactured and installed over the past four to five years has generally incorporated new

[137] Environnews, volume 116, 2008. Synthetic Turf: Health Debate Takes Root. Available online at: http://www.asgi.us/xwp/2008/07/10/%20ny-synthetic-turf-ban-defeated/ [Artificial Turf Field Moratorium Defeated in New York State].

features that address prior health and safety concerns, thus rendering research on older products less relevant. This evaluation focuses on more recent research and findings that specifically consider the new generation of synthetic turf fields, since the synthetic turf surface being evaluated in this section is one of these newer generation of surfaces, the current model of the Pro Series produced by FieldTurf (also known as FieldTurf Tarkett), as described in the project description in Chapter 3.0. Research into the effects of the new generation of synthetic surfacing is ongoing, and where appropriate, pending studies are noted below.

The analysis reflects a review of independent studies, particularly those where extensive peer reviews of many previous research efforts were conducted by public recreation and/or health agencies in which a broad compilation of issues and research findings from many sources were examined, and of studies conducted by researchers (e.g., universities) not affiliated with the synthetic turf industry. In addition, the results from several studies funded by product manufacturers have also been included along with other relevant information. The intent has been to provide an overview of current results and trends rather than a comprehensive and detailed evaluation of the hundreds of studies, reports and related materials that have already been published and will continue to increase as ongoing work is completed and new research is initiated. This analysis is intended to determine if the installation of synthetic turf fields with recycled rubber infill and possible release of constituents creates a significant hazard to the environment and users.

Composition of Synthetic Field. The FieldTurf Pro Series synthetic fields are comprised of a woven synthetic carpet with grass blades and an infill component. The top of the carpet consists of grass blades about two to two and one-half inches long made of colored polyethylene monofilament plastic that is resistant to ultraviolet (UV) light. The grass blade piles, which are designed to stand upright when no weight is applied, are attached to the synthetic carpet, typically made of polyethylene or polypropylene, with a backing that includes microscopic pores to allow drainage to percolate evenly through the material. Individual sections of carpet are glued or closely sewn together to create a consistent field surface.

Immediately underlying the turf, an infill layer with a depth of about one and one-half inches, provides resiliency, shock absorption, and playability characteristics that are intended to emulate a natural field turf along with the ability to drain runoff from the field. The infill is composed of a combination of cryogenic recycled rubber (about 30 percent by weight), which has been used by FieldTurf since 1998, and similarly sized particles of washed silica sand (about 70 percent by weight). The cryogenic rubber consists of rounded recycled rubber bits (known as styrene butidiene rubber or "SBR" and referred to as "crumb rubber" in many studies), ranging in size from 0.5 to 1.5 millimeters, that have been frozen and shattered to create smooth-sided spherical particles. The infill system consists of up to 21 layers of the cryogenic rubber and sand mixture that are sandwiched between a base layer of silica sand and a topping of cryogenic rubber. Based on the data, a synthetic turf field would generally have a lifetime of approximately ten years and the material can be recycled.[138]

Underlying the synthetic turf is a base system composed of rock, asphalt and/or sand along with pads for shock absorption and resiliency. The base system is sandwiched between the bottom of the infill

[138] FieldTurf, date unknown. FieldTurf (pamphlet).

layer and compressed soils, which limit permeability, underlying the field site. The material is typically capable of withstanding loads such as ambulances and other vehicles.

Studies, Research Findings, and Literature Reviews. Studies from the past several years have focused on concerns about the potential presence of elevated levels of heavy metals and petroleum-based constituents that could be released onto field surfaces, into subsurface soils, and carried away as leachate in runoff. Human health concerns (ranging from minor irritation and allergies, neurological conditions, endocrine disruption to cancer, depending upon the specific substance and level of concentration) have included inhalation, ingestion or contact with these constituents. The materials may typically include:

- heavy metals including arsenic, cadmium, zinc, copper, lead and iron;
- phthalates (e.g., BIS), which are also used in the manufacture of plastics;
- polyaromatic hydrocarbons (PAHs; e.g., pyrene) which are also present in such by-products of combustion (heat applied to organics) such as vehicle use and cooking and are found naturally in the environment;
- volatile organic compounds (VOCs; e.g., benzene, toluene, formaldehyde) which are vapors that may be present in substances such as fresh paint and auto exhaust; and
- polychlorinated biphenols (PCBs), which may occur in electrical insulation.

Numerous studies have been prepared that conclude that synthetic field use has little or no deleterious effects on either human health or the environment while other reports indicate that there may be impacts that warrant further research. Disagreements have arisen over testing procedures and the validity of their application, leading to conclusions that may or may not be applicable in real world conditions. Although there is currently no scientific consensus about the potential effects resulting from synthetic field use, there are compelling findings, particularly during the past couple of years, to indicate that the effects on human health and the environment may not be significant though some studies have called for or recommended further research to fill in gaps to address the uncertain risks posed by synthetic turf.

Examples of relatively recent studies and reports that provide a general overview and trend are provided below.

Analysis of Turf Alternatives on Human Health, Draft Final Report (2008). Prepared by Rutgers University, Edward J. Bloustein School of Planning and Public Policy conducted a literature review that utilized comparative risk assessment methodologies. While acknowledging that a SBR synthetic field (e.g., FieldTurf) contains PAHs, heavy metals and phthalates, the study found that "....the likelihood of significant health impacts is low (less likely and unlikely)" The study recognized the need for recreational facilities at the same time noting that further research is needed.[139]

Initial Evaluation of Potential Human Health Risks Associated with Playing on Synthetic Turf Fields on Bainbridge Island (2008). Prepared by D. Michael Johns, Ph.D, Windward Environmental LLC, the literature review and analysis of findings from a variety of previous research findings was

[139] Rutgers University, Edward J. Bloustein School of Planning and Public Policy, 2008. Analysis of Turf Alternatives on Human Health Draft Final Report. May 6.

commissioned by the Bainbridge Island Metro Parks and Recreation District and the Bainbridge Island School District as part of the consideration for the replacement of existing outdoor playing fields with synthetic turf fields. The study examined the chemical composition, potential for release, and risk to human health data from several reports including, but not limited to, research conducted by W. Crain and J. Zhang (*Hazardous Chemicals in Synthetic Turf,* 2006 and 2007), the Connecticut Agricultural Experiment Station (*Examination of Crumb Rubber Produced from Recycled Tires*, 2007), R. Moretto (*Environmental and Health Assessment of the Use of Elastomer Granulates as Filling in Third-generation Artificial Turf*, prepared for ALIAPUR [French government body responsible for used tires] and ADEME [French agency for the Environment and Energy Management], 2007), and the California Office of Environmental Health Hazard Assessment (OEHHA) (*Evaluation of Health Effects of Recycled Waste Tires in Playground and Track Products,* prepared for the State of California, Integrated Waste Management Board, 2007).

The research results "....indicate that the concentration of tire crumb and potential for release of chemicals is dependent on the technique used. The highest concentrations were detected when tire crumb was completely dissolved [in acid per the Crain and Zhang studies]. However, complete dissolution will not occur under environmental conditions, thus leachate test or site-specific analyses are more relevant." For potential impacts to human health, the author concluded that the balance of review studies "....indicate that human health risks from playing on synthetic turf fields is minimal, even though low concentrations of some chemicals have been demonstrated to leach from the tire crumb, or volatilize as vapor."[140]

Artificial Turf Pitches - An Assessment of the Health Risks for Football Players (2006). Prepared by the Norwegian Institute of Public Health and the Radium Hospital. The study evaluated use of artificial turf used for indoor football in recognition that there are many different chemical substances that have been identified in the rubber granulates and in the degassing of various VOCs. Worst-case scenarios were examined in which "....quantities within each substance category (PCBs, PAHs, phthalates, alkyl phenols and VOCs) were summed and the lowest no observed adverse effect value (NOAEL) was used (when available) for the most relevant biological end points (e.g., cancer, reproductive damage, organ damage]...."

The exposure scenarios ranged from adults, juniors, older children and young children. Exposure levels were based on inhalation (airborne dust) and/or oral ingestion for the range of substances tested. The duration and frequency of exposure used in the measurements and evaluation were based on information from managers at several indoor sports facilities (halls) in Norway. Measurements, based on the different means of exposure, were taken for an extensive range of substances from the rubber infill that could affect human health, which focused on numerous VOCs (individually and totally), phthalates, airborne dust/PAHs/PCBs, and alkyl phenols. The calculation and determination of health risks were based on available guidelines (e.g., U.S. Environmental Protection Agency and World Health Organization Air Quality Guidelines for Europe).

The results of the study concluded that "....Recycled rubber granulate contains many chemical substances which are potentially harmful to health. The concentrations of these substances are however extremely low, they are only leached from the rubber granulate in very small quantities and they are only present in low concentrations in the hall [indoor sports facility] air..... On the basis of

[140] D. Michael Johns, Ph.D, 2008. Potential Evaluation of Potential Health Risks Associated with Playing on Synthetic Turf Fields on Bainbridge Island.

estimated exposure values and the doses/concentrations which can cause harmful effects in humans or in animal experiments, it is concluded that the use of artificial turf halls does not cause any elevated health risk. This applies to children, older children, juniors and adults...."

The study did indicate that there were gaps in the health effects information. It noted that "....As regards total VOC, higher values were measured than are normally found in homes..... It is concluded that the values which were measured for total VOC do not constitute any elevated health risk, but our knowledge of this area is rather inadequate. It is reasonable to assume that the relatively high VOC values could contribute to the hall air being perceived as "poor" without this in itself actually causing any elevated health risk..." The study goes on to state that, while "....there is no evidence to indicate that the use of such halls [indoor synthetic turf facilities] causes an elevated health risk...", there is limited knowledge about exposure to latex allergens which can cause respiratory problems (though studies indicate that latex in car rubber dust is either less available for uptake and/or deactivated). Furthermore, though the study concludes that exposure to phthalates would not cause any increased health risk for all categories studied, there was a lack of knowledge to conduct a risk assessment.[141]

FieldTurf Publications. FieldTurf has published considerable information about the results of research studies and testing specific to the potential health and environmental effects of their products and other field brands using SBR infill. Information sources include many independent studies from government agencies, academic institutions, and private firms and laboratories. In addition, data and findings have also been gathered from their experience in the installation follow-up monitoring of over 1,500 fields worldwide.

The general results of the findings indicate that FieldTurf products do not pose potentially significant effects on human health (through inhalation, ingestion, or contact) or the environment from the components used in either the turf surface or the infill. According to the information provided by FieldTurf, ".... not a single injury has ever been reported where an athlete or anyone else has fallen sick or was injured as a result of inhaling, having skin contact with or ingestion of artificial turf infill materials."[142]

CPSC Staff Finds Synthetic Turf Fields OK to Install, OK to Play On (2008). Released by the U.S. Consumer Product Safety Commission (CPSC), the results from an evaluation by the CPSC staff concluded that young children are not at risk from exposure to lead from synthetic fields. The findings indicated that newer fields (e.g., FieldTurf) had no lead or generally had the lowest lead levels. Although small amounts of lead were detected on the surface of some older fields, none of these tested fields released amounts that were deemed harmful to children. The CPSC noted that the lead may be present in the pigment of some synthetic turf products at low levels and that some conditions (e.g., aging, weather, exposure to sunlight and subsequent wear) could release lead-containing grass fibers. The agency suggested that voluntary standards be developed to eliminate lead altogether from synthetic field turf products.[143] (According to the manufacturer, FieldTurf is lead free.[144])

[141] Norwegian Institute of Public Health and the Radium Hospital, 2006. Artificial Turf Pitches - An Analysis of the Health Risks for Football Players. January 6.
[142] FieldTurf, no date. Artificial Turf Facts: Understanding the Issues.
[143] Consumer Product Safety Commission, 2008. CPSC Staff Finds Synthetic Turf Fields OK to Install, OK to Play. July 30.
[144] FieldTurf, 2010. FieldTurf Product Website. Available at: http://www.fieldturf.com/artificial-turf-environmental-responsibility/. Accessed on June 15, 2010.

FieldTurf Projects in Redmond Washington - Microtox and Metals Testing Report (2003). Prepared for TALASAEA Consultants, LLC by AMEC Earth and Environmental, Inc., water quality testing was conducted for the King County Water and Land Resources Division in Seattle, Washington for two FieldTurf projects in the nearby City of Redmond. One site was located at a community park while the other was at the Microsoft campus. Stormwater samples were collected and the ensuing chemical compounds and mixtures in the leachate were used to assess potential toxicity effects on a marine bacterium (*Vibrio fischeri*). Water samples were tested for zinc, copper, hardness, pH, and toxicity in accordance with EPA testing protocols. The results indicated that all water samples collected from field underdrains had no effect on test organisms. Zinc and copper concentrations were undetected at one field site, and at the other site, copper concentrations were undetectable and zinc was well below allowable limits. No state and federal water quality standards were exceeded.[145]

Materials Safety Data Sheets - Polyethylene. Materials Safety Data Sheets (i.e., regulatory forms prepared by chemical manufacturers containing information about the properties of a particular substance, including health and safety risks) for polyethylene indicated that this substance, used in synthetic turf grass blades, does not pose a significant risk to human health or the environment. The material does not contain chemicals in excess of the applicable "de minimis" concentrations that are subject to requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 nor is it listed under the Toxic Substances Act inventory as an "extremely hazardous substance." While there may be some minor irritation from dust or vapors formed at high temperatures, the material is not a carcinogen nor federally or State-listed as a hazardous material or a U.S. Department of Transportation controlled material.[146]

San Francisco Recreation and Park Department - Synthetic Playfields Task Force Findings and Department Recommendations - Report to San Francisco Recreation and Park Commission (2009). Prepared by the San Francisco Recreation and Park Department, the report examined the need to provide adequate playfields for community use through the installation of synthetic turf facilities. The Task Force, assigned to explore issues and concerns, was asked to achieve three key objectives, including: (1) identify primary environmental and health concerns related to synthetic turf materials; (2) synthesize the scientific research available and discuss relevance to San Francisco playfields; and (3) provide feedback to inform Recreation and Park Department (RPD) recommendations and a course of action to the Recreation and Park Commission. The City's Department of the Environment (SFE) and the Department of Public Health reviewed the scientific research and data associated with synthetic fields and public concerns.

As part of its approach, the City used "Precautionary Principle" guidelines to review and evaluate the environmental impacts of its programs and initiatives. The principle "....does not advocate the avoidance of any and all potential environmental risks" and "....advocates for a public process in which the benefits of an action or technology are weighed against potential risks."

The SFE had the following environmentally-related findings based on the literature review:

[145] AMEC Earth and Environmental Inc., 2003. Field Turf Projects in Redmond, Washington - Microtox and Metals Testing Report. Prepared for TALASAEA Consultants. February.
[146] Total Petrochemicals USA, Inc., 2009. Material Safety Data Sheet – Polyethylene. Available online at: www.arkema-inc.com/plants/canada/msds/AP-p101.pdf

- Recognition that there are potential environmental advantages and disadvantages from synthetic turf use.
- Recognition that human health risks are minimal from exposure to the crumb rubber infill used in synthetic turf products according to the California Office of Environmental Health Hazard
- Assessment (OEHHA; see the Bainbridge Island study, summarized above). The SFE recommended a precautionary approach to assess risks due to the lack of established reference doses for some ingredients.
- Concern was expressed that there is no system available to recycle used synthetic turf [N.B., FieldTurf has instituted a relatively recent recycling program for its synthetic turf material].
- Recommendation that the RPD specify use of recycled content material for synthetic field products.
- Recognition of potential aquatic toxicity from synthetic turf leachate. The SFE did note that leachate concentrations would not approach levels of concern in normal installations above the water table.
- Recognition of potential health-related issues that may be related to synthetic turf including sports injuries and potential spread of methicillin-resistant Staphylococcus aureus among players.

Recommendations were identified to address environmental concerns including, but not limited to, field siting criteria, data disclosure of the constituents described in the field materials, data from manufacturers, player hygiene, and disposal and recycling public process in which the benefits of an action or technology are weighed against potential risks.[147]

City and County of San Francisco Recreation and Park Department - Memorandum: Synthetic Turf Standards - Information Only (2009). In an October 2, 2008 memo, the San Francisco Recreation and Park Commission approved recommendations in the Synthetic Playfield Task Force Report, in collaboration with the Department of the Environment and the City Fields Foundation, to develop standards for synthetic turf purchases for athletic fields being renovated with synthetic turf. In issuing the standards, San Francisco became the first known municipality in the U.S. to require recyclability as well as recycled content in synthetic turf purchases. According to the memo, "....The high amount of recycled content in styrene butadiene rubber (SBR) infill is a primary factor in the SF Department of the Environment's ongoing support for using SBR rubber in local synthetic turf fields..."

The San Francisco agencies have acknowledged that potential contaminants such as lead, chromium, and zinc are present in the crumb rubber infill. The intent of the San Francisco standards is to filter out products that have purposely added lead chromate or other lead compounds to the turf components and to conduct testing of runoff levels of zinc at a representative field. The turf standards fall into three general categories which include end-of-life recycling plans (potential vendors to provide plan to manage for end of life), post-consumer recycled content (all synthetic turf purchases are to include recycled content to extent feasible), and heavy metal and material content (potential vendors to conduct and provide product analysis, conducted by certified labs, of field constituent levels [total metals, leachable metals, volatile organic compounds, brominated flame retardants] with project bids). The City's maximum levels of permitted total metals in synthetic products (fibers,

[147] City and County of San Francisco Recreation and Park Department, 2009. Memorandum from Dan Mauer, Capital Division to Recreation and Park Commission. July 8.

underlayment, and backing) were established at 25 milligrams/kilogram (mg/kg) for chromium and 50 mg/kg for lead.[148]

An Assessment of Chemical Leaching, Releases to Air and Temperature at Crumb-rubber Infilled Synthetic Turf Fields (2009). Made available in May 2009, the document was prepared by the New York State Department of Environmental Conservation (Division of Solid and Hazardous Materials and the Division of Air Resources) and the New York State Department of Health. The report, which includes a series of studies to assess potential environmental and human effects associated with the use of crumb rubber for infill, was a comprehensive evaluation of potential chemical releases from constituents contained in several samples of recycled tires (car, truck, a mixture of car and truck, and a mixture of cryogenically produced rubber obtained from New York State manufacturers). The assessment was conducted to address public concern in the state (including a legislative effort to place a statewide moratorium on the installation of synthetic turf fields that overwhelmingly failed in 2007) about the possible effects of the crumb rubber. Under New York State Environmental Conservation Law, § 27-1901, crumb rubber is not considered a solid waste and therefore its use is not regulated as a solid waste.

The assessment included both field work and laboratory evaluation. Field sampling was conducted at two existing fields (John Mullay Park and Thomas Jefferson Park) in the city. The study focused on three areas of concern: the release and potential environmental impacts of chemicals into surface water and groundwater, release and potential public health impacts of chemicals from the surface of the fields into the air, and elevated surface temperatures and indicators of potential heat-related illness.

The results of the evaluation of leachate in the laboratory indicated that, though there are materials that include zinc, aniline, phenol, and benzothiazole which may be released over time, there does not appear to be a significant impact on either surface water or groundwater. These small concentrations are attenuated by adsorption, degradation, and dilution. Lead concentrations were well below the federal hazard standard for lead in soil and indicated that the crumb rubber would not be a significant source of this contaminant. A risk assessment for aquatic life protection performed in the laboratory ".... indicated that crumb rubber derived entirely from truck tires may have an impact on aquatic life due to the release of zinc. For the three other types of crumb rubber, aquatic toxicity was found to be unlikely."

Results of the air sampling from chemical releases at the synthetic turf surfaces of the two fields indicated that there were relatively low levels of only several contaminants including semi-volatile organic compounds (SVOCs). Analytes detected (benzene; 1,2,4-trimethylbenzene; ethyl benzene; carbon tetrachloride) are commonly found in an urban environment. Ambient air particulate matter sampling did not indicate significant differences in concentrations measured at the fields or measured upwind of the fields. A public health evaluation of the ambient air sampling results concluded "....that the measured levels of chemicals in air at the Thomas Jefferson and John Mullaly Fields do not raise a concern for non-cancer or cancer health effects for people who use or visit the fields..." The study also found that the fields were not a significant source of exposure to respirable particulate matter.

[148] Ibid.

For the temperature-related analysis, measurements were taken at both grass and sand fields as well as the two synthetic turf facilities during the months of August and September. Temperature records from previous years were also considered. The results indicated that the synthetic turf fields can have significantly greater surface temperatures compared to grass and sand fields (42 and 35 degrees F higher than grass; 40 and 26 degrees F higher than sand). Indicators of heat stress (discomfort, potential heat-related injuries, and heat-related illnesses) were found to differ little between the various field surface materials. However, the assessment noted that the much higher temperatures and prolonged contact with the hotter surfaces had a greatly likelihood to create heat stress.

The assessment report concluded that follow-up actions would be taken including the performance of additional sampling of surface and groundwater near synthetic fields and identification and implementation of measures to make the public aware of the dangers and symptoms of heat-related illness and identifying measures to reduce their incidence.[149]

A Scoping-Level Field Monitoring Study of Synthetic Turf Fields and Playgrounds (2009). The U.S. Environmental Protection Agency (EPA) carried out a limited-scale study about the concerns regarding possible human health and environmental risks associated with the presence of and exposure to tire crumb constituents in recreational fields, particularly as it may be relevant to children's exposures. The assessment was conducted during summer 2008 at the request of their Region 8 office to consider the issues and the results were released to the public in November 2009.

As part of the study, the EPA inventoried and reviewed the available scientific findings, U.S. studies, several laboratory studies of tire material content, off-gassing, and leaching characteristics and a few European studies that described the extent and availability of tire crumb constituents for potential human exposure. The intent of the study was to gain experience in field monitoring of recreational surfaces containing crumb rubber by evaluation methods for measuring environmental concentrations and to "...generate limited field monitoring data that will be used by EPA to help the Agency determine possible next steps to address questions from the public regarding the safety of tire crumb infill in recreational fields..." The EPA also noted that validated methods for sampling synthetic turf or playgrounds did not exist.

A full-study protocol was implemented at two synthetic turf fields and one playground in proximity to facilities of the EPA's National Exposure Research Laboratory. Samples were taken at two synthetic turf fields in EPA regions 4 and 5 and at one playground in EPA Region 3. At each site, air sampling was performed to collect particulate matter (PM_{10}), and grab volatile organic compound (VOC) samples were gathered at two or three locations at each facility and also at an upwind background locale. Samples of the tire crumb infill and turf blade samples were also collected at the three facilities along with selected samples at a few additional synthetic turf fields and one playground.

As part of its findings, the EPA concluded that the study protocol and many of the methods appeared to be reliable. There was considerable variability in the materials that were used at any given facility and the EPA concluded that more work was needed to determine where and how many samples would be required. Methods used to measure air concentrations of particulate matter and metals were found to be reliable. Concentrations of PM_{10} at the playground with high activity were higher than

[149] New York State Department of Environmental Conservation and New York State Department of Health, 2009. An Assessment of Chemical Leaching, Releases to Air and Temperature at Crumb-rubber Infilled Synthetic Turf Fields. May.

background levels. However, air concentrations were well below the federal standards for this emission.

All VOCs were measured at "extremely low" concentrations that were consistent with the ambient air environment. One VOC constituent (methyl isobutyl ketone) of the infill rubber was detected in samples at one field site, but was not found in the corresponding background sample.

Total extractable metals from turf field blades, crumb rubber, and field wipe samples were variable from site-to-site. Average extractable lead concentrations were low. And "...although there are no standards for lead in recycled tire material or synthetic turf, average concentrations were well below the EPA standard for lead in soil (400 parts per million)."

The EPA report concluded by stating that "....that on average, concentrations of components monitored in this study were below levels of concern; however, given the very limited nature of this study (i.e., limited number of components monitored, samples sites, and samples taken at each site) and the wide diversity of tire crumb material, it is not possible to reach any more comprehensive conclusions without the consideration of additional data."[150]

Review of the Impacts of Crumb Rubber in Artificial Turf Applications (2010). The University of California Berkeley Laboratory for Sustainability and Manufacturing, in collaboration with The Corporation for Manufacturing Excellence (Manex), prepared a study, released in February 2010, that identified and evaluated current research associated with the benefits, advantages, and safety concerns associated with crumb rubber. The characteristics of natural turf versus synthetic turf were comparatively evaluated. A search of existing research findings about possible impacts to the environment and human health from the presence of potentially toxic substances was performed along with a review of independent product test results of crumb rubber produced by BAS Recycling of Moreno Valley, CA, a high-volume producer of the infill material.

The UC Berkeley lab concluded that the results of their literature and testing reviews indicated that the use of crumb rubber fill for athletic field surfaces and playgrounds is "relatively safe." Furthermore, the study findings noted that characteristics such as all-weather availability, increased playing hours and reduced maintenance particularly favored synthetic turf.[151]

Temperatures of Synthetic Turf Fields. Based on measurements of both synthetic turf and natural turf, temperature differences may average 10 to 15 degrees Fahrenheit (F) higher and even as much as 40 to 60 degrees warmer at the surface of a synthetic field. Heat tends to be absorbed, in part, by the darker carpet fiber material between the grass blades, the lack of moisture within the field, and the retention of heat, resulting in "heat islands" and localized warming.[152]

[150] U.S. Environmental Protection Agency, 2009. A Scoping-Level Field Monitoring Study of Synthetic Turf Fields and Playgrounds. November.
[151] University of California, Berkeley Laboratory for Sustainability and Manufacturing, 2010. Review of the Impacts of Crumb Rubber in Artificial Turf Applications. Prepared for The Corporation for Manufacturing Excellence (Manex). February.
[152] New York State Department of Environmental Conservation and New York State Department of Health and Mental Hygiene, 2009. op.cit.

Within synthetic fields in the Bay Area (e.g., Danville, Walnut Creek, Castro Valley), reported measurements conducted by Gates and Associates, a firm experienced with the installation of synthetic turf facilities, indicated that temperatures during warm days were about 10 to as much as 15 to 20 degrees F greater than a natural turf field.[153]

Risk of Injury and Infection. Concerns have been expressed by members of the public and some health officials about the possible hazards, associated with a greater risk of injury and infection, posed by the use of synthetic turf fields.

Findings from extensive research of sports injuries incidences on natural and synthetic turf fields (manufactured by FieldTurf indicates that the number of injuries or their severity do not substantively differ. In a five-year study of Texas high school students, there appeared to be no significant differences between the two turf surfaces across injury categories (i.e., different parts of the body). Surface/epidermal injuries and muscle strains occurred at a higher rate on synthetic turf fields, possibly because of the consistency and speed of the playing surface. Incidences of neural, head trauma, and knee injuries were greater on a natural turf field than the newest generation synthetic field. The lower occurrence of these latter kinds of injuries are likely due to the shock absorbing qualities designed as part of the synthetic turf and its associated base system, which is considerably more forgiving, generally, than natural turf.[154]

Occurrence of infections, notably from methicillin-resistant Staphylococcus aureus (MRSA) bacteria does not appear to be significant with synthetic field systems. In a study conducted by the Pennsylvania State University College of Agricultural Sciences, 20 synthetic fields in the state were tested for the presence of MRSA bacteria. No samples came back positive for the bacteria. One of the study authors, Andrew McNitt, concluded that "....these infilled systems are not a hospitable environment for microbial activity. They tend to be dry and exposed to outdoor temperatures which fluctuate rapidly." The study also found that "....the microbe population of natural turf grass far exceeds anything....found in the infill systems." MRSA bacteria were found elsewhere on athletic facilities and equipment that included locker rooms, weight equipment, tables, and towels. According to FieldTurf literature, both the Center for Disease Control (CDC) and the National Collegiate Athletic Association (NCAA) concur that MRSA has yet to be found in synthetic turf.[155]

Pending Studies. In addition to the foregoing completed studies, various studies are presently in process. Because studies on this issue are of an ongoing nature, the present analysis focuses on final data now available. The additional studies noted below are for informational purposes; because they are not yet complete, there are no conclusions to include in the present analysis.

Santa Clara Valley Water District Synthetic Field Study. The Santa Clara Valley Water District, located in the southern Bay Area, is a wholesale water supplier that sells to retailers that, in turn, offer it to end users. Water provided by the District serves approximately half of the population of Santa

[153] Ainsworth, Todd, 2009. Principal, Gates and Associates. Personal Communication with Benson Lee, Consulting, January.
[154] Meyers, Michael C, Ph.D and Bill S. Barnhill, M.D., 2004. The Journal of Sports Medicine: Incidences, Causes, and Severity of High School Football Injuries on FieldTurf versus Natural Grass and McNitt, Andrew S. And Dianne Petrunak, Pennsylvania State University, 2006. Evaluation of Playing Surface Characteristics of Various In-Filled Systems. October 6.
[155] McNitt, Andrew S., Dianne Petrunak and Thomas Serensits, Pennsylvania State University, 2006. A Survey of Microbial Populations in In-Filled Synthetic Turf Fields. October 6 and FieldTurf, no date. Concerns about Staph/MRSA.

Clara County. It is also involved in flood protection and the quality of streams and other waters under its authorities.

In collaboration with Stanford University, which is serving as a consultant, the District is currently looking at the potential effects that runoff from synthetic turf fields may have on waters within its jurisdiction. Initiated in 2008, the study and its findings may be out toward the end of 2010.[156]

Senate Bill (SB) 1277. As previously described in 4.5.2 of the Regulatory Framework subsection, SB 1277 requires that, on or before September 1, 2010, CalRecycle, in concert with the Office of Environmental Health Hazard Assessment (OEHHA) and the State Department of Public Health, has been directed to prepare a study on the effects of synthetic turf and natural turf on the environment and the health of the public.

According to the OEHHA, the first part of the study--a literature search to review findings about the effects of synthetic fields on human health--has been completed to determine: (1) whether synthetic fields emit levels of chemicals or particulates into the air that cause illness when inhaled and (2) whether these fields infect athletes with the dangerous bacterium called methicillin-resistance MRSA.

In the OEHHA review of studies conducted from New York, the findings "....concluded that these fields did not constitute as [sic] serious public health concern, since cancer or non-cancer health effects were unlikely to result from these low level exposures." It was also noted that, of the 65 to 85 chemicals detected in the fields in New York, "many of these occurred at similar concentrations in the air sampled upwind of the fields." In another study of high school football players, the OEHHA stated "....It seems unlikely that the new generation of artificial turf is itself a source of MRSA, since MRSA has not been detected in any artificial turf field."[157]

The literature search will be followed by sampling of air and water for hazardous materials, followed by the completion of a report to the legislation with the result of the analysis and recommendations for any applicable future actions that may be needed. The OEHHA will conduct sampling when temperatures (95 to over 100 degrees F) at selected fields are sufficient to test for possible elevated levels of VOCs that may cause outgassing. The completion of the final report to the legislature is scheduled for September 2010.[158]

Conclusion. Based on the brief overview of the research and trends presented above, it is evident that considerable study and data have been made available in the scientific community to evaluate the potential environmental and health risk impacts that could potentially occur from the use of synthetic turf fields. Although there is a substantial body of results since approximately 2006 that addresses the newer generation of synthetic fields that consistently indicates that synthetic fields are likely safe, there is still further research pending and calls for further studies, including longer term evaluation (e.g., for ongoing health risk studies), to verify or refute existing studies. Studies continue to be

[156] Larabee, Jeannine, 2010. Water Utility Planning Unit, Santa Clara Valley Water District. Personal Communication with Benson Lee, Consulting, March 29, 2010.
[157] California Office of Environmental Health Hazard Assessment, 2009. Chemicals and Particulates in the Air Above the New Generation of Artificial Turf Playing Fields, and Artificial Turf as a Risk Factor for Infection by Methicillin-Resistant Stapylcoccus Aureus (RSA) Literature Review and Data Gap Analysis. October.
[158] Vidair, Charles. 2010. Project Manager, Office of Environmental Health Hazard Assessment. Personal Communication with Benson Lee, Consulting. April.

conducted (e.g., Stanford project on field leachate and the State's evaluation in accordance with SB 1277). Although there is a likely that the results of these studies may support much of the current body of data that concludes synthetic field to have little effect on health or pose risks to humans, there is still presently a lack of final consensus among part of the scientific community. Therefore, as a "conservative" finding, the potential hazardous effects from the use of the proposed synthetic turf field at Blair Park and Coaches Field would be considered a significant impact.

Implementation of the following mitigation measures would minimize the potential risk from the use of synthetic turf fields.

> **Mitigation Measure HAZ-2:** Prior to purchase of synthetic fields for installation, the City shall obtain information from the supplier that indicates that the manufacturer or supplier have conducted a product analysis of the materials used in the synthetic turf components in the form of certified laboratory results. Detailed plans for the management of the turf product components at the end of their useful life (e.g., recycling and/or disposal requirements) shall also be provided by the supplier or manufacturer.
>
> **Mitigation Measure HAZ-3:** The synthetic turf fields shall be "aired out" prior to their installation and use to minimize the presence of VOCs and other potential airborne contaminants, pursuant to the manufacturer's recommendations.
>
> **Mitigation Measure HAZ-4:** Signage shall be placed at both Blair Park and Coaches Field which indicates that on very warm or hot days that strenuous physical activities may cause possible overheating and heat stress. Cooling of the field by spraying with water shall also be considered as a means of lowering field temperatures on the hottest days that occur within the year (e.g., above 90 degrees Fahrenheit or as determined to be necessary).
>
> **Mitigation Measure HAZ-5:** To minimize the effects to individuals who may be sensitive to materials in the synthetic turf, signs shall be placed at both Blair Park and Coaches Field noting the use of crumb rubber in the infill. (SU)

Significance Level after Mitigation Implementation. Implementation of Mitigation Measure HAZ-1 would reduce potential impacts associated with disease vectors to a *less than significant* level. However, implementation of mitigation measures HAZ-2 through HAZ-5 would minimize, but would not reduce the potential hazardous effects of using the synthetic turf fields at Blair Park and Coaches Field. This impact would be *significant and unavoidable*.

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