Appendix 1

Notices of Preparation and Comments Received

City Place NOP and Comments Received

NOTICE OF PREPARATION
OF AN
ENVIRONMENTAL IMPACT REPORT
FOR THE
CITY PLACE SANTA CLARA PROJECT

Date of Distribution: July 30, 2014

PROJECT APPLICANT: Related Santa Clara, LLC

File No(s): PLN2014-10440

In accordance with the California Environmental Quality Act (CEQA), the purpose of this Notice of Preparation (NOP) is to inform interested parties that the City of Santa Clara is preparing a Draft Environmental Impact Report (EIR) for the City Place Santa Clara Project in the City of Santa Clara, California (Project).

The Project site is located at 5155 Stars and Stripes Drive on five large City-owned parcels. The Project would involve the demolition of the existing buildings and onsite features at the Project site (Santa Clara Golf & Tennis Club, a Bicycle-Motocross (BMX) track, and Santa Clara Fire Station 10) and the construction of a new multi-phased, mixed-use development. In total, the Project would include up to 8.34 million gross square feet (gsf) of office buildings, retail and entertainment facilities, residential uses (up to 540 units), hotels (up to 350 rooms), new open space, associated parking, new roads, and upgraded and expanded infrastructure. Buildings would be constructed to a height of up to 17 stories above retail and/or structured parking. Approval of the Project will require actions by the City of Santa Clara, including the preparation and certification of an EIR to support the entitlements.

According to State law, the deadline for your agency response is a 30-day comment period beginning on **July 30, 2014** and ending on **August 29, 2014**; however, we would appreciate an earlier response, if possible. A scoping meeting will be held on **August 12, 2014** at **6:00**. The scoping meeting is part of the EIR scoping process during which the City solicits input from the public and other agencies on specific topics that they believe should be addressed in the environmental analysis. Written comments on the scope of the EIR may also be sent to:

City of Santa Clara
Attn: Debby Fernandez
1500 Warburton Avenue
Santa Clara, CA 95050
(408) 615-2450
dfernandez@santaclaraca.gov

Kevin Riley
Director of Planning and Inspection

_____

Director of Planning and Inspection
Date: July 28, 2014

Notice of Preparation for an Environmental Impact Report for the City of Santa Clara

City Place Santa Clara Project

July 30, 2014

Introduction

The purpose of an Environmental Impact Report (EIR) is to inform decision-makers and the general public of the potential environmental effects of a project that an agency may implement or approve. The EIR process is intended to provide information sufficient to evaluate a project and its potential for significant impacts on the environment; to examine methods of reducing adverse impacts; and to consider alternatives to the project.

The EIR for the City Place Santa Clara Project (Project) will be prepared and processed in accordance with the California Environmental Quality Act (CEQA) of 1970, as amended. In accordance with the requirements of CEQA, the EIR will include the following:

- A summary of the Project;
- A Project Description;
- A description of the existing environmental setting, environmental impacts of the Project, including growth inducing impacts and cumulative impacts, and mitigation measures for the Project;
- An evaluation of alternatives to the Project as proposed; and
- A description of environmental consequences, including any significant environmental effects that cannot be avoided and any significant irreversible environmental changes if the Project is implemented.

Project Location

The Project site is located on five large City-owned parcels (APNs: 104-03-036, 104-03-037, 104-01-102, 097-01-039, and 097-01-073) totaling approximately 230 acres. The Project site is generally located north of Stars and Stripes Drive, east of Great America Parkway and San Tomas Aquino Creek, west of the Guadalupe River, and south of Great America Way and State Route (SR) 237 (See **Figure 1, Project Location**). The parcels were formerly utilized as the Santa Clara All-Purpose Landfill, which was closed in 1993. The Project site currently includes the Santa Clara Golf & Tennis Club, a Bicycle-Motocross (BMX) track, Santa Clara Fire Station 10, and a retention pond.

Project Description

The Project would involve the demolition of the existing buildings and onsite features at the Project site and the construction of a new multi-phased, mixed-use development. In total, the Project would include up to 8.34 million gross square feet (gsf) of office buildings, retail and entertainment facilities, residential units, hotel rooms, new roads, associated parking, and new upgraded and expanded infrastructure. The Project would also include large, shared open spaces throughout the Project site; new pedestrian and

vehicular entrances and roadway networks; and construction of new utilities and improvement of offsite connections. Due to the location of the Project on the former landfill, the following activities would be required: construction of foundation systems designed to avoid disturbance to preserve the integrity of the landfill components; relocating, upgrading and/or replacing, as necessary, the existing groundwater monitoring network, leachate collection system, and landfill gas collection and removal systems; and associated environmental remediation activities.

Two development options for the Project are proposed: Scheme A and Scheme B. The EIR will analyze both schemes, in addition to the alternatives normally contemplated by the CEQA process.

Scheme A

Scheme A would include a building area totaling 8.34 million[1] gsf on all four development areas with a floor area ratio (FAR) of 0.83. A significant portion of the use under Scheme A would be office, accounting for 73 percent of the total proposed building area (6.06 million gsf). The remaining building area under Scheme A would include: 540,000 gsf of residential uses (540 units), 1.26 million gsf of commercial uses (anchors, retail, and food/beverage), 300,000 gsf of hotels (350 rooms), and 180,000 gsf of entertainment uses. The proposed heights of the office, hotel, and residential buildings would be approximately 10 to 17 stories located above retail and/or structured parking. Approximately 25,180 parking spaces would be provided throughout the Project site in surface parking lots and structured parking.

Scheme B

Scheme B would include a building area totaling 6.27 million gsf on all four development areas with a FAR of 0.63. A significant portion of the use under Scheme B would be office, accounting for 57 percent of the total proposed building area (3.58 million gsf). The remaining building area under Scheme B would include: 408,000 gsf of residential uses (390 units), 1.8 million gsf of commercial uses (anchors, retail, and food/beverage), 300,000 gsf of hotels (350 rooms), and 180,000 gsf of entertainment uses. The proposed heights of the office, hotel, and residential buildings would be approximately 10 to 17 stories located above retail and/or structured parking. Approximately 19,770 parking spaces would be provided throughout the Project site in surface parking lots and structured parking.

Required Project Approvals

The Project site is currently designated in the City's General Plan as Regional Commercial and Parks/Open Space. The City's zoning code designates the Project site as Commercial Park (CP) and Public or Quasi-Public (B). Approval of the Project by the City would require:

- General Plan Amendment
- Rezoning to a Planned Development Master Community Zoning District

[1] All gross square footages, number of residential units, FAR calculations, and parking spaces described in this NOP are approximate.

- Master Community Plan
- Development Area Plans
- Tentative Map and/or Vesting Tentative Map
- Development Agreement and/or Disposition and Development Agreement
- Ground Lease
- Issuance of grading, building, and occupancy permits

The aspects of the Project affecting the closed landfill would also require approvals from the following agencies: the San Francisco Bay Regional Water Quality Control Board (RWQCB), the Santa Clara County Department of Environmental Health, Cal Recycle, and the Bay Area Air Quality Management District (BAAQMD). These approvals include:

- Post-Closure Land Use Plan ("PCLUP")
- Amended Closure Plan,
- Amended Post-Closure Maintenance Plan ("PCMP")
- Revisions to Corrective Action Plans
- Revised RWQCB Waste Discharge Requirements

Potential Environmental Impacts of the Project

The EIR will identify the significant environmental effects anticipated to result from the development of the Project. The EIR will include the following key specific environmental categories as related to the Project. Other environmental topics (i.e., agricultural and mineral resources) will be evaluated at a lesser level of detail.

1. *Aesthetics*

   Implementation of the Project would result in the removal of the existing on-site land uses and features and the construction of new commercial, residential, office, hotel, and retail land uses of a greater density and scale, which is anticipated to change the existing character on-site and create new sources of light and glare. To the extent required by the recent amendments to CEQA enacted by Senate Bill (SB) 743 of 2013, the EIR will describe the existing visual setting of the Project, the visual changes, and impacts to viewer groups that are anticipated to occur as a result of the Project. Mitigation measures will be identified for significant impacts, as warranted.

2. *Air Quality*

   The EIR will address the regional air quality conditions in the Bay Area and discuss the Project's impacts to local and regional air quality according to 2011 BAAQMD guidelines and thresholds. Temporary construction related impacts such as vehicle exhaust and air-borne particulates (i.e., dust) and any impacts associated with alteration of the landfill systems during construction will also be discussed. Mitigation measures will be identified for significant impacts, as warranted.

3. *Biological Resources*

   The Project site is currently developed with the Santa Clara Golf & Tennis Club, a fire station, and a BMX track. Several surveys will inform the Biological Resources section of the EIR, including a

survey of baseline biological conditions. In particular, the Project site could support burrowing owls, Congdon's tarplant, and wetlands. The EIR will provide a discussion of the removal of existing trees on-site and will conduct analyses related to on-site biological features and effects on biological resources, including potential wetland features. Mitigation measures will be identified for significant impacts, as warranted.

4. *Cultural Resources*

   The Project site is situated on a former landfill with highly disturbed soils; therefore, archeological and paleontological resources are not expected to be encountered. Regardless, in order to prepare a conservative analysis, consultation with the Native American Heritage Commission (NAHC) will be initiated and an Archaeological Inventory Report will be prepared. The EIR will address the potential historical significance of the existing structures on-site and address potential impacts to unknown below-ground resources during construction. Mitigation measures will be identified for significant impacts, as warranted.

5. *Geology and Soils*

   The Project site is located approximately 6 miles from the southern portion of the Hayward Fault and would be expected to experience very strong to violent shaking during a maximum probable event on the Hayward Fault. The EIR will include a review of geotechnical reports that characterize landfill materials and underlying geology. Additionally, the EIR will summarize geologic conditions potentially affecting the design of building foundations and will discuss Project grading, excavation, foundation systems, and impacts to, and/or alterations of, the existing clay landfill cap. Mitigation measures will be identified for significant impacts, as warranted.

6. *Greenhouse Gas Emissions*

   The EIR will address the Project's contribution to regional and global greenhouse gas emissions based on BAAQMD thresholds. Proposed design measures to reduce energy consumption, which in turn would reduce greenhouse gas emissions, will be discussed. Mitigation measures will be identified for significant impacts, as warranted.

7. *Hazards and Hazardous Materials*

   Former uses at the Project site include the Santa Clara All-Purpose Landfill, which closed in 1993. The EIR will summarize known hazardous materials conditions on and adjacent to the Project site, and will address the potential for the proposed development to be impacted by the risks associated with exposure to hazardous materials as well as potential release of hazardous materials during construction. In addition, the EIR will analyze potential impacts associated with alterations to the landfill gas collection systems, as well as potential impacts associated with implementing measures designed to remediate hazardous materials conditions, as set forth in the Closure Plan, Post-Closure Maintenance Plan, Post-Closure Land Use Plan, and/or Revised Waste Discharge Requirements. Mitigation measures will be identified for significant impacts, as warranted.

8. *Hydrology and Water Quality*

   The EIR will discuss how the Project would alter the leachate collection system and groundwater monitoring well network (as set forth in the Closure Plan, Post-Closure Maintenance Plan, Post-Closure Land Use Plan, and/or Revised Waste Discharge Requirements), and the potential impacts of such alterations. The EIR will include a description of the any alterations to or impacts upon the onsite 15-acre retention pond; analysis of drainage patterns and potential for inundation from several sources; analysis of impacts to groundwater; and a summary of FEMA-flood zone designations. The EIR will include Project impacts, which will describe potential impacts of the Project on surface hydrology/water quality, flooding/drainage, and groundwater hydrology/quality conditions. Mitigation measures will be identified for significant impacts, as warranted.

9. *Land Use and Planning*

   The Project site currently includes the Santa Clara Golf & Tennis Club and maintenance facility, a banquet facility, a BMX track, and a fire station. The EIR will describe the existing land uses adjacent to and within the Project site. Land use impacts that could occur as a result of the Project will be analyzed, including consistency of the Project with the City's General Plan and zoning code as well as compatibility of the proposed and existing land use in the Project area. Mitigation measures will be identified for significant impacts, as warranted.

10. *Noise*

    The noise environment at the Project site is primarily due to vehicular traffic along SR 237. The EIR will identify and discuss increases in the ambient noise environment as a result of the proposed land uses, as well increased traffic noise that would result from implementation of the Project. In addition, the EIR will consider potential noise impacts from the Mineta San Jose International Airport and Levi Stadium on proposed sensitive receptors at the Project site. Construction noise will also be discussed in the EIR. Noise levels will be evaluated for consistency with applicable standards and guidelines in the City of Santa Clara. Mitigation measures will be identified for significant impacts, as warranted.

11. *Population and Housing*

    The Project proposes residential uses that would generate an onsite population and commercial uses that would generate employees, resulting in an increase in offsite population and housing demand over existing conditions. The Project would contribute to the City's Association of Bay Area Governments (ABAG) Regional Housing Needs Assessment (RHNA) allocation. The EIR will focus on the direct and indirect growth in population and housing associated with this Project. The Project growth will be compared to the local and regional ABAG projections.

12. *Public Services*

    Project development would result in an increase in both residential and employee populations. Increased population generated by the Project will increase demand for police, fire, and library services, and generate increased student populations (K-12). The EIR will address the availability of public facilities and determine if the Project would trigger the need for construction of new facilities.

In addition, the Project would include the demolition of the existing Santa Clara Fire Station 10. Mitigation measures will be identified for significant impacts, as warranted.

13. *Recreation*

The Project would result in the removal of the existing Santa Clara Golf & Tennis Club and the BMX track, both of which are used for recreation purposes. This would result in a decrease of recreation opportunities, which will be analyzed in the EIR. In addition, the increase in population as a result of the Project could increase the demand on parks and other recreational facilities in the area. The EIR section will analyze the impacts associated with the removal or deterioration of existing recreation facilities and will consider the environmental impacts that could result.

14. *Transportation and Traffic*

The EIR will examine the existing traffic conditions in the immediate vicinity of the Project site. A transportation impact analysis (TIA) will be prepared for the Project in order to identify any potential impacts to the transportation system and the planned long-range transportation network. The focus of the TIA will be the existing and future operation of nearby intersections, increase in demand in transit services, and the evaluation of potential on- and off-site deficiencies to the bicycle and pedestrian facilities in the area. The TIA will also evaluate potential traffic impacts from construction-related activities. Mitigation measures will be identified for significant impacts, as warranted.

15. *Utilities and Service Systems*

Implementation of the Project will result in an increased demand on utilities and public facilities compared to existing conditions. The EIR will examine the impacts of the Project on utilities, such as sanitary storm drains, water supply, and solid waste management. The EIR will also discuss water supply and demand associated with implementation of the Project. Mitigation measures will be identified for significant impacts, as warranted.

16. *Energy*

Implementation of the Project will result in increased energy consumption on-site to accommodate the new development. The energy use of the Project will be analyzed consistent with Appendix F of the CEQA guidelines. The EIR will address the increase in energy use on-site and proposed design measures to reduce energy consumption. Mitigation measures will be identified for significant impacts, as warranted.

17. *Alternatives*

The EIR will examine alternatives to the Project, including a “No Project” alternative and two or more alternative development scenarios, depending on the impacts identified. Alternatives discussed will be chosen based on their ability to reduce or avoid identified significant impacts of the Project while attaining most of the basic objectives of the Project, including but not limited to the provision of additional housing units on the site.

18. *Significant and Unavoidable Impacts*

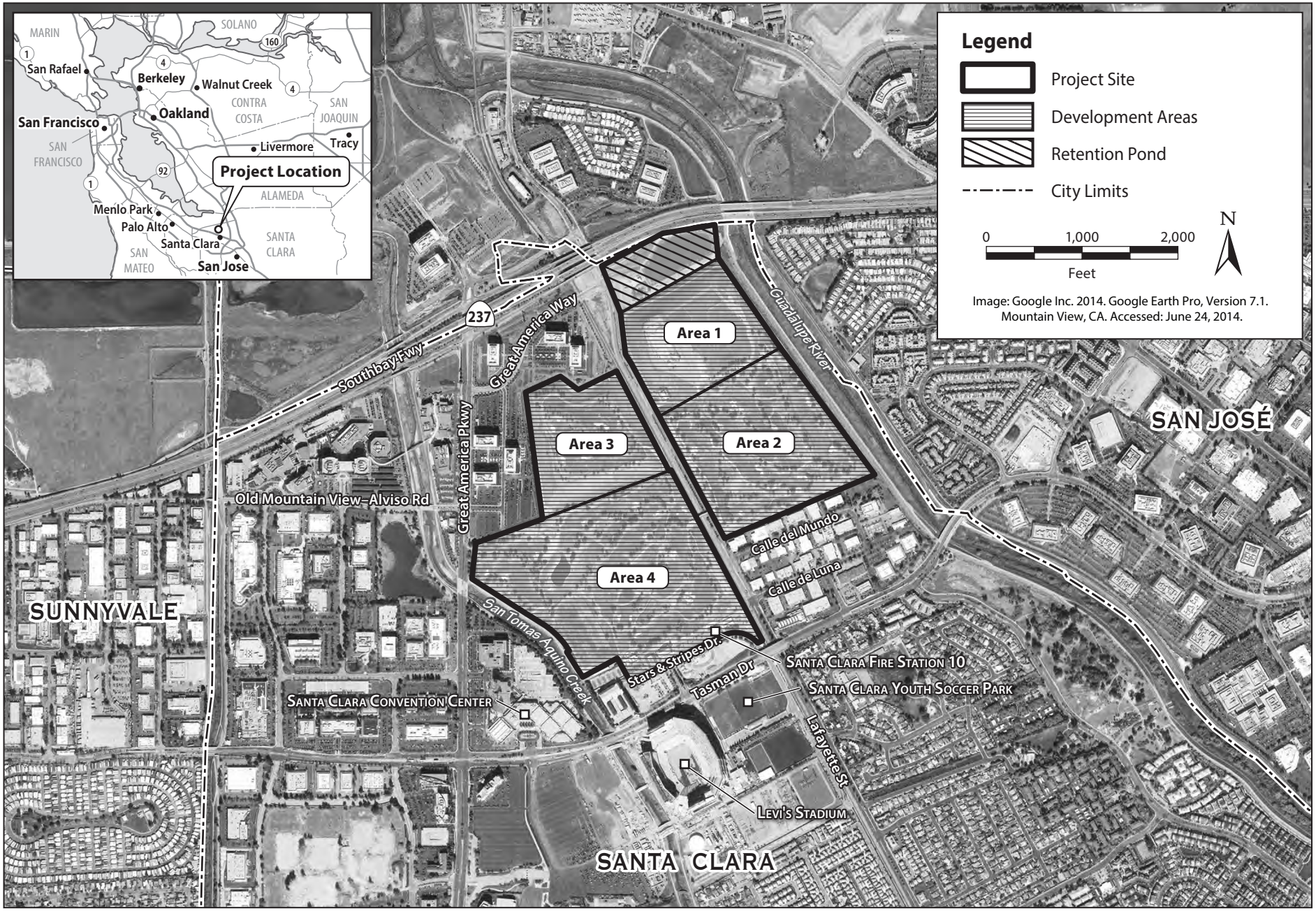
    The EIR will identify those significant impacts that cannot be avoided if the Project is implemented as proposed.

19. *Cumulative Impacts*

    The EIR will include cumulative impact discussions for each topic that will address the potentially significant cumulative impacts of the Project when considered with other past, present, and reasonably foreseeable future projects in the area.

In conformance with the CEQA Guidelines, the EIR will also include the following topics:

- Consistency with local and regional plans and policies;
- Growth inducing impacts; and
- Significant and irreversible environmental changes.



Graphics ... 00333.14 (7-23-2014) tm

Figure 1
Project Location
City Place Santa Clara

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse and Planning Unit

Edmund G. Brown Jr.
Governor

Ken Alex
Director

Notice of Preparation

July 31, 2014

RECEIVED
AUG 08 2014
PLANNING DIVISION

To: Reviewing Agencies

Re: City Place Santa Clara
SCH# 2014072078

Attached for your review and comment is the Notice of Preparation (NOP) for the City Place Santa Clara draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Debby Fernandez
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Attachments
cc: Lead Agency

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
TEL (916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# 2014072078
Project Title City Place Santa Clara
Lead Agency Santa Clara, City of

Type NOP Notice of Preparation

Description The Project would construct a new "city center" in the City. The Project would include up to 8.34 million gross square feet of office buildings, retail and entertainment facilities, residential units, hotel rooms, new open space, new roads, and new upgraded and expanded infrastructure. The conceptual land use plan provides two options for four parcels: Scheme A (with a building area totaling approximately 8.34 million gsf), and Scheme B (6.21 million gsf). The conceptual land use plan also includes: open space; a retention pond area; construction of a structural slab over the existing landfill cap; replacement of the existing groundwater monitoring network, leachate collection systems; environmental remediation activities; new pedestrian and vehicular entrances and roadway networks; and construction of new utilities.

Lead Agency Contact

Name Debby Fernandez
Agency City of Santa Clara
Phone (408) 615-2450 **Fax**
email
Address 1500 Warburton Avenue
City Santa Clara **State** CA **Zip** 95050

Project Location

County Santa Clara
City Santa Clara
Region
Cross Streets Stars and Stripes Drive, Great America Pkwy, SR 237, Lafayette Street
Lat / Long 37° 24' 22" N / 121° 58' 18" W
Parcel No. 104-03-036, -37, 097-01-039, etc.
Township **Range** **Section** **Base**

Proximity to:

Highways SR 237, US 101
Airports
Railways Amtrak, VTA
Waterways San Tomas Aquino Creek, Guadalupe River, SF Bay
Schools Santa Clara Unified
Land Use Regional Commercial and Parks/Open Space;
Z: Commercial Park and Public or Quasi-Public

Project Issues Aesthetic/Visual; Air Quality; Archaeologic-Historic; Biological Resources; Coastal Zone; Drainage/Absorption; Economics/Jobs; Flood Plain/Flooding; Forest Land/Fire Hazard; Geologic/Seismic; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Sewer Capacity; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Growth Inducing; Landuse; Cumulative Effects; Other Issues

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Reviewing Agencies Resources Agency; Department of Conservation; Office of Historic Preservation; Department of Parks and Recreation; Resources, Recycling and Recovery; Department of Fish and Wildlife, Region 3; Office of Emergency Services, California; Native American Heritage Commission; Public Utilities Commission; Department of Housing and Community Development; Caltrans, District 4; Air Resources Board; State Water Resources Control Board, Division of Drinking Water; Department of Toxic Substances Control; Regional Water Quality Control Board, Region 2

Document Details Report
State Clearinghouse Data Base

Date Received 07/31/2014 ***Start of Review*** 07/31/2014 ***End of Review*** 08/29/2014

Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

2014#1407207s

Project Title: City Place Santa Clara

Lead Agency: City of Santa Clara
Contact Person: Debby Fernandez
Mailing Address: 1500 Warburton Avenue
Phone: (408) 615-2450
City: Santa Clara
Zip: 95050
County: Santa Clara

Project Location: County: Santa Clara
City/Nearest Community: Santa Clara
Cross Streets: Stars and Stripes Drive, Great America Pkwy, SR 237, Lafayette Street
Zip Code: 90504
Longitude/Latitude (degrees, minutes and seconds): 37 ° 24 ′ 22 ″ N / 121 ° 58 ′ 18 ″ W
Total Acres: 230
Assessor's Parcel No.: 104-03-036, -37, 097-01-039, etc.
Section: ____ Twp.: ____ Range: ____ Base: ____
Within 2 Miles: State Hwy #: SR 237, US 101
Waterways: San Tomas Aquino Creek, Guadalupe River, SF Bay
Airports: n/a
Railways: Amtrak, VTA
Schools: Santa Clara Unified

RECEIVED
JUL 31 2014
STATE CLEARING HOUSE

Document Type:

CEQA:
- [x] NOP
- [ ] Early Cons
- [ ] Neg Dec
- [ ] Mit Neg Dec
- [ ] Draft EIR
- [ ] Supplement/Subsequent EIR (Prior SCH No.) ____
- Other: ____

NEPA:
- [ ] NOI
- [ ] EA
- [ ] Draft EIS
- [ ] FONSI

Other:
- [ ] Joint Document
- [ ] Final Document
- [ ] Other: ____

Local Action Type:

- [ ] General Plan Update
- [x] General Plan Amendment
- [ ] General Plan Element
- [ ] Community Plan
- [ ] Specific Plan
- [ ] Master Plan
- [ ] Planned Unit Development
- [ ] Site Plan
- [x] Rezone
- [ ] Prezone
- [ ] Use Permit
- [ ] Land Division (Subdivision, etc.)
- [ ] Annexation
- [x] Redevelopment
- [ ] Coastal Permit
- [x] Other: DA

Development Type:

- [x] Residential: Units 540< Acres ____
- [x] Office: Sq.ft. 6.1M< Acres ____ Employees ____
- [x] Commercial: Sq.ft. 1.8M< Acres ____ Employees ____
- [ ] Industrial: Sq.ft. ____ Acres ____ Employees ____
- [ ] Educational: ____
- [ ] Recreational: ____
- [ ] Water Facilities: Type ____ MGD ____
- [ ] Transportation: Type ____
- [ ] Mining: Mineral ____
- [ ] Power: Type ____ MW ____
- [ ] Waste Treatment: Type ____ MGD ____
- [ ] Hazardous Waste: Type ____
- [x] Other: Entertainment (180,000 sf), hotel (300,000 sf)

Project Issues Discussed in Document:

- [x] Aesthetic/Visual
- [ ] Agricultural Land
- [x] Air Quality
- [x] Archeological/Historical
- [x] Biological Resources
- [x] Coastal Zone
- [x] Drainage/Absorption
- [x] Economic/Jobs
- [ ] Fiscal
- [x] Flood Plain/Flooding
- [x] Forest Land/Fire Hazard
- [x] Geologic/Seismic
- [ ] Minerals
- [x] Noise
- [x] Population/Housing Balance
- [x] Public Services/Facilities
- [x] Recreation/Parks
- [x] Schools/Universities
- [ ] Septic Systems
- [x] Sewer Capacity
- [x] Soil Erosion/Compaction/Grading
- [x] Solid Waste
- [x] Toxic/Hazardous
- [x] Traffic/Circulation
- [x] Vegetation
- [x] Water Quality
- [x] Water Supply/Groundwater
- [x] Wetland/Riparian
- [x] Growth Inducement
- [x] Land Use
- [x] Cumulative Effects
- [x] Other: GHG

Present Land Use/Zoning/General Plan Designation:

Regional Commercial and Parks/Open Space; Zoning : Commercial Park (CP) and Public or Quasi-Public (B)

Project Description: *(please use a separate page if necessary)*

The Project would construct a new "city center" in the City. The Project would include up to 8.34 million gross square feet (gsf) of office buildings, retail and entertainment facilities, residential units, hotel rooms, new open space, new roads, and new upgraded and expanded infrastructure. The conceptual land use plan provides two options for four parcels: Scheme A (with a building area totaling approximately 8.34 million gsf), and Scheme B (6.21 million gsf). The conceptual land use plan also includes: open space; a retention pond area; construction of a structural slab over the existing landfill cap; replacement of the existing groundwater monitoring network, leachate collection systems; environmental remediation activities; new pedestrian and vehicular entrances and roadway networks; and construction of new utilities.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".
If you have already sent your document to the agency please denote that with an "S".

X Air Resources Board
___ Boating & Waterways, Department of
___ California Emergency Management Agency
___ California Highway Patrol
X Caltrans District # 4
___ Caltrans Division of Aeronautics
X Caltrans Planning
___ Central Valley Flood Protection Board
___ Coachella Valley Mtns. Conservancy
___ Coastal Commission
___ Colorado River Board
___ Conservation, Department of
___ Corrections, Department of
___ Delta Protection Commission
___ Education, Department of
___ Energy Commission
X Fish & Game Region # 3
___ Food & Agriculture, Department of
___ Forestry and Fire Protection, Department of
___ General Services, Department of
X Health Services, Department of
X Housing & Community Development
X Native American Heritage Commission

___ Office of Historic Preservation
___ Office of Public School Construction
X Parks & Recreation, Department of
___ Pesticide Regulation, Department of
X Public Utilities Commission
X Regional WQCB #2
___ Resources Agency
X Resources Recycling and Recovery, Department of
X S.F. Bay Conservation & Development Comm.
___ San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
___ San Joaquin River Conservancy
___ Santa Monica Mtns. Conservancy
___ State Lands Commission
___ SWRCB: Clean Water Grants
___ SWRCB: Water Quality
___ SWRCB: Water Rights
___ Tahoe Regional Planning Agency
X Toxic Substances Control, Department of
X Water Resources, Department of

___ Other: ___
___ Other: ___

Local Public Review Period (to be filled in by lead agency)

Starting Date ___ Ending Date ___

Lead Agency (Complete if applicable):

Consulting Firm: ICF International
Address: 620 Folsom Street, Ste 200
City/State/Zip: San Francisco, CA 94107
Contact: Erin Efner
Phone: 415.677.7181

Applicant: Steve Eimer/Related Santa Clara, LLC
Address: 333 S. Grand Avenue, Ste 3350
City/State/Zip: Los Angeles, CA 90071
Phone: ___

Signature of Lead Agency Representative: [signature], DRO **Date:** 7-29-14

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

NOP Distribution List

County: Santa Clara

SCH# 2014072078

Resources Agency

- [x] Resources Agency
  Nadell Gayou
- [ ] Dept. of Boating & Waterways
  Nicole Wong
- [ ] California Coastal Commission
  Elizabeth A. Fuchs
- [ ] Colorado River Board
  Tamya Trujillo
- [x] Dept. of Conservation
  Elizabeth Carpenter
- [ ] California Energy Commission
  Eric Knight
- [ ] Cal Fire
  Dan Foster
- [ ] Central Valley Flood Protection Board
  James Herota
- [x] Office of Historic Preservation
  Ron Parsons
- [x] Dept of Parks & Recreation
  Environmental Stewardship Section
- [x] California Department of Resources, Recycling & Recovery
  Sue O'Leary
- [ ] S.F. Bay Conservation & Dev't. Comm.
  Steve McAdam
- [ ] Dept. of Water Resources
  Resources Agency
  Nadell Gayou

Fish and Game

- [ ] Depart. of Fish & Wildlife
  Scott Flint
  Environmental Services Division
- [ ] Fish & Wildlife Region 1
  Donald Koch
- [ ] Fish & Wildlife Region 1E
  Laurie Harnsberger
- [ ] Fish & Wildlife Region 2
  Jeff Drongesen
- [x] Fish & Wildlife Region 3
  Charles Armor
- [ ] Fish & Wildlife Region 4
  Julie Vance
- [ ] Fish & Wildlife Region 5
  Leslie Newton-Reed
  Habitat Conservation Program
- [ ] Fish & Wildlife Region 6
  Tiffany Ellis
  Habitat Conservation Program
- [ ] Fish & Wildlife Region 6 I/M
  Heidi Sickler
  Inyo/Mono, Habitat Conservation Program
- [ ] Dept. of Fish & Wildlife M
  George Isaac
  Marine Region

Other Departments

- [ ] Food & Agriculture
  Sandra Schubert
  Dept. of Food and Agriculture
- [ ] Depart. of General Services
  Public School Construction
- [ ] Dept. of General Services
  Anna Garbeff
  Environmental Services Section
- [ ] Delta Stewardship Council
  Kevan Samsam

Independent Commissions,Boards

- [ ] Delta Protection Commission
  Michael Machado
- [x] OES (Office of Emergency Services)
  Dennis Castrillo
- [x] Native American Heritage Comm.
  Debbie Treadway
- [x] Public Utilities Commission
  Leo Wong
- [ ] Santa Monica Bay Restoration
  Guangyu Wang
- [ ] State Lands Commission
  Jennifer Deleong
- [ ] Tahoe Regional Planning Agency (TRPA)
  Cherry Jacques

Business, Trans & Housing

- [ ] Caltrans - Division of Aeronautics
  Philip Crimmins
- [ ] Caltrans - Planning
  Terri Pencovic
- California Highway Patrol
  Suzann Ikeuchi
  Office of Special Projects
- [x] Housing & Community Development
  CEQA Coordinator
  Housing Policy Division

Dept. of Transportation

- [ ] Caltrans, District 1
  Rex Jackman
- [ ] Caltrans, District 2
  Marcelino Gonzalez
- [ ] Caltrans, District 3
  Eric Federicks – South
  Susan Zanchi - North
- [x] Caltrans, District 4
  Erik Alm
- [ ] Caltrans, District 5
  David Murray
- [ ] Caltrans, District 6
  Michael Navarro
- [ ] Caltrans, District 7
  Dianna Watson
- [ ] Caltrans, District 8
  Dan Kopulsky
- [ ] Caltrans, District 9
  Gayle Rosander
- [ ] Caltrans, District 10
  Tom Dumas
- [ ] Caltrans, District 11
  Jacob Armstrong
- [ ] Caltrans, District 12
  Maureen El Harake

Cal EPA

Air Resources Board

- [x] All Projects
  CEQA Coordinator
  - [ ] Transportation Projects
    Nesamani Kalandiyur
  - [ ] Industrial Projects
    Mike Tollstrup
- [ ] State Water Resources Control Board
  Regional Programs Unit
  Division of Financial Assistance
- [x] State Water Resources Control Board
  Jeffery Werth
  Division of Drinking Water
- [ ] State Water Resources Control Board
  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- [ ] State Water Resouces Control Board
  Phil Crader
  Division of Water Rights
- [x] Dept. of Toxic Substances Control
  CEQA Tracking Center
- [ ] Department of Pesticide Regulation
  CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

- [ ] RWQCB 1
  Cathleen Hudson
  North Coast Region (1)
- [x] RWQCB 2
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] RWQCB 3
  Central Coast Region (3)
- [ ] RWQCB 4
  Teresa Rodgers
  Los Angeles Region (4)
- [ ] RWQCB 5S
  Central Valley Region (5)
  - [ ] RWQCB 5F
    Central Valley Region (5)
    Fresno Branch Office
  - [ ] RWQCB 5R
    Central Valley Region (5)
    Redding Branch Office
- [ ] RWQCB 6
  Lahontan Region (6)
  - [ ] RWQCB 6V
    Lahontan Region (6)
    Victorville Branch Office
- [ ] RWQCB 7
  Colorado River Basin Region (7)
- [ ] RWQCB 8
  Santa Ana Region (8)
- [ ] RWQCB 9
  San Diego Region (9)

- [ ] Other _____
  _____
  _____

- [ ] _____
  Conservancy

Last Updated 7/24/2014

EDMUND G. BROWN Jr., Governor

STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
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OAKLAND, CA 94623-0660
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PLANNING DIVISION

August 29, 2014

SCL237205
SCL/237/PM 6.45
SCH# 2014072078

Ms. Debbie Fernandez
Planning Division
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050

Dear Ms. Fernandez:

City Place Santa Clara – Notice of Preparation (NOP)

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the project referenced above. We have reviewed the NOP and have the following comments to offer.

Traffic Impact Study (TIS)
One of Caltrans' ongoing responsibilities is to collaborate with local agencies to avoid, eliminate, or reduce to insignificance potential adverse impacts by local development on State highways. We recommend using the Caltrans *Guide for the Preparation of Traffic Impact Studies* (TIS Guide) for determining which scenarios and methodologies to use in the analysis. The TIS Guide is a starting point for collaboration between the lead agency and Caltrans in determining when a TIS is needed. The appropriate level of study is determined by the particulars of a project, the prevailing highway conditions, and the forecasted traffic. The TIS Guide is available at the following website address:
http://dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa_files/tisguide.pdf.

The TIS should include:

1. Vicinity map, regional location map, and a site plan clearly showing project access in relation to nearby State roadways. Ingress and egress for all project components should be clearly identified. The State right-of-way (ROW) should be clearly identified. The maps should also include project driveways, local roads and intersections, parking, and transit facilities.

2. Project-related trip generation, distribution, and assignment. The assumptions and methodologies used to develop this information should be detailed in the study, and should be supported with appropriate documentation.

3. Average Daily Traffic, AM and PM peak hour volumes and levels of service (LOS) on all roadways where potentially significant impacts may occur, including crossroads and controlled intersections for existing, existing plus project, cumulative and cumulative plus project scenarios. Calculation of cumulative traffic volumes should consider all traffic-generating developments, both existing and future, that would affect study area roadways and intersections. The analysis should clearly identify the project's contribution to area traffic and any degradation to existing and cumulative LOS. Caltrans' LOS threshold, which is the transition between LOS C and D, and is explained in detail in the TIS Guide, should be applied to all State facilities.

4. Schematic illustration of traffic conditions including the project site and study area roadways, trip distribution percentages and volumes as well as intersection geometrics (i.e., lane configurations) for the scenarios described above.

5. The project site building potential as identified in the General Plan. The project's consistency with both the Circulation Element of the General Plan and the Congestion Management Agency's Congestion Management Plan should be evaluated.

6. Identification of mitigation for any roadway mainline section or intersection with insufficient capacity to maintain an acceptable LOS with the addition of project-related and/or cumulative traffic.

7. The intersection of Great America Parkway and the State Route (SR) 237 westbound (WB) off-ramp is operating with one signal controller which is currently degrading the efficiency of the corridor. We request that the traffic engineer for the TIA consult with us regarding the signal operation assumptions for the analysis. Caltrans may ask that a second controller be added.

8. The following freeway on-ramps are expected to be significantly impacted by the proposed project during ramp metering hours:

   - Northbound (NB) U.S. Highway (U.S.) 101 at the Great America Parkway diagonal on-ramp;
   - Southbound (SB) U.S. 101 at the Great America Parkway loop on-ramp;
   - SB U.S. 101 at the Montague Expressway diagonal on-ramp;
   - WB SR 237 at the Great America Parkway diagonal on-ramp;
   - Eastbound (EB) SR 237 at the Great America Parkway diagonal on-ramp.

   The existing on-ramp queues will likely be lengthened with additional traffic demand and may impact traffic operations on the local streets. We request that the provision of additional storage on the on-ramps and/or local streets be proposed to prevent secondary impacts from ramp-meter queuing, including a High Occupancy Vehicle (HOV) preferential lane for the freeway onramps.

Caltrans has existing Traffic Operation Systems (TOS) and ramp metering equipment along U.S. 101 and SR 237. This equipment must be maintained and kept operational during all phases of the proposed project. Should they be impacted as a result of the proposed project, including project mitigation, the applicant or the entity responsible for mitigating the project's impacts will need to obtain Caltrans approval for equipment relocation and/or replacement.

Lead Agency
As the lead agency, the City of Santa Clara (City) is responsible for all project mitigation, including any needed improvements to State highways. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

This information should also be presented in the Mitigation Monitoring and Reporting Plan of the environmental document. Required roadway improvements should be completed prior to issuance of the Certificate of Occupancy. Since an encroachment permit is required for work in the State ROW, and Caltrans will not issue a permit until our concerns are adequately addressed, we strongly recommend that the City work with both the applicant and Caltrans to ensure that our concerns are resolved during the environmental process, and in any case prior to submittal of an encroachment permit application. Further comments will be provided during the encroachment permit process; see the end of this letter for more information regarding encroachment permits.

Vehicle Trip Reduction
Caltrans commends and encourages the City to continue locating any needed housing, jobs and neighborhood services near major mass transit centers, with connecting streets configured to facilitate walking and biking, as a means of promoting mass transit use and reducing regional vehicle miles traveled and traffic impacts on the State highways.

We also commend and encourage the City to continue developing Travel Demand Management (TDM) policies to promote usage of nearby public transit lines and reduce vehicle trips on the State Highway System. These policies could include lower parking ratios, car-sharing programs, bicycle parking and showers for employees and residents, and providing transit passes to residents and employees, among others.

In addition, please ensure secondary impacts on pedestrians and bicyclists resulting from any traffic impact mitigation measures are analyzed. The analysis should describe any pedestrian and bicycle mitigation measures and safety countermeasures that would in turn be needed as a means of maintaining and improving access to transit facilities and reducing vehicle trips and traffic impacts on State highways.

Traffic Impact Fees
Please identify traffic impact fees to be used for project mitigation. Development plans should require traffic impact fees based on projected traffic and/or based on associated cost estimates for public transportation facilities necessitated by development. Scheduling and costs associated

with planned improvements on State ROW should be listed, in addition to identifying viable funding sources correlated to the pace of improvements for roadway improvements, if any.

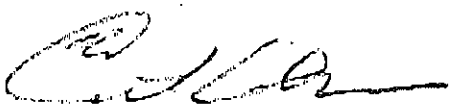
Voluntary Contribution Program
U.S. 101, SR 237, and other State facilities near the site are critical to regional and interregional traffic in the San Francisco Bay region. They are vital to commuting, freight, and recreational traffic and are among the most congested regional facilities. Given the scale and location of the proposed project and the traffic generated, along with other projects in the vicinity, this project will have a cumulative significant regional impact to the already congested State Highway System.

Caltrans encourages the City to participate in Santa Clara Valley Transportation Authority's (VTA) voluntary contribution program (Program) and plan for the impact of future growth on the regional transportation system. Contributions would be used to help fund regional transportation programs that improve the transportation system to lessen future traffic congestion, improve mobility by reducing time delays, and maintain reliability on major roadways throughout the San Francisco Bay Area.

Reducing delays on State facilities will not only benefit the region, but also reduce any queuing on local roadways caused by highway congestion. The VTA is developing two Express Lane projects in the vicinity: (1) the U.S. 101 Express Lane project; and (2) the SR 237 Express Lane project. We request that the applicant be asked to contribute to the Program for these two projects as mitigation for expected freeway segment impacts.

Should you have any questions regarding this letter, please contact Brian Brandert of my staff at (510) 286-5505 or brian.brandert@dot.ca.gov.

Sincerely,



ERIK ALM, AICP
District Branch Chief
Local Development - Intergovernmental Review

c: Scott Morgan, State Clearinghouse
Robert Swierk, Santa Clara Valley Transportation Authority (VTA) – electronic copy
Robert Cunningham, Santa Clara Valley Transportation Authority (VTA) – electronic copy

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bay Delta Region
7329 Silverado Trail
Napa, CA 94558
(707) 944-5500
www.wildlife.ca.gov

EDMUND G. BROWN JR., *Governor*
CHARLTON H. BONHAM, *Director*

August 28, 2014

Ms. Debby Fernandez
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050

Dear Ms. Fernandez:

Subject: City Place Project, Notice of Preparation of a Draft Environmental Impact Report, SCH #2014072078, City and County of Santa Clara

This letter is in response to the Notice of Preparation (NOP) of a draft Environmental Impact Report (EIR) for the City Place Project (Project), received by the California Department of Fish and Wildlife (CDFW) on August 4, 2014. The Project will consist of the construction of up to 8.34 million square feet of new retail/entertainment, hotel, restaurant, office space, and urban residential within a 230-acre development envelope. The Project is in an area which currently supports a golf course and tennis club, fire station, BMX track, and open space. It is located north of Tasman Drive, west of Lafayette Street, and west of Great American Parkway in the City and County of Santa Clara.

CDFW is identified as a Trustee Agency pursuant to the California Environmental Quality Act (CEQA) §15386. As a trustee for the State's fish and wildlife resources, CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants and the habitat necessary for biologically sustainable populations of those species pursuant to California Fish and Game Code §1802. In this capacity, CDFW administers the California Endangered Species Act (CESA), the Native Plant Protection Act, the Lake and Streambed Alteration Program and other provisions of the Fish and Game Code that afford protection to the State's fish and wildlife trust resources. Therefore, CDFW is offering the following comments, and recommendations regarding the proposed Project.

Burrowing owl

Once one of the most common birds in the state, burrowing owl numbers have declined significantly since the 1940s with an increasing downward trend from the 1970s onward. The burrowing owl population in the entire South San Francisco Bay Area was probably around 1000 pairs in the 1970s and by 1980, there were perhaps only 250 pairs remaining (Albion Environmental, Inc. 2000).

The first comprehensive surveys of burrowing owls in the Bay Area took place beginning in 1991 (DeSante et al. 1997; DeSante et al. 2007) and yielded estimates of 153 pairs (1997) and 165 pairs (2007) for the Bay Area as a whole. Results of a larger statewide survey suggested that there had been approximately 50% declines in both the numbers of owls and the number of breeding groups in the San Francisco Bay Area from the period 1986–1991. A report by Albion

Environmental, Inc.(2000) estimated that the Santa Clara County burrowing owl population in 1997 consisted of between 120 and 141 pairs, most of which were found in 12 discrete locations.

As part of the development of the conservation strategy for the Santa Clara Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) (Plan), the Plan area was surveyed for breeding burrowing owls from May 26 to July 23 2008 (Albion Environmental, Inc. 2008). The survey was conducted at 96 locations: 84 locations inside the HCP/NCCP area and 12 immediately outside the northern and southern boundaries of the HCP/NCCP area where breeding owls were known to occur, i.e., Alviso environs and northern San Benito County. This survey resulted in an estimate of 19–20 pairs in the HCP/NCCP area, 20 to 21 pairs in the City of San Jose (includes pairs in Alviso outside the plan area), and 21 to 23 breeding pairs when including pairs observed just outside the north and south HCP/NCCP Plan area boundaries. All except two breeding pairs in the Plan area were located on either San Jose International Airport or north San Jose/Alviso. These data strongly support the observation that the South Bay burrowing owl population has declined catastrophically, since just 1997 and that the remaining owls are limited to fewer and fewer locations. In developing a Population Viability Analysis to provide the basis for a HCP/NCCP conservation strategy for the species, only three sites in the South Bay Area; Moffett Airfield, San Jose International Airport, and Shoreline Park had enough owls to be used in the analysis.

The current circumstances are such that the remaining burrowing owl breeding and foraging areas are found on the open spaces along the Highway 237 corridor from roughly Shoreline/Moffett to the west to Interstate 880 to the east. This area includes the parcels where the Centennial Gateway development is proposed. These areas are critical to the sustainability of the local burrowing owl population and any loss of useable open space in this area should be considered a significant impact in any CEQA evaluation.

The California Natural Diversity Data Base lists numerous burrowing owl occurrences on and around the Centennial Gateway site (see attached). In addition to the pair of owls which bred near Levi's Stadium the past two years, local burrowing owl biologists have observed owls foraging on the golf course, nesting on the slope of Tasman Drive in front of the golf course parking lot, under the sidewalk along Centennial, and on the berm inside the Pacific Gas and Electric Company substation at the end of Centennial. These records and the proximity of other nesting occurrences establish the site as active burrowing owl habitat and this should be used as the CEQA baseline in the draft EIR.

As noted above, a regionally-specific burrowing owl recovery plan was developed as part of the Santa Clara HCP/NCCP to establish a recovery strategy for the species within the Plan area. Since almost all the remaining owls in the South Bay are located in or near the HCP/NCCP area, this recovery strategy, by extension, serves as the most specific, detailed and local strategy to compensate for the loss of burrowing owl habitat (foraging, movement and breeding) in the South Bay and on the Peninsula. Accordingly, the strategy (Appendix M of the HCP/NCCP, available at http://scv-habitatagency.org/DocumentCenter/Home/View/120), is the best available mitigation and should be discussed and utilized in the draft EIR to mitigate for the loss of burrowing owl habitat resulting from the eventual construction of Centennial Gateway.

Given the state of the local population, out of the area mitigation should not be considered for this project as it will provide no benefit locally and little for the species as a whole.

Nitrogen Deposition

Atmospheric nitrogen deposition is a complex process by which reactive chemical species of nitrogen (N)—nitrogen oxides (NO_X), ammonia (NH_3), and their reaction products—are deposited onto surfaces and enter ecosystems as N fertilizer. N-deposition estimates (from varied studies) for the Santa Clara Valley range from 8–20 kilograms of nitrogen per hectare per year (kg-N/ha/y).

In Santa Clara County, N-deposition threatens serpentine grasslands that support numerous rare and endangered species, including the threatened Bay checkerspot butterfly (*Euphydryas editha bayensis*). The added N allows nutrient-poor serpentine soils to be invaded by non-native annual grasses that displace the native forbs that provide caterpillar food and adult nectar for the butterfly. N-deposition is the largest indirect impact of urban development on the serpentine grassland ecosystem. Although indirect, the impacts from new development on local serpentine communities are considerable and is advised to be considered a significant impact in the draft EIR.

As with burrowing owls, a specific N deposition analysis was done for the HCP/NCCP (Appendix E, available at http://scv-habitatagency.org/DocumentCenter/Home/View/113). The City and its consultant team should work closely with the HCP/NCCP Implementing Entity and the U.S. Fish and Wildlife Service to analyze the specific impact from Centennial Gateway and to establish appropriate mitigation based on the local, specific strategy developed for this impact.

Thank you for the opportunity to comment at this early stage of the review process. If you have any questions, please contact Mr. Dave Johnston, Environmental Scientist, at (831) 464-6870 or david.johnston@wildlife.ca.gov; or Ms. Annee Ferranti, Senior Environmental Scientist (Supervisory) at (707) 944-5554 or annee.ferranti@wildlife.ca.gov

Sincerely,

Scott Wilson

Scott Wilson
Regional Manager
Bay Delta Region

ec:
Joseph Terry, U.S. Fish and Wildlife Service – joseph_terry@fws.gov
Edmund Sullivan, Santa Clara Valley Habitat Agency – edmund.sullivan@scv-habitatagency.org
Terah Donovan, ICFI International – Terah.Donovan@icfi.com

Reference:

Albion Environmental, Inc. 2000. City of San Jose, burrowing owl habitat conservation strategy and implementation plan. Draft Final Report. April 2000.

Albion Environmental, Inc. 2008. Burrowing owl survey in the Santa Clara Valley HCP/NCCP. Unpublished report.

DeSante, D.F., E.D. Ruhlen, S.L. Adamany, K.M. Burton and S. Amin. 1997. A census of burrowing owls in central California in 1991. Pages 38–48 in Lincer, J.L. and K. Steenhof. (Eds.). 1997. *The Burrowing Owl, its Biology and Management: Including the Proceedings of the First International Symposium.* Raptor Research Report Number 9.

DeSante, D.F., E.D. Ruhlen, and R. Scalf. 2007. The distribution and relative abundance of burrowing owls in California during 1991–1993: Evidence for a declining population and thoughts on its conservation. Pages 1–41 in Barclay, J.H., K.W. Hunting, J.L. Lincer, J. Linthicum, and T.A. Roberts (Eds.). 2007. *Proceedings of the California Burrowing Owl Symposium, November 2003.* Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc. Point Reyes Station, CA, vii + 197 pp.

Map of Project Area

- Plant (80m)
- Plant (specific)
- Plant (non-specific)
- Plant (circular)
- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)
- Terrestrial Comm. (80m)
- Terrestrial Comm. (specific)
- Terrestrial Comm. (non-specific)
- Terrestrial Comm. (circular)
- Aquatic Comm. (80m)
- Aquatic Comm. (specific)
- Aquatic Comm. (non-specific)
- Aquatic Comm. (circular)
- Multiple (80m)
- Multiple (specific)
- Multiple (non-specific)
- Multiple (circular)

1:36,112

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

August 25, 2014

Author: djohnston
Printed from http://bios.dfg.ca.gov

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www.capitolcorridor.org

August 28, 2014

Debby Fernandez
Associate Planner
City of Santa Clara Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

SUBJECT: Comments on the Notice of Preparation - City Place Santa Clara project

Dear Ms. Fernandez:

The Capitol Corridor Joint Powers Board (CCJPA) currently manages the operation of the Capitol Corridor intercity passenger trains along the Union Pacific Railroad (UPRR) rail route between Oakland and San Jose, bisecting the proposed project area. These trains service the Santa Clara Great America station adjacent to the proposed project. Current ridership includes passengers destined for area businesses, the Great America theme park, the Levi's Stadium, and adjacent residential areas. At this time, 14 trains daily service this station.

The CCJPA is currently beginning a service expansion plan for the Capitol Corridor with the near-term intent of increasing the number of trains to 22 daily trips. This service expansion is planned to accommodate near-term expected ridership increases at the Santa Clara Great America station and the Silicon Valley/San Jose travel market. The parameters of this expansion plan have not been fully worked out between the CCJPA and the UPRR, but will likely involve building additional track and signal infrastructure on the railroad's existing right-of-way adjacent to the proposed development. Some modifications to the existing boarding facilities at the Great America station may also be required.

Development of the proposed City Place Santa Clara project will likely increase demands on the Capitol Corridor service in terms of increased ridership on the trains, numbers of passengers boarding and alighting at the Santa Clara Great America station, parking demand at the station parking lot, and vehicle and pedestrian circulation to and from the station.

Generally, trespassing on the railroad right-of-way is unauthorized and dangerous and has resulted in injuries and fatalities to trespassers and imposed major delays to the Capitol Corridor trains. The proposed project area is currently separated from the adjacent railroad right-of-way with a cyclone-type fence. A hardened fence or appropriate barrier should be incorporated into the project to ensure the safety of trains and pedestrians. Providing appropriate safe, legal and convenient routes for vehicles and pedestrians to cross the rail right-of-way will go a long way to preventing accidents in the future. Currently, there is a bridge that connects the two areas of the proposed project; it is presumed that this grade separation will be incorporated into the final project design. It may be necessary to provide additional grade separated access between the east and west areas of the site depending on the needs of the proposed development.

Beyond the current service expansion plans outlined above, the CCJPA anticipates additional ridership growth in the future. This may require additional train service in this area, which could require additional modifications to the railroad infrastructure. It is thought that this could require a major modification to the existing boarding platform for the Santa Clara Great America station, changing it from a single track side platform to a center island platform serving a double main track. If this comes to pass, it will be necessary to re-align the existing track and add another track, which may include the acquisition or retention of additional right-of-way for the additional station and track infrastructure.

The CCJPA appreciates the opportunity to submit comments on the Notice of Preparation and looks forward to working with the City of Santa Clara on the City Place Project.

Sincerely,

David B. Kutrosky
Managing Director

cc: CCJPA Board of Directors
Nuria Fernandez, Santa Clara Valley Transportation Authority
Stacey Mortensen, Executive Director – San Joaquin Regional Rail Commission

August 26, 2014
CIWQS ID # 205075

City of Santa Clara
Attn: Debby Fernandez
(dfernandez@santaclaraca.gov)
1500 Warburton Ave.
Santa Clara, CA 95050

Subject: Comments on Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the City Place Santa Clara Project, Santa Clara County

Dear Ms. Fernandez:

Regional Water Board staff has the following comments on the Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the proposed City Place Santa Clara Project dated 30 July, 2014. We very much appreciate that the City of Santa Clara, Related Santa Clara and its consultants have sought our involvement early in the planning process for this proposed project.

According to the NOP, the proposed project site is located on five large, city-owned parcels totaling approximately 230 acres. The parcels were formerly utilized as the Santa Clara All Purpose Landfill, which was closed in 1993. The project site currently includes the Santa Clara Golf & Tennis Club, a bicycle-motorcross (BMX) track, Santa Clara Fire Station 10, and a retention pond.

The proposed project would involve the demolition of the existing buildings and onsite features at the proposed project site, including the golf course, and the construction of a new multi-phased, mixed-use development. The proposed project would include office buildings, retails and entertainment facilities, residential units, hotel rooms and new upgraded and expanded infrastructure.

As we have made clear in multiple meetings with the City and its development team, we have concerns about some aspects of the proposed development. Our primary concern with the project is the proposal to build residential units above a former municipal landfill, as this is something we have not approved previously at any other landfill in the Bay Area due to potential adverse health impacts to residents that would reside in structures built over waste.

Soil gas data collected in April 2014 indicates that toxic volatile organic compounds (VOCs) including benzene, ethylbenzene, tetrachloroethene and vinyl chloride are present at the proposed development site in concentrations that exceed the Water Board's Commercial and Residential Environmental Screening Levels, and may pose vapor intrusion risks to future site occupants. Prior to site development, we recommend full remediation of these hazardous compounds to the extent practicable, followed by risk mitigation measures during and after construction.

The Regional Water Board requests that the EIR include in the range of reasonable alternatives an alternative that evaluates removal of contamination, as discussed above, and/or an alternative that does not propose construction of residential units above the landfill. Both of these alternatives would feasibly attain most of the basic development objectives but would avoid or substantially lessen the potential for significant effects on human health.

We will continue to work closely with the City's development team, Santa Clara County, and CalRecycle to determine the appropriate ways to remediate VOC source areas, and reduce and manage risks associated with development of the former landfill during the course of the proposed project.

If you have any questions, please contact my staff Devender Narala at (510) 622-2309, email: devender.narala@waterboards.ca.gov.

Sincerely,

Terry Seward, Chief
Groundwater Protection Division

Cc:
Steve Eimer
Related Santa Clara
Email: seimer@related.com

Ruth Shikada
City of Santa Clara
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NORMAN Y. MINETA
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RECEIVED
AUG 12 2014
PLANNING DIVISION

August 11, 2014

Debby Fernandez
City of Santa Clara Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

Subject: NOP for City Place Santa Clara Project (File #PLN2014-10440)

Dear Ms. Fernandez:

Thank you for sending the subject EIR Notice of Preparation to the City of San Jose Airport Department. As the proposed development would include high-rise buildings, the environmental analysis should address the project's compatibility with the airspace requirements of the San Jose International Airport and compliance with Federal Aviation Regulations Part 77 (as appropriately noted in the NOP for the adjacent Centennial Gateway Mixed-Use Project).

City or consultant staff are welcome to contact me at cgreene@sjc.org or 408-392-3623 for any questions regarding that analysis. The Airport will also appreciate the opportunity to review the Draft EIR when available.

Sincerely,

Cary Greene

Cary Greene
Airport Planner

1701 Airport Boulevard, Suite B-1130 • San José, CA 95110-1206 • Tel 408.392.3600 • Fax 408.441.4591 • www.flysanjose.com

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

County of Santa Clara
Roads and Airports Department

101 Skyport Drive
San Jose, California 95110-1302
1-408-573-2400

August 29, 2014

Debby Fernandez
Associate Planner
1500 Warburton Avenue
Santa Clara, CA 95050

SUBJECT: Notice of Preparation of an Environmental Impact Report
City Place Santa Clara Project

Dear Ms. Fernandez:

The County of Santa Clara Roads and Airports Department appreciates the opportunity to review to the Notice of Preparation (NOP) and is submitting the following comments.

The NOP states that a Traffic Impact Analysis (TIA) will be prepared for the proposed project following the latest adopted Congestion Management Program (CMP) TIA Guidelines to identify significant impacts for the DEIR. The TIA should include, but not be limited to, all signalized, unsignalized, CMP and non-CMP intersections on Montague Expressway, San Tomas Expressway, Lawrence Expressway, and Central Expressway.

The analysis should be conducted using County signal timing for County study intersections and the most recent CMP count and LOS data for CMP intersections. Please contact Ananth Prasad at (408) 494-1342 or Ananth.Prasad@rda.sccgov.org for the correct signal timing.

The *Comprehensive County Expressway Planning Study - 2008 Update* adopted by the Board of Supervisors in March 2009 should be consulted for a list of mitigation measures for significant impacts to the expressways. Should the *Expressway Study* not include an improvement that would mitigate a significant impact, the TIA should identify mitigation measures that would address the significant impact. Mitigation measures listed in the TIA should be incorporated into the EIR document.

If you have any questions or concerns about these comments, please contact me at (408) 573-2465 or dawn.cameron@rda.sccgov.org.

Sincerely,

for

Dawn S. Cameron
County Transportation Planner

cc: Masoud Akbarzadeh, County Traffic Engineer
Ananth Prasad, Senior Traffic Engineer

Board of Supervisors: Mike Wasserman, Cindy Chavez, Dave Cortese, Ken Yeager, S. Joseph Simitian
County Executive: Jeffrey V. Smith

SANTA CLARA
Valley Transportation Authority

August 28, 2014

City of Santa Clara Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

Attention: Kevin Riley, Director of Planning and Inspection

Subject: Notice of Preparation for City Place Santa Clara Project

Dear Kevin Riley:

The Santa Clara Valley Transportation Authority (VTA) has reviewed the Notice of Preparation (NOP) for the City Place Santa Clara Project. We have a number of comments on the document, which are included in the attached memorandum. However, I would like to highlight here the key themes from our review.

- First, VTA supports the proposed land use intensification at this important site, strategically located on the regional transportation network within walking distance of the Great America and Lick Mill Light Rail Transit (LRT) Stations and the Santa Clara Great America train station. The synergy of this project with Levi's Stadium and the proposed Centennial Gateway project offers an extraordinary opportunity to leverage this combined investment to provide world-class transportation options to Santa Clara's "new downtown." VTA would like to partner with the City to make all modes of transportation work in the area. VTA recommends coordinating the analysis of transportation impacts and mitigation measures for the City Place and Centennial Gateway projects, to pursue effective area-wide mitigation strategies, described in detail in the attached memorandum.
- Second, given the size of the project and limited roadway access to and from the project area, the project should increase connectivity and include a robust Transportation Demand Management (TDM) Program to reduce auto trips, vehicle miles traveled, greenhouse gas emissions, and transportation impacts. The single most important measure is to design the project to facilitate the maximum percentage of trips taken by pedestrian, bicycle and transit modes. Additional recommended TDM measures are included in the attached memorandum.
- Lastly, based on the level of transit demand to be generated by the City Place Santa Clara Project in combination with the nearby developments, transit improvements will likely be necessary to effectively move people within and through the area. VTA already has projects planned that will improve transit service to the area, including a direct light rail transit (LRT) connection with future BART service. VTA recommends that the City consider developer contributions to transit improvements in the project area, such as construction of a new bus transfer center; fencing the light rail tracks along Tasman Drive, consistent with City commitments, to enhance safety and increase speeds; and station/access improvements and double-tracking of the Santa Clara Great America train station.

VTA would like to work directly with the City as part of the project team as this project continues to move forward. Please do not hesitate to contact me at (408) 321-5713 or Robert Cunningham at (408) 321-5792 if you have any questions or would like to arrange a meeting.

Sincerely,

John Ristow, Director of Planning and Program Development

cc: Chris Augenstein, Ying Smith, Roy Molseed, VTA
Debby Fernandez, Gloria Sciara, Rajeev Batra, Dennis Ng, City of Santa Clara

MEMORANDUM

TO: Debby Fernandez, Senior Planner
City of Santa Clara Planning Division

FROM: Robert Cunningham
VTA Planning and Program Development Division

DATE: August 28, 2014

SUBJECT: Notice of Preparation for City Place Santa Clara Project

The Santa Clara Valley Transportation Authority (VTA) has reviewed the Notice of Preparation (NOP) for the City Place Santa Clara Project. In addition to the key themes raised in our letter from John Ristow dated August 29, 2014, we have the following specific comments based on our review.

Coordination with Centennial Gateway

The Centennial Gateway Project of up to 825,000 square feet of office, hotel and residential was recently proposed on a site located between the City Place site and Levi's Stadium (NOP dated July 10, 2014). The proximity and timing of the projects and location across the street from the newly-opened Levi's Stadium offers an extraordinary opportunity for the City to leverage this combined investment to offer world-class transportation options to Santa Clara's "new downtown." VTA recommends coordinated mitigation strategies such as the formation of a Transportation Management Association (TMA), transit access improvements potentially including a new bus transfer center, contributions to additional public or private transit service in the area, and roadway mitigation measures and operational improvements. VTA also recommends that the City consider area-wide strategies to analyze and mitigate impacts in the area such as a Specific Plan, Traffic Impact Fee (TIF) Program, and/or an area-wide Multimodal Improvement Plan.

Land Use Mix and Density

VTA supports the proposed land use intensification at this important site, strategically located on the regional transportation network adjacent to the Santa Clara Great America train station served by Altamont Corridor Express (ACE) and Capitol Corridor services, and within walking distance of the Great America and Lick Mill Light Rail Transit (LRT) Stations. In addition, the project's location within walking distance of Levi's Stadium and the Centennial Gateway Project will offer additional opportunities for residents and employees to reduce vehicle trips and greenhouse gas emissions. In particular, the proposed land use mix including entertainment, retail and restaurant uses will help to spread out the arrival and departure times of attendees at Levi's Stadium events, reducing the concentration of traffic congestion and transit trips during these times.

Tasman Drive is identified as a Corridor in VTA's Community Design & Transportation (CDT) Program Cores, Corridors and Station Areas framework, which shows VTA and local jurisdiction priorities for supporting concentrated development in the County. VTA invites the

City to partner with VTA to conduct a Tasman Corridor Study to develop strategies to make all modes of transportation successful in this corridor.

TIA Report

VTA's Congestion Management Program (CMP) requires a Transportation Impact Analysis (TIA) for any project that is expected to generate 100 or more net new peak-hour trips. Based on the information provided on the size of this project, a TIA may be required. The current March 2009 version of the *TIA Guidelines* may be downloaded from http://www.vta.org/cmp/technical-guidelines. For more information on the *TIA Guidelines*, please call Shanthi Chatradhi of the VTA Planning and Program Development Division at 408-952-4224.

Transportation Demand Management/Trip Reduction

Given the size of the project and limited roadway access to and from the project area, the project should include a robust Transportation Demand Management (TDM) Program to reduce auto trips, vehicle miles traveled and greenhouse gas emissions. Such measures will be critical in order to facilitate efficient transportation access to and from the site and reduce transportation impacts associated with the project. VTA recommends that the City consider the following TDM/Trip Reduction strategies:

- Project design to encourage walking, bicycling, and convenient transit access;
- Parking cash out/parking pricing;
- Formation of a Transportation Management Association (TMA) in partnership with other developments in the area;
- Adoption of an aggressive trip reduction target with a Lead Agency monitoring and enforcement program;
- Transit fare incentives such as such as free or discounted transit passes on a continuing basis;
- Public-private partnerships or employer contributions to provide improved transit or shuttle service in the project area.

Connectivity and Transit Access

Given the limited roadway access to and from the project area, VTA recommends that the project increase roadway, transit, pedestrian and bicycle connectivity in the area. Potential improvements could include additional bridges across Lafayette Street and Tasman Drive, new routes to access Highway 237, and additional transit connections. VTA recommends that the new north/south roadway planned for the portion of the development east of Lafayette Street be configured to provide future through-connectivity to Calle Del Sol and the Lick Mill light rail station when the area redevelops. In addition, given the intensification of uses in the area VTA may in the future consider providing bus service on Lafayette Street, and would like to work with the City and the applicant to ensure that the design of the development does not preclude transit access on this street.

Potential Transit Improvements

Based on the size of the City Place Santa Clara Project and other projects in the area, VTA recommends that the DEIR and TIA analyze anticipated transit demand and capacity in the

project vicinity. This analysis should refer to the guidance in Chapter 12 – Special Project Types in the *VTA TIA Guidelines.*

Improvements to transit service may be necessary to accommodate the increased transit demand in the area. VTA is open to engaging in dialogue with the City about how to make transit successful in the area, as an effective measure to reduce automobile travel. VTA already has projects planned that will improve transit service to the area, including a direct light rail transit (LRT) connection with future BART service. VTA recommends that the City consider project contributions to transit improvements in the project area, such as:

- Construction of a new bus transfer center within the project vicinity in coordination with VTA. VTA notes that this would also provide a central area for bus staging during Levi's Stadium events and would significantly benefit transit and traffic operations in the area on game-days as well as non-game-days;
- Fencing the light rail tracks along Tasman Drive, consistent with City commitments, to enhance safety and increase speeds;
- Access improvements and double-tracking of the Santa Clara Great America ACE/Capitol Corridor train station, in coordination with Union Pacific Railroad.

VTA's *Transit Sustainability Policy & Service Design Guidelines* (TSP/SDG), adopted by the VTA Board in February 2007, contain information about ridership performance standards and land use density targets for considering potential service changes. VTA notes that any future decision to potentially increase transit service in the area would rest with the VTA Board and would be evaluated based on sufficient transit demand among other factors.

<u>Pedestrian and Bicycle Accommodations</u>
The project should provide exceptional pedestrian and bicycle accommodations, both internally and along arterial roadways surrounding the site, to showcase the development's role as Santa Clara's "new downtown" and accommodate the high volumes of trips expected to, from and within the site. VTA recommends, at a minimum, the inclusion of bike lanes, wide sidewalks and buffer strips between pedestrians and automobiles with consistent street trees. Resources on quality of service, such as the Highway Capacity Manual 2010 Pedestrian and Bicycle Level of Service methodologies, indicate that such accommodations improve perceptions of comfort and safety on a roadway.

Given the location of the project in close proximity to destinations such as Levi's Stadium and the future Centennial Gateway Project, VTA recommends that this analysis of pedestrian and bicycle modes in the DEIR and TIA consider the high volumes of pedestrian and bicycle trips expected to and from the site. This analysis should refer to the guidance in Chapter 12 – Special Project Types in the *VTA TIA Guidelines*. VTA notes that high volumes of pedestrians and bicyclists crossing Tasman at this location could potentially degrade transit operations, including transit trips serving Levi's Stadium and City Place. If the analysis shows that the demand for pedestrian and bicycle travel through the area will exceed capacity, VTA recommends that the City consider measures to improve pedestrian and bicycle facilities to increase capacity and improve safety, such as providing a grade-separated bicycle/pedestrian crossing of Tasman Drive as a project feature or mitigation measure.

VTA recommends that the project provide abundant conveniently located bicycle parking. Bicycle parking facilities can include bicycle lockers or secure indoor parking for all-day storage and bicycle racks for short-term parking. VTA's Bicycle Technical Guidelines provide guidance for estimating supply, siting and design for bicycle parking facilities. This document may be downloaded from http://www.vta.org/projects-and-programs/planning/bikes-bicycle-technical-guidelines-btg.

Vehicle Miles Traveled (VMT) Analysis

VTA recommends the inclusion of a vehicle miles traveled (VMT) analysis in the transportation section of the DEIR and TIA, in light of recent state legislation.

Access to Santa Clara Great America Train Station

A preliminary diagram of access improvements in the project vicinity shared with a VTA Working Group on 8/13/2014 show new slip ramps from Tasman Drive into a new parking garage to be constructed as part of the Centennial Gateway project. The placement of this parking garage directly adjacent to the Santa Clara Great America train station, along with potential new slip ramps adjacent to the station, has the potential to negatively impact the experience of pedestrians walking to and from the train station. In order to foster an attractive and welcoming environment for passengers arriving to the area via the train station, including Levi's Stadium event attendees, VTA recommends that the City work with the applicants of the City Place and Centennial Gateway projects to consider alternative sites for the parking garage and/or design features to improve the pedestrian connection to the train station.

CMP Facilities

Based on the size and location of the project, there may be impacts to one or more Congestion Management Program (CMP) facilities, including freeway segments and CMP intersections. If the transportation analysis in the DEIR indicates that there will be significant impacts according to CMP standards, VTA suggests early coordination with the appropriate agencies to identify potential mitigation measures and voluntary contribution opportunities based on the transportation projects included in *Plan Bay Area* in the project vicinity, such as SR 237 Express Lanes Phase II and/or US 101 Express Lanes.

County of Santa Clara

Department of Environmental Health

1555 Berger Drive, Suite 300
San Jose, California 95112-2716
(408) 918-3400
www.EHinfo.org

August 27, 2014

City of Santa Clara
Attn: Debby Fernandez
1500 Warburton Ave.
Santa Clara, CA 95050

RE: File #PLN2014-10440 – City Place Santa Clara – NOP Evaluation

Dear Ms. Fernandez:

The County of Santa Clara Department of Environmental Health (DEH) received a Notification of Preparation (NOP) from the City of Santa Clara that an EIR is being prepared for the above project and was requested to provide input on the scope of environmental analysis to be performed. There has been only conceptual model information presented to the LEA to date. There have been very few details on the project and the LEA can only comment on those aspects of the project that we know about. We cannot provide specific comments on those aspects we have not seen.

Our Department has been designated by California's Department of Resources Recycling and Recovery (CalRecycle) as the Local Enforcement Agency (LEA) to oversee solid waste facilities per Title 14 and Title 27 of the California Code of Regulations. These regulations for closed landfills were basically promulgated with the idea of minimal use of the closed landfill along the lines of non-irrigated open space, not a full blown urban development. The City Place proposed project of 8.34 million gross square feet of office buildings, retail and entertainment facilities, residential units, and hotel rooms up to a height of 17 stories tall on a 230-acre site is a project of such a magnitude, that Title 14 and Title 27 does not specifically address all of the detailed engineering controls necessary to protect health and safety. This project is likely to be one of the largest mixed use developments ever considered on a closed landfill.

With this in mind, DEH has the following inputs on the scope of the environmental analysis:

1. *Hazards and Hazardous Materials (7).* This property is primarily a closed landfill containing several million tons of mixed municipal solid waste. Any structure proposed or any alteration of the existing use must be reviewed and approved by two agencies within the California Environmental Protection Agency and DEH. We will determine compliance with the pertinent regulations concerning the threats of methane and other

landfill gases as well as the exposure to leachate liquids. The project must protect the integrity of the closed landfill, as well as prevent the movement of hazardous landfill waste byproducts away from the existing containment area. A significant part to consider is the feasibility of ongoing monitoring to insure the integrity of the landfill and its infrastructure, as well as to monitor the gas collection system sensors and alarms that will be placed under and inside of every building structure. This needs to be mentioned and studied as an ongoing long term fiscal impact to the city, as the owner of the land, and the developer as owner of the buildings. Furthermore, we request for analysis, the feasibility of a joint powers hazard assessment district, or a similar singular entity, that would have the authority to manage and be responsible for overseeing all landfill requirements and associated costs. Another necessary feature for analysis would be a monitoring network system of connected alarms and sensors which can be accessed from a central location computer that has links for monitoring landfill gas compliance. We would also assert that financial impacts upon regulatory agencies be evaluated regarding long term regulatory oversight. Currently quarterly inspections of the landfill and the gas mitigation systems throughout the project are required to be conducted; we request an evaluation of whether or not this frequency will be feasible and adequate. In addition, the costs for the City/Operator regarding testing, repairing and calibration of the methane monitoring system should be analyzed as an ongoing expense for the city and developer. Lastly, subsurface fires can occur in old landfills. We request an evaluation of how this risk will be addressed in regards to prevention, control and post-fire repair and maintenance.

2. *Geology and Soils (5).* Any new structure for parking, or the trenching and drilling that is proposed below the existing landfill surface, such as excavations under the podium foundations could result in exposing waste. The EIR should clearly describe the extent and estimated depth of any below grade excavations, such as for parking garages under the buildings or pedestal foundations, which could potentially intercept soil lenses containing landfill gases or leachate liquids, or disturb the integrity of the clay cap and liner soil for the landfill.
3. *Alternatives (17).* The biggest concern from a regulatory standpoint is the proposal for residential development directly over a landfill. This has never been done in California at such a large scale as this project and should be a main item of analysis. The prospect of families living over buried tons of decomposing waste will require the most careful attention to every detail of safeguards before approval can be granted. There can be a myriad of health and safety risks associated with long term exposures to hazardous gases, infrastructure breakdown due to differential settlement of the ground beneath the development, and underground fires, to name a few. In addition, according to CalRecycle's History and Potential Hazards of Closed Landfill Development (2007) there is a record of engineering failures over landfills with smaller sized developments. Thus, we request that this EIR examines other alternatives, such as clean closure and removal

of all waste below the residential/commercial development areas. We would also request that an evaluation be made as far as the lowest risk areas for residential development.

4. *Utilities and Service Systems (15).* For this project it will be critical to analyze how the several underground utilities (electricity, water, sewer, etc.) will be properly secured throughout the area to avoid breakage of these underground utilities as the waste decays and differentially settles. Pedestal style foundations anchored in bay muds may possible settle under the massive weight of the project over time and should be evaluated. Similarly, the installation of underground piping on the landfill mass will undoubtedly settle over time and will break off of the foundations without proper engineering controls and long lasting flex connections. This issue needs to be evaluated as a serious long term potential impact. Lastly, inspection and maintenance access to any of these underground utilities should also be described and evaluated.

The LEA, CalRecycle, BAAQMD and the RWQCB are Responsible Agencies for this project. The City, as lead agency, should consider all the concerns and comments to allow proper project evaluation. Please send to us any Initial Studies, Draft and Final EIR, or any supporting documentation for this project.

We appreciate the opportunity to provide input and comment on the scope of environmental analysis. We value working together in addressing the concerns for potential risks this project poses for the environment and the community.

If you have any questions, please feel free me (408) 918-1964 or Stan Chau at (408) 918-1961. I can also be reached at chris.rummel@deh.sccgov.org

Sincerely,

Chris Rummel

Chris Rummel
Acting Program Manager
Solid Waste Programs
Hazardous Materials Compliance Division

Cc: Alfred Worcester, Calrecycle, Alfred.worcester@calrecycle.ca.gov
Devender Narala, RWQCB, Devender.narala@waterboards.ca.gov

Letter of Transmittal

SANTA CLARA
UNIFIED SCHOOL DISTRICT

Date: August 28, 2014

To:

Debbie Fernandez
City of Santa Clara
Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

From:

Michal Healy
Santa Clara Unified School District
Bond Project Office
1889 Lawrence Road
Santa Clara, CA 95051
408.423.2085

Ms. Fernandez,

Attached is the Santa Clara Unified School District's response to the Notice of preparation for the CEQA EIR for City Place Santa Clara, PLN2014-10440.

Please contact me with any questions.

Michal Healy

SANTA CLARA UNIFIED SCHOOL DISTRICT

1889 Lawrence Rd.
Santa Clara, CA
95051
(408) 423-2000
STANLEY ROSE III, Ed.D.
SUPERINTENDENT

August 28, 2014

Debbie Fernandez
Associate Planner
City of Santa Clara
1500 Washburn Avenue
Santa Clara, CA 95050

RE: NOP for EIR; City Place Santa Clara Project: PLN2014-10440

Dear Ms. Fernandez,

The Santa Clara Unified School District appreciates the opportunity to provide input for the CEQA Environmental Impact Report (EIR) for this proposed development. The location of the development is very close to Kathryn Hughes Elementary School and the health and safety of all students is paramount. The project has several impacts to schools the EIR should consider.

Students are extremely sensitive receptors to pollution and the air quality around the school can have a significant effect on students' health. The increased traffic congestion, construction equipment, and ongoing airborne contaminants due to the project should be studied relative to the proximity of the school. An Air Health Risk Assessment is suggested for emissions to ensure levels are not significant for students, parents and faculty. The increase in vehicle trips may also affect the transportation and safety of students to and from the elementary school.

The new housing units will increase the student count at all grade levels. The new development will also attract new employees to the area and every 1,664 square feet of commercial or industrial development creates the need for one additional housing unit in the Santa Clara area for new employees of the businesses. The District's schools do not have the capacity to accommodate the students from these homes until new schools are built.

Based on the current estimated cost of building new elementary, middle, and high schools, we request the above developments mitigate their impact on the District by paying the full mitigation amount per square foot of residential and commercial/industrial construction.

The Santa Clara Unified School District is requesting a Health Risk Study, an analysis of the Safe Routes to and from School and the developers work with the District to mitigate these impacts related to additional classrooms and/or schools. The District will likely submit additional comments when the EIR document is circulated. Please contact Michal Healy, mhealy@scusd.net with any questions.

Sincerely,

Mark Allgire, CPA, Assistant Superintendent, Business Services

MA:mh

BOARD OF EDUCATION

INA K. BENDIS
JIM CANOVA
ALBERT GONZALEZ
CHRISTINE KOLTERMANN
ANDREW RATERMANN
MICHELE RYAN
CHRISTOPHER STAMPOLIS

"The mission of Santa Clara Unified School District is to prepare students of all ages and abilities to succeed in an ever-changing world."

SANTA CLARA VALLEY
HABITAT AGENCY

City of Gilroy | City of Morgan Hill | City of San José | County of Santa Clara | Santa Clara Valley Water District | Santa Clara Valley Transportation Authority

RECEIVED
SEP 03 2014
PLANNING DIVISION

September 7, 2014

Ms. Debby Fernandez
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050

Subject: City Placer Project, Notice of a Draft Environmental Impact Report, SCH #2014072078, City and County of Santa Clara

Dear Ms. Fernandez:

This letter is in response to the notice of Preparation (NOP) of a draft Environmental Impact Report (EIR) for the City Place Project (Project). The Santa Clara Valley Habitat Agency, as a responsible public agency tasked with conserving natural communities and the recovery of state and federal special status species covered by the Santa Clara Valley Habitat Plan (Plan), wishes to bring to the Lead Agency's (City of Santa Clara) attention Project impacts that could detrimentally effect the Santa Clara Valley Habitat Agency's ability to implement several of the Plan's conservation goals and objectives. In particular, direct impacts to Western burrowing owl breeding and foraging habitat, and cumulatively through Project generated vehicle miles traveled and the resulting nitrogen deposition on local serpentine grasslands from those same Project generated vehicle miles traveled.

The Project site is located on five large City-owned parcels (APNs: 104-03-036, 104-03-037, 104-01-1 02, 097-01-039, and 097-01-073) totaling approximately 230 acres. Construction of City Place would include up to 8.34 million gross square feet of office buildings, retail and entertainment facilities, residential units, hotel rooms, new roads, associated parking, and new upgraded and expanded infrastructure. Local burrowing owl biologists have observed owls foraging on the golf course, nesting on the slope of Tasman Drive near the golf course, under the sidewalk along Centennial, and on a PG&E berm at the end of Centennial.

Nesting burrowing owls in the greater San Francisco Bay area and the South Bay area in particular, are a dwindling resource. In the early 1990s there were an estimated 150–170 breeding pairs in the San Francisco Bay area (DeSante and Ruhlen 1995;

DeSante et al. 1997). It was estimated that these numbers represented a 53% decline from the previous census period of 1986–1990 (DeSante et al. 1997) and more recent numbers indicate that, if anything, the downward trend is increasing. In those estimates it was assumed that 75% of the San Francisco Bay area burrowing owl population occurred in Santa Clara County and nearly all of those owls were congregated around the southern edge of the San Francisco Bay (DeSante et al. 1997). Surveys in the early 1990s revealed that about a third (43–47 pairs) of Santa Clara County breeding pairs occurred inside what is now the Santa Clara Valley Habitat Plan study area (City of San José 2000).

The Plan proposes to undertake a suite of measures aimed at reversing the declining trend of the burrowing owl population in Santa Clara County. The conservation goal of the Plan, as implemented by these measures, is to establish a burrowing owl population in the Santa Clara County that is first stable, then increasing over time, while accounting for normal fluctuations in population levels. The general approach will be to increase the numbers, distribution, and connectivity of burrowing owl colonies in the permit area so that the potential for conservation success is high. The Project site, which could support burrowing owls, is adjacent to known occurrences and part of the remaining burrowing owl breeding and foraging areas along Highway 237. The proposed Project site is critical to the survival of the local population and loss of these five parcels is a significant impact to western burrowing owl long-term survivability in Santa Clara County. The Project, unless mitigation measures are identified in the Project EIR offsetting Project impacts, will undermine the Plan's conservation strategy is to increase the size and sustainability of the breeding population and increase the distribution of breeding and wintering burrowing owls in the Santa Clara County. Moreover, the predicted increase in local and regional vehicular traffic due to the Project may also result in increased disturbance in the area and resulting loss of burrowing owl from vehicular collisions.

In addition to burrowing owl impacts, nitrogen deposition cumulative impacts on the local serpentine grassland community associated with the Project could be significant. The serpentine grassland community is the focus of Plan preservation and enhancement actions to offset the effects of nitrogen deposition on this community.

Atmospheric nitrogen deposition is a complex process by which reactive chemical species of nitrogen (N)—nitrogen oxides (NOX), ammonia (NH3), and their reaction

products – are deposited onto surfaces and enter ecosystems as N-fertilizer. N-deposition estimates (from varied studies) for the Santa Clara Valley range from 8–20 kilograms of nitrogen per hectare per year (kg-N/ha/y). In Santa Clara County, N-deposition threatens serpentine grasslands that support numerous covered species, including the threatened Bay checkerspot butterfly (Euphydryas editha bayensis). The added N allows nutrient-poor serpentine soils to be invaded by non-native annual grasses that displace the native forbs that provide caterpillar food and adult nectar for the butterfly. N-deposition is the largest indirect impact of urban development on the serpentine grassland ecosystem.

The effects of N-deposition on non-serpentine annual grasslands and the grassland understory of oak woodlands are similar to those on serpentine grassland—increased annual grass growth displaces native forbs. Non-serpentine annual grasslands and oak woodlands in the study are extensive (310,875 acres, or 60% of the Plan area), so these adverse effects could be widespread. Although an indirect effect, the impacts from new development like City Place on the local serpentine grassland communities is significant.

Thank you for this opportunity to comment at this early stage of the environmental review process. If you have any questions, please feel free to contact me at (408) 779-7265 or edmund.sullivan@scv-habitatagency.org.

Sincerely,

Edmund Sullivan,
Executive Officer

References

City of San José. 2000. Burrowing Owl Habitat Conservation Strategy and Implementation Plan. Draft Final Report. April. Department of Planning, Building and Code Enforcement. Prepared by Albion Environmental, Inc. San José, CA.

DeSante, D.F. and E.D. Ruhlen. 1995. *A Census of Burrowing Owls in California, 1991–1993.* Point Reyes Station, CA: Institute for Bird Populations.

DeSante, D.F., E.D. Ruhlen, and R. Scalf. 2007. The distribution and relative abundance of burrowing owls in California during 1991–1993: Evidence for a declining population and thoughts on its conservation. Pages 1–41 *in* Barclay, J.H., K.W. Hunting, J.L. Lincer, J. Linthicum, and T.A. Roberts (Eds.). 2007. *Proceedings of the California Burrowing Owl Symposium, November 2003.* Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc. Point Reyes Station, CA, vii + 197 pp.

DeSante, D.F., E.D. Ruhlen, S.L. Adamany, K.M. Burton and S. Amin. 1997. A census of burrowing owls in central California in 1991. Pages 38–48 *in* Lincer, J.L. and K. Steenhof. (Eds.). 1997. *The Burrowing Owl, its Biology and Management: Including the Proceedings of the First International Symposium.* Raptor Research Report Number 9.

Debby Fernandez, Associate Planner
City of Santa Clara

September 8th, 2014

Re: Scoping comments Re: Notice of Preparation for the City Place Santa Clara Project, 5155 Stars and Stripes Drive

Dear Ms. Fernandez,

Santa Clara Valley Audubon Society, the Loma Prieta Chapter of the Sierra Club, the California Native Plant Society, Santa Clara Valley Chapter and the Citizens Committee to Complete the Refuge are local environmental organizations concerned with land use choices and their impact on our region's biological and natural resources. This letter provides our scoping comments for the proposed City Place Santa Clara Project (Project).

The project would utilize about 230 city owned acres which now support a golf and tennis club, BMX track, fire station and open space. The Project would build a very large development that would forever change the landscape of the City of Santa Clara and the Santa Clara Valley, including 8.34 million gross square feet of office buildings, retail and entertainment facilities, residential units and hotel, plus supportive parking, roads and infrastructure. Buildings would be constructed to a height of 17 stories above retail or parking structures. The Project is adjacent to two creeks: San Tomas Aquino and the Guadalupe River.

Please accept the following scoping comments:

1. Burrowing Owls
We believe that construction of the project has the potential to forever eliminate the recovery for this species in Santa Clara Valley.

Based on extensive surveys and best available science, the Santa Clara Valley Habitat Conservation Plan / Natural Communities Conservation Plan (HCP) identifies open spaces along Highway 237, including landfills and golf courses, as essential to the recovery of burrowing owls in Santa Clara County and the region. Parts of the Project site

have been historically set aside to mitigate impacts of previous City of Santa Clara projects on burrowing owls and thus should not be available to development.

While the City of Santa Clara is not a partner agency, the Project's properties are included in the Burrowing Owl Extended Study Area. The properties are included in Burrowing Owl nesting area fee zone (http://www.hcpmaps.com/habitat/).

The HCP includes detailed scientific study of burrowing owl populations in Santa Clara County and the South Bay, and it provides the most appropriate mitigation measures in a Burrowing Owl Recovery Strategy (Appendix M of the HCP).

Please provide analysis of the compatibility of the Project with the HCP. Please consider that since the Project consumes a portion of the land that the HCP expected to be used for the recovery of the species in the region, mitigation requirements for this Project should be set higher than those allowed in the HCP. Please do not consider mitigation outside of the immediate area, since such mitigation provides no benefits to burrowing owls locally or statewide.

2. Nitrogen deposition

Nitrogen is a powerful fertilizer that triggers growth among a wide variety of vegetation types. The fertilizer encourages invasive plant growth that crowds out native plants. The Wildlife Agencies and scientific researchers agree that vehicle exhaust includes nitrogen oxide that is airborne and then settles. A 2006 report from the California Energy Commission, *Impacts of Nitrogen Deposition on California Ecosystems and Biodiversity*, addressed the impacts of nitrogen deposition. Also, a notable number of applicable research studies have identified nitrogen deposition impacts for locations outside California including other parts of the world. The HCP provides state-of-the-art scientific analysis of the impacts of vehicular emissions, specifically nitrogen emissions, on sensitive species and habitat.

Nitrogen from vehicle exhaust that settles on the ground also negatively impacts other land cover types in Santa Clara County including California Annual Grassland, Northern Mixed Chaparral / Chamise Chaparral, Northern Coastal Scrub / Diablan Sage Scrub, Valley Oak Woodland, Mixed Oak Woodland and Forest, Blue Oak Woodland, Coast Live Oak Forest and Woodland, Foothill Pine - Oak Woodland, Mixed Evergreen Forest, Redwood Forest, Coastal and Valley Freshwater Marsh, Seasonal Wetland, and Pond habitat.

Serpentine land cover in Santa Clara County has been shown to experience adverse indirect impacts due to nitrogen deposition. This land cover type supports host plants of the threatened Bay checkerspot butterfly. As such, loss of serpentine vegetation results in loss of habitat for the butterfly, which is a violation of the federal Endangered Species Act. In the vicinity of the project area, nitrogen emission may impact grasslands (including land set aside for restoration of habitat for burrowing owl habitat and for preservation of the Congdon's Tar Plant at the San-Jose Santa-Clara Regional Waste Water Facility), vernal pool, wetland and marsh habitat (including the Don Edwards

National Wildlife Refuge near Alviso and the Warm Springs Unit, as well as the Salt Pond restoration Project, hosting a number of endangered species including but not limited to the California clapper rail and the salt marsh harvest mouse).
Please analyze impacts of nitrogen deposition to baylands, marshlands, grasslands, and serpentine soil habitats.

The traffic generated by the Project will add to the cumulative impacts of N-deposition on sensitive habitats. Please provide analysis of increased vehicle trips and vehicle miles traveled, and an estimate of NO_x and NH_3 emissions from those vehicle trips. Appropriate mitigations similar in scale to those provided for power plants and for the Santa Clara Valley Habitat Plan should be developed.

3. Impacts of glass surfaces on resident and migratory birds
Scientific studies show that collisions with glass surfaces kill 300 million to a billion birds in the country every year (Loss et. al. 2014, Hager et. al. 2013, attached). Attraction to lights causes additional mortality. A six-year study at the California Academy of Sciences estimates the toll at 54 birds per year – all at one building. It seems that many of the fatalities were fledging birds, with little experience of flight and with less agile navigation skill in their environment. The building that was monitored does not have expansive glass surfaces, so it is possible that buildings with more glazing would exert a higher toll. The California Academy of Sciences study (Jack Dumbacher, personal communication) as well as Hager et. al. 2013 (attached) show that spatial building configuration and building window area are primary concerns and should be considered in the design of buildings, landscaping and their configurations.

Please provide analysis of cumulative impacts to birds, and mitigate by requiring design criteria that avoid reduce light pollution impacts and the risk of collision. Please see:

- https://dl.dropboxusercontent.com/u/56352315/Bird-friendly Building engl.pdf
- http://www.abcbirds.org/abcprograms/policy/collisions/pdf/Bird-friendly_Building_Guide_WEB.pdf

4. Energy efficiency of glass building envelops
Please analyze energy expenditure associated with glass building envelops, and minimize the impact by requiring design criteria that reduce the expanses of glass. See attached:

- http://urbangreencouncil.org/high-cholesterol-buildings

5. Segmentation of CEQA review
The Centennial Gateway Mixed-Use Project at 5120 Stars and Stripes Drive and the City Place Santa Clara Project at 5155 Stars and Stripes Drive should be considered together because their cumulative impacts are likely to be synergistic, and because they would utilize the same infrastructure and services. Additionally, Water Supply Assessment should be prepared for both projects together.

We thank you for your consideration. Please put us on the notification list for any updates or public opportunities to participate and comment as the project moves forward.

Respectfully,

Shani Kleinhaus, Environmental Advocate
Santa Clara Valley Audubon Society

Mike Ferreira, Chapter Conservation Chair
Sierra Club Loma Prieta Chapter

Linda Ruthruff, Conservation Committee Chair
California Native Plant Society, Santa Clara Valley Chapter

Eileen McLaughlin, Board Member
Citizens Committee to Complete the Refuge

THE CONDOR
Ornithological Applications
www.cooper.org

Volume 116, 2014, pp. 8–23
DOI: 10.1650/CONDOR-13-090.1

RESEARCH ARTICLE

Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability

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Received October 9, 2013; Accepted October 17, 2013; Published January 2, 2014

ABSTRACT

Building collisions, and particularly collisions with windows, are a major anthropogenic threat to birds, with rough estimates of between 100 million and 1 billion birds killed annually in the United States. However, no current U.S. estimates are based on systematic analysis of multiple data sources. We reviewed the published literature and acquired unpublished datasets to systematically quantify bird–building collision mortality and species-specific vulnerability. Based on 23 studies, we estimate that between 365 and 988 million birds (median = 599 million) are killed annually by building collisions in the U.S., with roughly 56% of mortality at low-rises, 44% at residences, and <1% at high-rises. Based on >92,000 fatality records, and after controlling for population abundance and range overlap with study sites, we identified several species that are disproportionately vulnerable to collisions at all building types. In addition, several species listed as national Birds of Conservation Concern due to their declining populations were identified to be highly vulnerable to building collisions, including Golden-winged Warbler (*Vermivora chrysoptera*), Painted Bunting (*Passerina ciris*), Canada Warbler (*Cardellina canadensis*), Wood Thrush (*Hylocichla mustelina)*, Kentucky Warbler (*Geothlypis formosa)*, and Worm-eating Warbler (*Helmitheros vermivorum)*. The identification of these five migratory species with geographic ranges limited to eastern and central North America reflects seasonal and regional biases in the currently available building-collision data. Most sampling has occurred during migration and in the eastern U.S. Further research across seasons and in underrepresented regions is needed to reduce this bias. Nonetheless, we provide quantitative evidence to support the conclusion that building collisions are second only to feral and free-ranging pet cats, which are estimated to kill roughly four times as many birds each year, as the largest source of direct human-caused mortality for U.S. birds.

Keywords: anthropogenic mortality, Birds of Conservation Concern, individual residence, low-rise, high-rise, systematic review, window collision

Colisiones entre aves y edificios en los Estados Unidos: Estimaciones de mortalidad anual y vulnerabilidad de especies

RESUMEN

Colisones con edificios, en particular contra ventanas, presentan una amenaza antropogénica importante para las aves, y se estima que causan la muerte de entre 100 millón a mil millones de aves anualmente. Sin embargo, no existen estimaciones para los Estados Unidos que estén basadas en un análisis sistemático de datos provenientes de multiples fuentes. Revisamos datos publicados y tambien adquirimos bases de datos inéditos para cuantificar de una manera sistemática la mortalidad causada por colisones entre aves y edificios, y la vulnerabilidad de diferentes especies. Basado en 23 estudios, estimamos que entre 365 y 988 millones de aves (promedio = 599 millones) mueren anualmente como consecuencia de colisiones con edificios en los Estados Unidos, con aproximadamente 56% de la mortalidad en edificios de baja altura, 44% en residencias, y <1% en edificios de muchos pisos. Basado en >92,000 fatalidades registradas, y luego do controlar por abundancia poblacional y solapamiento de rango con area de estudio, identificamos varias especies que son desproporcionalmente vulnerables a colisiones con todos los tipos de edificio. Además, varias especies listadas nacionalmente como Aves de Interés para la Conservación debido a sus poblaciones en declive fueron identificadas como altamente vulnerables a colisiones, incluyendo *Vermivora chrysoptera*, *Passerina ciris*, *Cardellina canadensis*, *Hylocichla mustelina*, *Geothlypis formosa*, y *Helmitheros vermivorum*. La identificación de estas cinco especies migratorias con rangos geográficos restringidos a Norteamérica oriental y central refleja sesgos estacionales y regionales en la disponibilidad de datos actuales disponibles de colisiones con edificios. La mayoría del muestreo ha ocurrido durante la época de migración y en el este de los Estados Unidos. Hacen falta investigaciones adicionales a través de estaciones y en regiones poco representadas par reducir este sesgo. Sin embargo, presentamos

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evidencia cuantitativa que apoya la conclusión que, como causa de mortalidad ligada derectamente a los humanos en los Estados Unidos, las colisiones con edificios son superados solamente por los gatos mascotas libres, los cuales matan aproximadamente cuatro veces la cantidad de aves anualmente.

Palabras clave: mortalidad antropogénica, Aves de Interés para la Conservación, residencia particular, edificio de baja altura, edificio de muchos pisos, revisión sistemática, colisión con ventana

INTRODUCTION

Collisions between birds and man-made structures, including communication towers, wind turbines, power lines, and buildings, collectively result in a tremendous amount of bird mortality. Buildings are a globally ubiquitous obstacle to avian flight, and collisions with buildings, especially their glass windows (Figure 1), are thought to be a major anthropogenic threat to North American birds (Klem 1990a, 2009, Machtans et al. 2013). Estimates of annual mortality from building collisions range from 100 million to 1 billion birds in the United States (Klem 1990a, Dunn 1993) and from 16 to 42 million birds in Canada (Machtans et al. 2013). This magnitude of mortality would place buildings behind only free-ranging domestic cats among sources of direct human-caused mortality of birds (Blancher 2013, Loss et al. 2013).

Research on bird–building collisions typically occurs at individual sites with little synthesis of data across studies. Conclusions about correlates of mortality and the total magnitude of mortality caused by collisions are therefore spatially limited. Within studies, mortality rates have been found to increase with the percentage and surface area of buildings covered by glass (Collins and Horn 2008, Hager et al. 2008, 2013, Klem et al. 2009, Borden et al. 2010), the presence and height of vegetation (Klem et al. 2009, Borden et al. 2010), and the amount of light emitted from windows (Evans Ogden 2002, Zink and Eckles 2010). In the most extensive building-collision study to date, per-building mortality rates at individual residences were higher in rural than urban areas and at residences with bird feeders than those without feeders (Bayne et al. 2012). However, compared with larger buildings in urban areas (e.g., skyscrapers and low-rise buildings on office and university campuses), detached residences appear to cause lower overall mortality rates and relatively high amounts of mortality during non-migratory periods (Klem 1989, Dunn 1993, O'Connell 2001, Klem et al. 2009, Borden et al. 2010, Machtans et al. 2013).

FIGURE 1. A Swainson's Thrush killed by colliding with the window of a low-rise office building on the Cleveland State University campus in downtown Cleveland, Ohio. Photo credit: Scott Loss

Despite the apparently large magnitude of bird–building collision mortality and the associated conservation threat posed to bird populations, there currently exist no U.S. estimates of building-collision mortality that are based on systematic analysis of multiple data sources. The most widely cited estimate (100 million to 1 billion fatalities per year) was first presented as a rough figure along with qualifications (Klem 1990a) but is now often cited as fact (Best 2008). Assessment of species-specific vulnerability to collisions is also critical for setting conservation priorities and understanding population impacts; however, existing estimates of species vulnerability are limited in spatial scope. In the most systematic U.S. assessment of building collisions to date, species vulnerability was calculated using data from only three sites in eastern North America, but vulnerability values from this limited sample were used to conclude that building collisions have no impact on bird populations continent-wide (Arnold and Zink 2011, but see Schaub et al. 2011, Klem et al. 2012).

We reviewed the published literature on bird–building collisions and also accessed numerous unpublished datasets from North American building-collision monitoring programs. We extracted >92,000 fatality records—by far the largest building collision dataset collected to date—and (1) systematically quantified total bird collision mortality along with uncertainty estimates by combining probability distributions of mortality rates with estimates of numbers of U.S. buildings and carcass-detection and scavenger-removal rates; (2) generated estimates of mortality for different classes of buildings (including residences 1–3 stories tall, low-rise non-residential buildings and residential buildings 4–11 stories tall, and high-rise buildings ≥12 stories tall); (3) conducted sensitivity analyses to identify which model parameters contributed the greatest uncertainty to our estimates; and (4) quantified species-specific

vulnerability to collisions across all buildings and for each building type.

METHODS

Literature Search

We searched Google Scholar and the Web of Science database (using the Web of Knowledge search engine) to locate peer-reviewed publications about bird–building collisions. We used the search terms "bird window collision" and "bird building collision" and both terms with "bird" replaced by "avian." We checked reference lists and an annotated bibliography (Seewagen and Sheppard 2012) to identify additional studies. Data from collision-monitoring programs were located using a Google search with the term "window collision monitoring program" and by contacting program coordinators listed on project websites. We cross-checked the datasets we found with a comprehensive list of "Lights Out" programs provided by C. Sheppard. Additional unpublished datasets were located based on our knowledge of ongoing studies presented at professional conferences or in published abstracts. Finally, we learned of unpublished datasets when contacting first authors of published studies; these additional datasets were either more extensive versions of authors' published datasets, completely new datasets, or in one case, a dataset from an independent citizen scientist.

Inclusion Criteria and Definition of Fatality

Different studies employed different sampling designs and data collection protocols. To reduce this variability, to ensure a baseline for the rigor of studies we used, and to minimize bias in our analyses, we implemented inclusion criteria to filter data at both the study and record levels. Inclusion criteria were different for the analyses of total mortality and species vulnerability. As a first step, we only included studies for in-depth review if they were conducted in the U.S. or Canada and provided original data on bird–building collisions. We implemented study-level inclusion criteria for the estimate of total mortality as follows. We excluded studies that were based on sampling at a single structure; these studies often focus only on unique building types with non-representative mortality rates (e.g., museums, convention centers, or exceptionally tall high-rises). We included datasets that were based on systematic carcass surveys or systematic surveys of home-owners, but we excluded those that were based on sampling in response to predicted building kills, incidental observations, opportunistically sampled collections, or undocumented methods. Because estimating per-building mortality rates was a major component of the mortality estimate, we also excluded studies if they did not record numbers of buildings monitored or provide street addresses of buildings that would have allowed us to estimate numbers of buildings.

Because the species vulnerability analysis was based on count proportions rather than on per-building mortality rates, we implemented a different set of inclusion criteria than that used for the total mortality estimate. This resulted in the use of some studies that were excluded from the total mortality estimate. Studies were only included in the species analysis if they identified carcasses to species. We excluded studies documenting fewer than 100 collision records because proportions based on small samples are more likely to be abnormally high or low. As with the total mortality estimate, we excluded data that were based on incidental or opportunistic sampling or undocumented methods. However, we did include studies even if data were based on sampling of a single structure or if we could not determine the number of buildings sampled. Thus, we assume that species composition within a site is independent of the number of buildings sampled. The study-level inclusion criteria resulted in 23 and 26 datasets used for the total mortality and species vulnerability estimates, respectively (Table 1). Seven studies were excluded from all analyses (Table S1 in Supplemental Material Appendix A).

Many datasets include some collision records that were collected during standardized surveys and others found incidentally. In addition, definitions of fatalities differ among studies. We therefore applied inclusion criteria to filter individual records and set our own definition of what constitutes a fatality. The record-level inclusion criteria were the same for all of our analyses. We excluded records clearly denoted as incidental finds (i.e. not collected during surveys), records with a disposition of "alive" or "survived," and records of released birds. We also excluded records of blood and/or feather spots on windows with no carcass found. From the remaining records, we defined fatalities to include any record with a disposition including "dead," "collected," or any disposition indicating severe injury (e.g., "disabled," "squashed," "fracture," or "injured"). All other records were considered to have unknown disposition (e.g., "stunned," "exhausted," "weak," "dis-oriented," or any disposition indicating a bird was sent to rehabilitation) and were excluded from all analyses. The record-level criteria resulted in 92,869 records that we used to generate total mortality and species vulnerability estimates. It was not possible to confirm whether fatalities were caused by collisions with windows or with other non-reflective portions of buildings; therefore, for the purposes of this study, we treated all records as building–collision fatalities. Nonetheless, the majority of bird mortality at buildings likely occurs due to collision with windows or other reflective surfaces (Klem 2009).

TABLE 1. Sampling coverage, number of buildings sampled, and mortality rates documented in studies meeting inclusion criteria for estimation of total annual U.S. mortality from bird–building collisions and/or calculation of species-specific collision vulnerability.

Building class	Location	Year-round sampling?	Used for mortality estimate?	Used for vulnerability analysis?	Buildings sampled	Mortality per building		Study
						Average	Range	
Residences (1–3 stories)	Alberta	Yes	Yes	No[c]	1,747	0.7	0–43	Bayne et al. 2012
	U.S. & Canada	No	Yes	Yes	1,165	0.85	0–21	Dunn 1993
	Duluth, MN	No	Yes	Yes	42	2.3[f]	?	Bracey 2011
	Illinois	Yes	Yes	No[c]	242	1.5	?	Weiss & Horn 2008
	Carbondale, IL	Yes	No[a]	Yes[h]	1	33.0	NA	Klem 1979
	Purchase, NY	Yes	No[a]	Yes[h]	1	26.0	NA	Klem 1979
Low-rises	Richmond, VA	Yes	Yes	Yes	4	29.0	21–38	O'Connell 2001
	Cleveland, OH	Yes	Yes	Yes	18	15.1	?	Borden et al. 2010
	Elsah, IL	Yes	Yes	Yes	4	24.0	?	Hager et al. 2008
	Decatur, IL	Yes	Yes	Yes	11	7.5[f]	?	Collins & Horn 2008
	Washington, DC	No	Yes	Yes	21–38[e]	4.0	1–30	Lights Out DC 2010–2012
	Rock Island, IL	No	Yes	No[d]	20	2.6	0.3–52.1	Hager et al. 2013
	Decatur, IL	No	Yes	No[d]	11	4.8	?	Horn personal communication
	Murray, KY	No	Yes	No[d]	13	1.6	0–7	Somerlot 2003
	Stillwater, OK	Yes	No[a]	Yes	1	32.0	NA	O'Connell personal communication
	Rock Island, IL	Yes	No[a]	Yes	1	54.8	NA	Hager et al. 2008
	Chicago, IL	No	No[a]	Yes	1	1,028.0[g]	NA	McCormick Place 1978–2012
	Rochester, MN	No	No[b]	Yes	?	?	?	Project Birdsafe Minnesota 2010–2011
	San Francisco, CA	Yes	No[a]	Yes	1	47.2[g]	NA	California Academy of Sciences 2008–2012
High-rises	Indianapolis, IN	No	Yes	Yes	48	3.3	1–14	Lights Out Indy 2009–2010
	Atlanta, GA	No	Yes	Yes	53	8.4	0–40	Sexton 2006
	Calgary, AB	No	Yes	Yes	15–36	5.5[g]	1–89	Collister et al. 1996, 1997, Booth & Collister 1998
	Baltimore, MD	No	Yes	Yes	16–48[e]	7.1[g]	1–81	Lights Out Baltimore 2008–2012
	Twin Cities, MN	No	Yes	Yes	118	3.0[g]	?	Project Birdsafe Minnesota 2007–2012
	New York, NY	No	Yes	Yes	17–31[e]	5.5[g]	1–52	Project Safe Flight New York 2009–2011
	Philadelphia, PA	No	Yes	Yes	10	13.2[g]	?	Pennsylvania Audubon 2008–2011
	Columbus, OH	No	Yes	No[d]	20[e]	1.4	0–5	Lights Out Columbus 2012
	Portland, OR	No	Yes	No[d]	21–44	1.0[g]	?	Bird Safe Portland 2009–2011
	Toronto, ON	No	Yes	Yes	74–194[e]	17.4[g]	1–535	Fatal Light Awareness Program 2000–2010
	Winston-Salem, NC	No	Yes	Yes	16	3.6[g]	0–10	Lights Out Winston-Salem 2011–2012
	Toronto, ON	No	No[a]	Yes	1	157.0	NA	Ranford & Mason 1969
	Chicago, IL	No	No[b]	Yes	?	?	?	Chicago Bird Collision Monitors 2002–2012
	Milwaukee, WI	No	No[b]	Yes	?	?	?	Wisconsin Night Guardians 2007–2011
	Toronto, ON	No	No[b]	Yes	?	?	?	Fatal Light Awareness Prog. 2007, 2011
	New York, NY	No	No[b]	Yes	?	?	?	Klem 2009

[a] Study excluded from total mortality estimate because sampling conducted at a single building.
[b] Study excluded from total mortality estimate because number of buildings sampled not recorded and no information provided to calculate this number.
[c] Study excluded from species estimates because species data not provided.
[d] Study excluded from species estimates because sample size <100.
[e] Number of buildings is an estimate based on the average of potential minimum and maximum (see text); range indicates year-to-year variation in number of buildings sampled.
[f] Mortality rate is corrected for scavenger removal and searcher detection rates.
[g] Mortality rate is an average per-building rate across all years of the study/monitoring program.
[h] Study used for species risk assessment for building class but not assessment across all building classes (sample size <100).

Data Extraction

We classified studies into three building classes thought to cause different mortality rates (Machtans et al. 2013) and for which data on the number of U.S. buildings is available. These classes include residences 1–3 stories tall (detached houses and multi-unit residences; hereafter, "residences"), low-rise non-residential buildings and residential buildings 4–11 stories tall (hereafter, "low-rises"), and high-rise buildings $\geq$12 stories tall (hereafter, "high-rises"). For unpublished data from downtown areas of major cities, we assumed that all data came from high-rises because it was not possible to determine building height without visiting each site. For all other data sources, we were able to confirm the building type from which data were collected. Published studies that met our inclusion criteria either reported an annual mortality rate per building (averaged across buildings) or presented both the number of dead birds found and the number of buildings sampled, thus allowing us to calculate this rate. For published studies, we extracted a single annual mortality rate for each study unless the study included data from more than one non-adjacent site, in which case we extracted a separate rate for each site (e.g., Klem 1979). For unpublished datasets that included the number of buildings sampled, we always extracted a single mortality rate. This value was generated by first calculating a single-year per-building mortality rate (averaged across buildings) for each year of the study and then averaging these rates across years. In some cases, we determined that two or more sources presented duplicate data when we observed that the data were collected at the same study sites and during the same range of dates. In these instances, we extracted the data from the source that provided more detailed methods or more extensive fatality data, and we excluded the duplicated data when extracting from the other source.

Data from collision-monitoring programs often include the street address or intersection where a carcass was found but not the number of buildings sampled. Single buildings can have more than one address, and a single address can include more than one building. In addition, some monitoring programs have no systematic protocol for recording addresses, resulting in multiple similar entries for an address (e.g., 1 Main, 1 Main St., and 1 Main—Smith Tower). To account for these issues, we entered addresses into Google Maps and used satellite view to determine if addresses referred to one or more buildings. If it was still unclear from mapping whether an address referred to one or more buildings, we assumed it referred to one. Likewise if we could not confirm that two or more similar addresses referred to one building, we assumed they were separate buildings. If addresses with different cardinal directions were possible (e.g., 1 Main E and 1 Main W), we assumed they referred to separate buildings, but if they were not possible (i.e. only 1 Main exists), we assumed data entry error and combined addresses.

Recognizing that these methods could not account for all duplicate addresses and data entry errors, we estimated a minimum and maximum number of buildings sampled in each year. We estimated a maximum number based on the number of unique addresses remaining after following the above steps and the assumption that intersections referred to a number of buildings equal to the number of carcasses found up to four (i.e. four or more carcasses may result from collision with four separate buildings, one at each intersection corner). We estimated a minimum number by combining similar addresses that may have been from one building, even if we could not confirm this with mapping, and assuming that all intersections referred to one building. We used the average of the minimum and maximum number to estimate per-building mortality rates.

Quantification of Annual Mortality from Building Collisions

The studies we used cover varying portions of the year, but most focus all or most of sampling effort on migration periods. Using raw per-building mortality rates would therefore result in a national estimate that is only relevant to spring and fall migration periods. We sought to account for partial-year sampling and to generate estimates that reflected the entire year, because several studies have indicated that building collision mortality can be substantial during summer and winter (Dunn 1993, Klem 2009, Bayne et al. 2012, Hager et al. 2013). Given enough year-round studies, partial-year mortality rates can be standardized to year-round estimates using year-round studies as a baseline (Longcore et al. 2012, Loss et al. 2013). However, there were few year-round studies that met inclusion criteria (Table 1), so we could not adjust individual studies to year-round estimates. Instead, we accounted for this limitation in our estimation model (details below) by only using a year-round study for residences, repeating estimation using a subset of studies that sampled year-round for low-rises, or incorporating a correction factor to account for mortality during periods other than migration for high-rises, a building type for which little data exists for summer and winter (see definition of and rationale for this correction factor in Supplemental Material Appendix B). Despite the limitation of applying a post hoc correction factor to the high-rise estimate, we argue that this approach is preferable to assuming that no mortality occurs during the summer and winter.

We estimated mortality in each building class by multiplying data-derived probability distributions of per-building mortality rates by distributions of numbers of buildings. For residences, we followed Machtans et al.

(2013), which based mortality rates on the only year-round building collision survey to date that sampled across a large number of residences, a study of 1,458 Alberta residents in single and multi-unit residences (Bayne et al. 2012). This study documented higher mortality rates at rural residences compared with urban residences and at residences with bird feeders compared with those without feeders. The study also documented increasing mortality with increasing age of urban residences. We incorporated these elements into our residence sub-model:

$$\begin{aligned}&\text{Mortality}_{\text{rural with feeder}}(M_{\text{RF}})\\&\quad = N_{\text{residence}} \times R \times F \times K_{\text{rural with feeder}} \times D_{\text{residence}}\end{aligned} \tag{1}$$

$$\begin{aligned}&\text{Mortality}_{\text{rural no feeder}}(M_{\text{RNF}})\\&\quad = N_{\text{residence}} \times R \times (1-F) \times K_{\text{rural no feeder}} \times D_{\text{residence}}\end{aligned} \tag{2}$$

$$\begin{aligned}&\text{Mortality}_{\text{urban with feeder}}(M_{\text{UF}})\\&\quad = N_{\text{residence(age)}} \times (1-R) \times F \times K_{\text{urban with feeder(age)}}\\&\qquad \times D_{\text{residence}}\end{aligned} \tag{3}$$

$$\begin{aligned}&\text{Mortality}_{\text{urban no feeder}}(M_{\text{UNF}})\\&\quad = N_{\text{residence(age)}} \times (1-R) \times (1-F)\\&\qquad \times K_{\text{urban no feeder(age)}} \times D_{\text{residence}}\end{aligned} \tag{4}$$

$$\begin{aligned}&\text{Mortality}_{\text{residences}}(M_{\text{R}})\\&\quad = M_{\text{RF}} + M_{\text{RNF}} + M_{\text{UF}} + M_{\text{UNF}}\end{aligned} \tag{5}$$

where N is the number of residences in the U.S., R is the percentage of residences in rural areas, F is the percentage of residences with bird feeders, K is the annual per-building mortality rate, and D is a correction factor to account for two biases that lead to underestimation of mortality (Hager et al. 2013): removal of carcasses by scavengers prior to fatality surveys and imperfect detection of the carcasses remaining at the time of surveys. For Equations (3) and (4), we calculated mortality by building age classes (0–8, 9–18, and 19–28 years, and all ages $\geq$29 years), and summed estimates across age classes. These age classes correspond closely to those in Machtans et al. (2013), but we shifted classes slightly (e.g., 9–18 years instead of 10–20 years) to match housing age data from the U.S. Census Bureau.

For low-rises, we generated two separate estimates of collision mortality, one using mortality rates based on all eight studies meeting our inclusion criteria and one based only on four year-round studies. We used the following sub-model for both estimates:

$$\text{Mortality}_{\text{low-rise}}(M_{\text{L}}) = N_{\text{low-rise}} \times K_{\text{low-rise}} \times D_{\text{low-rise}} \tag{6}$$

For high-rises, there are no datasets based on year-round systematic sampling. We incorporated a correction factor (Y) into the mortality estimation sub-model to account for additional fatalities occurring outside of migration periods:

$$\begin{aligned}\text{Mortality}_{\text{high-rise}}(M_{\text{H}}) = {}& N_{\text{high-rise}} \times K_{\text{high-rise}} \times Y\\&\times D_{\text{high-rise}}\end{aligned} \tag{7}$$

We estimated total annual building collision mortality by summing estimates for individual building classes; we conducted estimation twice, once using each of the low-rise estimates:

$$\text{Mortality}_{\text{total}} = M_{\text{R}} + M_L + M_{\text{H}} \tag{8}$$

All of the above parameters were treated as probability distributions. From the probability distribution of each parameter (see Table 2 for specific distributions, Supplemental Material Appendix B for rationale for all distributions, and Table S2 in Supplemental Material Appendix C for numbers of buildings), we randomly drew one value and used the above formulas. We used "runif" and "rnbinom" commands (for uniform and negative binomial distributions, respectively) in Program R and conducted 10,000 iterations to generate a range of estimate uncertainty.

Sensitivity Analysis

We used multiple linear regression analyses assuming a normal error distribution (function "lm" in Program R) to investigate the percentage of uncertainty in mortality estimate ranges explained by each model parameter (Blancher 2013, Loss et al. 2013). We treated the 10,000 mortality-estimate replicates as the values of the dependent variable and randomly drawn values of each parameter as values of predictor variables. We used partial R^2 values to interpret the percentage of variance in the estimate range explained by each parameter. We repeated this regression analysis four times: once for the total mortality estimate (including all parameters) and once for each of the three building class estimates (with each regression model only including the parameters relevant to that building class).

Quantification of Species Vulnerability

In addition to estimating total annual mortality, we calculated vulnerability for species and taxonomic groups. We followed Arnold and Zink (2011), who identified "super-collider" and "super-avoider" species using collision records from three unpublished datasets. We greatly expanded upon the earlier study by using 26 datasets from across North America (Table 1). All analyses described below were conducted across all datasets to estimate overall building collision vulnerability, as well as separately

TABLE 2. Probability distributions used to estimate total annual U.S. mortality from bird–building collisions. We defined uniform distributions for most parameters because not enough data exist to ascribe higher probability to particular values in the defined range. We defined negative binomial distributions for the low-rise and high-rise mortality rate distributions because they allowed the majority of probability density to match the confidence intervals indicated by the data while also allowing for a small probability of higher collision mortality rates, reflecting the exceptionally high mortality rates that have been documented at some low-rises and high-rises (see mortality rates in Table 1).

Parameter	Distribution type	Distribution parameters	Source
Residences (1–3 stories)			
Number of residences	Uniform	Varies by age (Supplemental Material Appendix C)	U.S. Census Bureau 2011
Percentage in urban areas	Uniform	Min = 72.6%; Max = 88.8%	U.S. Census Bureau 2012
Percentage with bird feeders	Uniform	Min = 15%; Max = 25%	Dunn 1993
Mortality rate			
Rural with feeders (all ages)	Uniform	Min = 2.17; Min = 4.03	Bayne et al. 2012, Machtans et al. 2013
Rural without feeders (all ages)	Uniform	Min = 0.98; Max = 1.82	Bayne et al. 2012, Machtans et al. 2013
Urban with feeders			
Age 0–8	Uniform	Min = 0.28; Max = 0.52	Bayne et al. 2012, Machtans et al. 2013
Age 9–18	Uniform	Min = 0.42; Max = 0.78	Bayne et al. 2012, Machtans et al. 2013
Age 19–28	Uniform	Min = 0.56; Max = 1.04	Bayne et al. 2012, Machtans et al. 2013
Age 29+	Uniform	Min = 0.63; Max = 1.17	Bayne et al. 2012, Machtans et al. 2013
Rural without feeders			
Age 0–8	Uniform	Min = 0.11; Max = 0.20	Bayne et al. 2012, Machtans et al. 2013
Age 9–18	Uniform	Min = 0.18; Max = 0.33	Bayne et al. 2012, Machtans et al. 2013
Age 19–28	Uniform	Min = 0.25; Max = 0.46	Bayne et al. 2012, Machtans et al. 2013
Age 29+	Uniform	Min = 0.28; Max = 0.52	Bayne et al. 2012, Machtans et al. 2013
Scavenging/detectability correction	Uniform	Min = 2; Max = 4	Dunn 1993
Low-rises			
Number of low-rises	Uniform	Min = 14.0 million; Max = 16.2 million	Multiple sources (see Supplemental Material Appendix C)
Mortality rate (all studies)	Neg. bin.	$n = 4.6$; $p = 0.35$	95% of distribution prob. density = 4–18[a]
Mortality rate (year-round studies)	Neg. bin.	$n = 5.1$; $p = 0.26$	95% of distribution prob. density = 5–28[b]
Scavenging/detectability correction	Uniform	Min = 1.28; Max = 2.56	Hager et al. 2012, 2013
High-rises			
Number of high-rises	Uniform	Min = 19,854; Max = 21,944	Sky Scraper Source Media 2013
Mortality rate	Neg. bin.	$n = 4.0$; $p = 0.37$	70% of distribution prob. density = 4–11[b]
Partial-year sampling correction	Uniform	Min = 1.05; Max = 1.20	Additional 5–20% mortality outside of migration
Scavenging/detectability correction	Uniform	Min = 1.37; Max = 5.19	Ward et al. 2006, Hager 2012, 2013

[a] Range represents 95% confidence interval of mortality rates calculated across all eight studies of low-rises meeting inclusion criteria.
[b] Range represents 95% confidence interval of mortality rates calculated from four year-round studies of low-rises meeting inclusion criteria.
[c] Range represents 95% confidence interval of mortality rates calculated from 11 studies of tall buildings meeting inclusion criteria.

for each building class to estimate class-specific vulnerability. As described previously, we only included datasets with more than 100 records for the overall vulnerability analysis. However, because there were only two datasets for residences that had more than 100 records, we also included two smaller datasets to calculate collision vulnerability for this building class.

Numbers of fatalities can vary among species due to population abundance and the degree of range overlap with study locations (Arnold and Zink 2011). To account for population abundance, we extracted national population size estimates from the Partners in Flight Population Estimates Database (Rich et al. 2004), which includes North American population estimates generated using U.S. Breeding Bird Survey data (Sauer et al. 2012). We used North American abundance rather than regional abundance because it is difficult to link study sites where mortality occurs to the affected regional subsets of bird populations, especially for species that are killed primarily during migration (Loss et al. 2012). To account for range overlap with study sites, we counted the number of sites overlapping with each species' breeding, wintering, and/or migration range (Sibley 2000). We followed Arnold and Zink's (2011) approach for calculating species vulnerability. To give each site equal weighting, we first standardized each dataset to 36,000, the largest single-site total

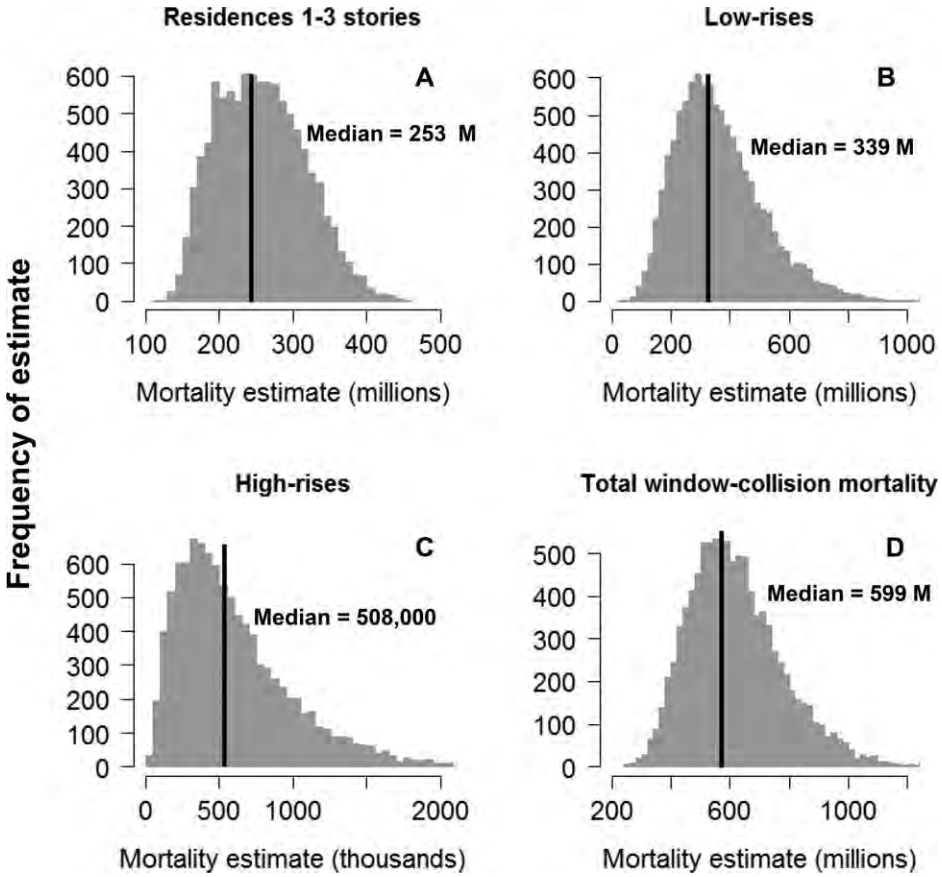

FIGURE 2. Frequency histograms for estimates of annual U.S. bird mortality caused by collisions with (**A**) residences 1–3 stories tall, (**B**) low-rises (residences 4–11 stories tall and all non-residential buildings $\leq$11 stories tall), (**C**) high-rises (all buildings $\geq$12 stories tall), and (**D**) all buildings. Estimates for low-rises and for all buildings are based on the average of two estimates: one calculated with all eight low-rise studies meeting inclusion criteria and one calculated with a subset of four low-rise studies that conducted year-round sampling.

number of fatalities, and then summed standardized counts across studies for each species. We regressed $\log_{10}(X+1)$ species counts ($X + 1$ transformation to account for zero counts for some species at some sites) on $\log_{10}$ population size and $\log_{10}$ range overlap. Vulnerability was estimated by fixing coefficients for population size and range overlap to 1.0 (this assumes that, for example, a 10-fold increase in abundance is associated with a 10-fold increase in collision mortality, all else being equal; Arnold and Zink 2011), calculating residuals, and raising 10 to the power of the absolute value of residuals. This approach of fixing model coefficients was taken because there was an unknown level of error in both the dependent and independent variables and, therefore, standard regression models could not produce unbiased slope estimates (Warton et al. 2006, Arnold and Zink 2011). Calculated vulnerability values indicate the factor by which a species has a greater chance (positive residuals) or smaller chance (negative residuals) of experiencing building collision mortality compared with a species with average vulnerability. We estimated vulnerability for taxonomic groups by averaging residuals across species occurring in at least two studies.

RESULTS

Estimates of Bird–Building Collision Mortality

The 95% confidence interval of annual bird mortality at residences was estimated to be between 159 and 378 million (median = 253 million) (Figure 2A and Table 3) after correcting for scavenger removal and imperfect detection. This equates to a median annual mortality rate of 2.1 birds per building (95% CI = 1.3–3.1). Reflecting the large number of residences in urban areas and residences without bird feeders, we estimate that urban residences without feeders cumulatively account for 33% of mortality at residences, followed by rural residences without feeders (31%), urban residences with feeders (19%), and rural residences with feeders (17%).

TABLE 3. Estimates of annual bird mortality caused by building collisions at U.S buildings. For low-rises (and therefore, for the total mortality estimate), we generated two separate estimates of collision mortality, one using mortality rates based on all eight low-rise studies meeting our inclusion criteria and one based on a subset of four low-rise studies that sampled mortality year-round.

		Point estimate		95% CI	
Building class	Mean no. of buildings in U.S.	Total	Per building	Total	Per building
Residences (1–3 stories)	122.9 million	253.2 million	2.1	159.1–378.1 million	1.3–3.1
Low-rises	15.1 million	245.5 million[a]	16.3[a]	62.2–664.4 million[a]	4.1–44.0[a]
		409.4 million[b]	27.1[b]	114.7–1,028.6 million[b]	7.6–68.1[b]
High-rises	20,900	508,000	24.3	104,000–1.6 million	5.0–76.6
Total	138.0 million	507.6 million[a]	3.7[a]	280.6–933.6 million[a]	2.0–6.8[a]
		667.1 million[b]	4.8[b]	349.9–1,296 million[b]	2.5–9.4[b]

[a] Estimate based on low-rise estimate using all eight studies meeting inclusion criteria.
[b] Estimate based on low-rise estimate using subset of four year-round studies meeting inclusion criteria.

The 95% confidence interval of annual low-rise mortality based on all studies meeting inclusion criteria was estimated to be between 62 and 664 million birds (median = 246 million). The 95% confidence interval based on the four year-round low-rise studies was estimated to be between 115 million and 1.0 billion birds (median = 409 million). The average of the two median figures is 339 million (95% CI = 136–715 million) (Figure 2B), equating to a median annual rate of 21.7 birds per building (95% CI = 5.9–55).

The 95% confidence interval of high-rise mortality was estimated to be between 104,000 and 1.6 million birds (median = 508,000) (Table 3 and Figure 2C) after correcting for scavenger removal, imperfect carcass detection, and mortality during periods other than migration. Despite causing the lowest total mortality, high-rises had the highest median annual mortality rate: 24.3 birds per building (95% CI = 5–76). Combining estimates from all building classes (using the average of the two low-rise estimates) results in an estimate of 599 million birds killed annually across all U.S. buildings (95% C.I. = 365–988 million) (Figure 2D).

Factors Explaining Estimate Uncertainty

Due to the large number of low-rises and uncertainty about low-rise mortality rates, sensitivity analyses indicated that the low-rise mortality rate explained a large amount of uncertainty for the estimates of both low-rise mortality (85%) and total mortality (75%). Other parameters explaining substantial uncertainty for the total estimate included the correction factors for scavenger removal and carcass detection at low-rises (10%) and residences (9%). For residences, 70% of uncertainty was explained by the correction factor for scavenging and detection and 15% was explained by the proportion of residences in urban areas. For the high-rise estimate, the greatest uncertainty was explained by the mortality rate (67%), followed by the correction factor for scavenging and detection (25%).

Species Vulnerability to Building Collisions

Of 92,869 records used for analysis, the species most commonly reported as building kills (collectively representing 35% of all records) were White-throated Sparrow (*Zonotrichia albicollis*), Dark-eyed Junco (*Junco hyemalis*), Ovenbird (*Seiurus aurocapilla*), and Song Sparrow (*Melospiza melodia*). However, as expected, there was a highly significant correlation between fatality counts and population size ($r = 0.53$, $P < 0.001$, df =213) and between counts and range overlap with study sites ($r = 0.25$, $P < 0.001$, df = 223). After accounting for these factors, estimated vulnerability across all buildings was highly variable, ranging from 1,066 times more likely to collide than average to 273 times less likely to collide than average (high vulnerability species in Table 4; all values in Tables S3–S6 in Supplemental Material Appendix D).

Several species exhibit disproportionately high vulnerability to collisions regardless of building type, including Ruby-throated Hummingbird (*Archilochus colubris*), Brown Creeper (*Certhia americana*), Ovenbird, Yellow-bellied Sapsucker (*Sphyrapicus varius*), Gray Catbird (*Dumetella carolinensis*), and Black-and-white Warbler (*Mniotilta varia*). Seven species that are disproportionately vulnerable to building collisions are national Birds of Conservation Concern and 10 are listed regionally (Table 4; U.S. Fish and Wildlife Service 2008). Species in the former group include Golden-winged Warbler (*Vermivora chrysoptera)* and Canada Warbler (*Cardellina canadensis*) at low-rises, high-rises, and overall, Painted Bunting (*Passerina ciris*) at low-rises and overall, Kentucky Warbler (*Geothlypis formosa*) at low-rises and high-rises, Worm-eating Warbler (*Helmitheros vermivorum*) at high-rises, and Wood Thrush (*Hylocichla mustelina*) at residences. For species with vulnerability indices calculated from a

TABLE 4. Estimates of species vulnerability to building collisions. Risk values indicate the factor by which species are at a greater risk of collision compared with a species with average risk. Species in boldface italics are Birds of Conservation Concern at the national level and species in boldface are Birds of Conservation Concern in at least one U.S. region (U.S. Fish and Wildlife Service 2008). Scientific names are in Supplemental Material Appendix D.

All buildings		Residences (1–3 stories)		Low-rises		High-rises	
Species	Risk	Species	Risk	Species	Risk	Species	Risk
Anna's Hummingbird[a]	1,066.4	**Purple Finch**	257.2	***Golden-winged Warbler***	141.7	Townsend's Solitaire	167.4
Black-throated Blue Warbler	45.5	Ruby-throated Hummingbird	174.7	***Painted Bunting***	129.3	Black-throated Blue Warbler	78.5
Ruby-throated Hummingbird	37.0	Ovenbird	112.1	Ruby-throated Hummingbird	103.7	Connecticut Warbler	52.0
Townsend's Solitaire	36.3	Brown Creeper	81.1	Black-throated Blue Warbler	86.4	Brown Creeper	44.3
Golden-winged Warbler	35.3	House Finch	80.1	Swamp Sparrow	50.6	Ovenbird	43.7
Painted Bunting	32.1	Black-and-white Warbler	68.7	***Canada Warbler***	46.7	Ruby-throated Hummingbird	43.4
Brown Creeper	26.2	Cedar Waxwing	50.5	**Louisiana Waterthrush**	46.4	***Worm-eating Warbler***	26.5
Connecticut Warbler	22.9	**Field Sparrow**	48.3	Brown Creeper	44.8	***Canada Warbler***	25.8
Ovenbird	21.8	***Wood Thrush***	41.0	**Yellow-bellied Sapsucker**	38.3	Gray Catbird	23.9
Canada Warbler	17.9	Swainson's Thrush	34.7	Connecticut Warbler	35.7	**Yellow-bellied Sapsucker**	23.7
Swamp Sparrow	16.7	Northern Cardinal	27.5	Ovenbird	30.4	***Golden-winged Warbler***	23.1
Yellow-bellied Sapsucker	16.2	Blue Jay	26.5	Sharp-shinned Hawk	27.8	American Woodcock	22.1
Louisiana Waterthrush	14.3	White-breasted Nuthatch	25.0	Rose-breasted Grosbeak	24.1	Common Yellowthroat	20.4
Gray Catbird	12.8	**Yellow-bellied Sapsucker**	22.6	Gray Catbird	23.2	Scarlet Tanager	18.5
Pine Grosbeak[a]	12.4	Northern Waterthrush	22.5	Black-and-white Warbler	22.7	Black-and-white Warbler	18.3
American Woodcock	11.7	Nashville Warbler	22.2	American Woodcock	21.1	Swamp Sparrow	18.1
Pygmy Nuthatch[a]	11.4	Gray Catbird	20.7	***Kentucky Warbler***	20.2	Rose-breasted Grosbeak	16.2
Black-and-white Warbler	11.1	**Northern Flicker**	20.2	Mourning Warbler	19.3	***Kentucky Warbler***	14.0
Pied-billed Grebe[a]	11.0	Downy Woodpecker	18.7	Common Yellowthroat	18.4	**Northern Goshawk**	13.6
Common Yellowthroat	10.9	Black-capped Chickadee	14.9	Cape May Warbler	16.7	**Eastern Whip-poor-will**	13.4

[a] Species is ranked for all buildings but not individual classes because it occurs in $\geq$2 total studies, but $<$2 studies within building class.

relatively small sample of studies (e.g., those noted with a superscript in Table 4), vulnerability indices may be biased. For example, the exceptionally high vulnerability value for Anna's Hummingbird (*Calypte anna*) likely results from this species occurring in only two studies and experiencing exceptionally high mortality in one of these studies.

Vulnerability estimates for taxonomic groups are in Table 5. Several high-risk bird groups are represented in our dataset by only one or two species (e.g., grebes, shorebirds, kingfishers, and gulls and terns); average risk values for these groups may not represent the entire taxonomic family. Other taxa, particularly the hummingbirds and swifts and the warblers, appear especially vulnerable to building collisions, with more than one species ranking in the overall high-vulnerability list. In particular, warblers experience disproportionately high collision risk, with 10 species ranking among the 25 most vulnerable species overall and 12 and 14 species ranking among the 25 most vulnerable species for low-rises and high-rises, respectively. Taxonomic groups with particularly low collision risk include ducks and geese, swallows, herons, upland game birds, and blackbirds, meadowlarks, and orioles.

TABLE 5. Average vulnerability of bird groups to building collisions across all building types. Risk values indicate the factor by which a species has a greater chance (for positive residuals) or a smaller chance (for negative residuals) of mortality compared with a species with average risk.

Group	Residual	Risk
Hummingbirds and swifts	1.52	33.2
Grebes	1.04	11.0
Shorebirds	0.68	4.7
Kingfishers[a]	0.56	3.6
Waxwings	0.55	3.6
Warblers	0.54	3.4
Gulls and terns[a]	0.52	3.3
Nuthatches, tits, and creeper	0.50	3.1
Cuckoos	0.46	2.9
Mimic thrushes	0.41	2.6
Diurnal raptors	0.40	2.5
Cardinaline finches	0.36	2.3
Kinglets	0.36	2.3
Thrushes	0.25	1.8
Cardueline finches	0.23	1.7
Nightjars	0.16	1.4
Woodpeckers	0.15	1.4
Owls	0.10	1.3
Doves and pigeons	0.08	1.2
Sparrows	0.08	1.2
House Sparrow[a]	−0.15	1.4
Wrens	−0.20	1.6
Coots and rails	−0.24	1.7
Flycatchers	−0.41	2.6
Vireos	−0.55	3.6
Starling[a]	−0.56	3.6
Corvids	−0.61	4.1
Blackbirds, meadowlarks, and orioles	−0.64	4.4
Upland game birds	−0.77	5.9
Herons	−1.05	11.3
Swallows	−1.07	11.6
Ducks and geese	−1.25	17.9
Gnatcatchers[a]	−1.68	48.1

[a] Values based on data from a single species.

DISCUSSION

Comparison of Mortality Estimate to Previous Estimates

Our estimate of 365–988 million birds killed annually by building collisions is within the often-cited range of 100 million to 1 billion (Klem 1990a). Other estimates are either outdated (3.5 million, Banks 1979) or are simply a mid-point of the above range (550 million, Erickson et al. 2005). Our larger estimate of low-rise mortality based only on year-round studies suggests that total annual building collision mortality could exceed one billion birds, as suggested by Klem (2009). Using the year-round low-rise estimate results in an annual mortality estimate of up to 1.3 billion birds. Regardless of which figure is interpreted, our results support the conclusion that building collision mortality is one of the top sources of direct anthropogenic mortality of birds in the U.S. Among other national estimates that are data-driven and systematically derived, only predation by free-ranging domestic cats is estimated to cause a greater amount of mortality (Loss et al. 2013). A similar ranking has been made for anthropogenic threats in Canada (Blancher et al. 2013, Machtans et al. 2013). Major sources of direct anthropogenic bird mortality currently lacking systematically derived estimates include collisions with automobiles and other vehicles, collisions and electrocution at power lines, and poisoning caused by agricultural chemicals, lead, and other toxins. Additional systematic quantification of mortality is needed to allow rigorous comparisons among all mortality sources.

A general pattern across and within building classes is that a large proportion of all mortality occurs at structures that kill small numbers of birds on a per-building basis but collectively constitute a high percentage of all buildings (e.g., residences compared to low-rises and high-rises; urban compared to rural residences; residences without feeders compared to those with feeders). This finding suggests that achieving a large overall reduction in mortality will require mitigation measures to be applied across a large number of structures (e.g., urban residences). Our conclusion about the relative importance of residences for causing U.S. mortality is similar to that made for Canada by Machtans et al. (2013). This similarity arises because residences are estimated to comprise a similar proportion of all buildings in both countries (87.5% in the U.S and 95.3% in Canada). Even assuming the low-end mortality estimate for residences (159 million), total

mortality at high-rises would have to be 100 times greater than our high-end estimate for that building class (1.6 million) for the two building classes to cause equivalent mortality. On a per-building basis, if each residence killed one bird per year, each high-rise would have to kill >5,800 birds per year to cause equivalent mortality. No evidence exists that high-rises kill this large number of birds.

The species composition of window collision mortality also differs by building class. While the high risk group for individual residences includes several non-migratory resident species—including Downy Woodpecker (*Picoides pubescens*), Black-capped Chickadee (*Poecile atricapillus*), and Northern Cardinal (*Cardinalis cardinalis*)—nearly all high-risk species for low-rise and high-rise buildings are migratory. Compared with resident species, migratory species traverse longer distances, use a greater diversity of habitat types, and encounter more building types and total buildings during the annual cycle. Additionally, migratory species are attracted to large lighted buildings during their nocturnal migration; this attraction causes a large amount of mortality at low-rises and high-rises as birds either immediately collide with lighted buildings or become entrapped before later dying of collision or exhaustion (Evans Ogden 1996). The greater representation of resident species in the high-risk group for residences may be due to the propensity for many of these species to congregate at bird feeders, a behavior that may place them at a greater risk of colliding with windows (Dunn 1993, Klem et al. 2004, Bayne et al. 2012).

Despite the critical importance of reducing mortality at residences, mitigation measures targeted at a relatively small number of buildings with high per-building mortality rates (e.g., some high-rises and low-rises) will likely result in large per-building reductions in mortality and therefore may represent a cost-efficient starting point for reducing mortality. The mortality proportions that we attribute to different residence types are similar to those estimated by Machtans et al. (2013). This result arises from both the previous study and ours basing analysis on Bayne et al. (2012), a Canadian study that provides a reasonable approximation of U.S. mortality rates as evidenced by rates documented in U.S. studies (Dunn 1993, Weiss and Horn 2008, Bracey 2011).

Species Vulnerability to Building Collisions

Our vulnerability analysis indicates that several species experience a disproportionately high risk of building collision mortality. Of particular concern within the list of high-risk species (Table 4) are those identified as national Birds of Conservation Concern (species likely to become candidates for listing under the U.S. Endangered Species Act without further action based on population trends, threats to populations, distribution, abundance, and relative density; U.S. Fish and Wildlife Service 2008). For species that are vulnerable to collisions at more than one building class or overall, including Golden-winged Warbler, Painted Bunting, Kentucky Warbler, and Canada Warbler, building collision mortality appears substantial and may contribute to or exacerbate population declines. For species identified as highly vulnerable to collision for one building class but not across building types (Wood Thrush at residences, Worm-eating Warbler at high-rises), building collisions may still represent a threat. However, risk rankings for these species are more likely to be inflated by high mortality rates at a few sites, and further research is required to clarify the degree to which populations of these species are threatened by collision mortality.

Inferences about population impacts of a mortality source should ideally be based on incorporating mortality estimates into demographic models (Loss et al. 2012) or comparing estimates to population abundance (Longcore et al. 2013). Data limitations preclude intensive population modeling of building collision impacts. Sampling bias toward densely populated areas east of the Mississippi River, and therefore toward certain bird species, prevented us from estimating species-specific annual mortality. We initially attempted to apply average species proportions to the overall mortality estimate following Longcore et al. (2013), but this method returned unrealistically high estimates for species that comprised a high percentage of counts in many studies (e.g., 140% of the total population of Ovenbirds estimated to be killed each year by building collisions). Our vulnerability estimates controlled for abundance and range overlap with study sites and therefore provide a less biased approximation of species-specific collision risk.

Our vulnerability analysis expanded upon the analysis of Arnold and Zink (2011), which was based on three sites in the northeastern U.S. and adjacent Canada. Nonetheless, we documented some of the same vulnerable species, including Brown Creeper, Black-throated Blue Warbler (*Setophaga caerulescens*), and Swamp Sparrow (*Melospiza georgiana*), and similar high- and low-risk taxonomic groups (e.g., warblers and swallows, respectively). As in the previous study, the vast majority of highly vulnerable species were long-distance migrants. Unlike the previous study, we did not assess whether population trends were correlated with building collision vulnerability. This approach has received criticism (Schaub et al. 2011, Klem et al. 2012) and shifts focus away from identifying which individual species of conservation concern face a high risk of colliding with buildings.

Research Needs and Protocol Improvements

Sensitivity analyses indicated that more research of mortality rates at low-rises will contribute greatly to improving mortality estimates. Future research should sample a variety of low-rise types, including residential,

commercial, and industrial buildings. Research at low-rises has occurred mostly at buildings that are known to cause large numbers of fatalities (e.g., office or university campus buildings with many windows and/or near favorable bird habitat). Random selection of buildings for monitoring (for all building classes) allows for less-biased conclusions about local mortality rates and more reliable extension of results within study areas and across regions. Mortality data specific to different low-rise building types will allow improvement upon the current approach of assuming that all low-rise buildings have similar mortality rates. Because we based our low-rise estimate on the number of U.S. "establishments," and because the relationship between numbers of establishments and numbers of buildings is unknown, we suggest that improved data be collected and made available for the number of U.S. low-rise buildings. Non-residential low-rises are not currently included in assessments by the U.S. Census Bureau.

Sensitivity analyses also indicate that mortality estimates will benefit from quantification of searcher efficiency and scavenger removal rates. Recent research has resulted in major advancements in understanding these biases, including studies that estimate carcass detection and/or scavenger removal rates (Collins and Horn 2008, Hager et al. 2012, 2013) or apply methods to simultaneously account for both biases (Bracey 2011, Etterson 2013). In the future, studies should account for these biases when possible and investigate how these rates are affected by size and species of carcasses, abundance and community composition of scavengers, and characteristics of vegetation and habitat near buildings.

A large portion of the unpublished data we used were collected by volunteer-led collision-monitoring programs in major cities. These citizen-science programs have contributed greatly to the understanding of bird–building collisions; however, standardization of data collection and recording procedures is necessary to make these data more comparable across programs and across years within programs. As a first step, all monitoring programs should record sampling effort, including (1) a record of all surveys conducted, even those with zero fatalities found; (2) the number of person-hours of sampling in every survey; (3) the number of buildings and building facades sampled; (4) street addresses of buildings (with attention to avoiding multiple addresses referring to one building and clarifying when one address includes >1 building); and (5) separate records of fatalities found during surveys on official routes and those found incidentally outside of survey periods and/or off of routes. This information will allow increased comparability of data among regions, improved understanding of seasonal and regional mortality patterns, and reduced bias in estimates of per-building mortality rates and overall mortality. Combining effort-corrected mortality data with information about buildings (e.g., height in stories and meters; orientation and area of building facades; glass area, type, extent, and reflectivity; vegetation presence, type, density, and height; and amount of light emitted), will allow identification of mortality rate correlates, prediction of mortality rates from building characteristics, and implementation of techniques to reduce mortality. Monitoring programs could also expand to incorporate sampling at multiple building types, including individual residences and additional types of low-rises and high-rises. A national reporting system and database for bird mortality data would facilitate standardization of data collection for building collisions and other mortality sources (Loss et al. 2012). Until this type of comprehensive system is developed and launched, window collision monitoring programs can use simple user-defined data entry portals that will increase standardization of data recording, formatting, and compilation (see example at https://docs.google.com/spreadsheet/viewform?usp=drive_web&formkey=dDA1dDVTSVUzS1NfX0NxWmZxTEctbHc6MQ#gid=0), and therefore benefit research that synthesizes multiple datasets.

Model Limitations

Because data collection methods varied greatly among studies, we could not account for all differences among the datasets we synthesized. How this limitation influenced our estimates is unclear. Nonetheless, our inclusion criteria removed studies that lacked a systematic component to sampling, and we accounted for partial-year sampling by either estimating mortality using only year-round studies or applying correction factors to mortality estimates. We also accounted for sample size differences when estimating species vulnerability. However, the data we analyzed overrepresented the eastern U.S. and underrepresented the Great Plains, Interior West, and West Coast. Because of this data limitation, the mortality rate distributions that we applied to all U.S. buildings were primarily based on data from the eastern U.S. This could have biased our estimates if mortality rates in the West differ consistently from those documented in the East; however, the lack of western data prevents conclusions about such regional variation. In addition, our species vulnerability estimates do not cover species with a large proportion of their range in the West. Further research of bird–building collisions in areas west of the Mississippi River is needed to document whether per-building mortality rates differ consistently from those in well-studied regions of the east and to assess building collision vulnerabilities for western bird species. Our mortality estimates are limited by the assumption that all non-residential establishments listed by the U.S. Census Bureau are ≤11 stories tall and that all buildings sampled by monitoring programs in major downtown areas are >12 stories tall. These assumptions were unavoidable because U.S. low-rise building data are not available and

building height information was not recorded in most studies.

Our mortality estimates may be conservative because data from buildings that cause exceptionally high annual rates of collision were removed from our analysis before extending average rates to the scale of the entire U.S. Hundreds to greater than one thousand birds per year have been found at intensively monitored buildings in or near areas with a high concentration of birds during migration (e.g., Taylor and Kershner 1986, M. Mesure and D. Willard personal communication). Other factors that may have contributed to underestimation include crippling bias (e.g., an uncertain percentage of birds fly away from sampling areas before dying) and sub-lethal effects that may influence social interactions and migration behavior even if not causing eventual death (Klem 1990b). Further research to quantify crippling bias and sub-lethal effects is crucial for continued improvement in the accuracy of mortality and species vulnerability estimates.

Finally, we were unable to quantify seasonal patterns of mortality due to a limited sample of studies that surveyed throughout the year. Additionally, several studies employed varying sampling effort across seasons and did not record effort data that could be used to account for this variation. Among records meeting our inclusion criteria, 60.0% were found during fall migration (August–November) and 37.0% were found during spring migration (March–May). These figures are likely inflated relative to non-migratory periods because most studies sampled only during spring and fall. Despite varying sampling effort among seasons, mortality during fall migration appears to be consistently greater than during spring migration; this pattern was seen in most of the datasets and could be related to larger populations of birds in the fall due to presence of young-of-the-year birds. Notably, several studies have indicated substantial building collision mortality during periods outside of migration, including in winter at individual residences (Dunn 1993, Klem 2009) and in summer at low-rise buildings (Bayne et al. 2012, Hager et al. 2013). Our methods accounted for partial-year sampling by either using only year-round studies (for residences and low-rises) or applying a correction factor that assumed additional mortality during summer and winter (for high-rises, a building type for which little data exists for non-migration periods). Species vulnerability estimates were also likely to be influenced by seasonal sampling biases, with in-transit migratory species likely overrepresented compared with summer and winter residents. Additional year-round studies are needed at all building types to clarify how mortality rates and species composition of fatalities vary by season.

Conclusions

As human populations and numbers of buildings increase in the U.S. and globally, actions to reduce bird mortality from building collisions will be necessary at all types of buildings. For residences, mitigation techniques could include reducing vegetation near windows, angling windows to reduce reflection, and installing netting, closely spaced decals, or UV light-reflecting glass (Klem et al. 2004, Klem 2006, 2009). For low-rises and high-rises, mortality can be reduced by minimizing light emission at night (Evans Ogden 1996, 2002) and incorporating bird friendly design elements into new and existing buildings (e.g., Brown and Caputo 2007, Sheppard 2011). A long-term approach to reducing mortality is the continued adaptation of Green Building certification standards to include bird collision risks (Klem 2009).

We provide quantitative evidence of the large amount of bird mortality caused by building collisions in the U.S. Our estimates represent roughly 2–9% of all North American birds based on a rough estimate of 10–20 billion total birds in North America (U.S. Fish and Wildlife Service 2002). However, because our results illustrate that not all species are equally vulnerable to building collisions, and because considerable uncertainty remains regarding species-specific mortality and population abundance, the actual impacts of collisions on population abundance are uncertain. Despite this uncertainty, our analysis indicates that building collisions are among the top anthropogenic threats to birds and, furthermore, that the several bird species that are disproportionately vulnerable to building collisions may be experiencing significant population impacts from this anthropogenic threat.

ACKNOWLEDGMENTS

We thank the following people and organizations for providing access to unpublished datasets from building collision monitoring programs: K. Brand (Lights Out Winston-Salem, Forsyth County Audubon Society & Audubon North Carolina), A. Conover (Lights Out Columbus, Ohio Bird Conservation Initiative & Grange Insurance Audubon Center), M. Coolidge (Bird Safe Portland, Audubon Society of Portland), S. Diehl and C. Sharlow-Schaefer (Wisconsin Night Guardians, Wisconsin Humane Society), J. Eckles, K. Nichols, and R. Zink (Project Bird Safe Minnesota, Audubon Minnesota & University of Minnesota), S. Elbin and A. Palmer (Project Safe Flight, New York City Audubon), M. Flannery (California Academy of Sciences), D. Gorney (Lights Out Indy, Amos W. Butler Audubon Society), A. Lewis and L. Fuisz (Lights Out DC, City Wildlife), M. Mesure (Toronto Fatal Light Awareness Program), W. Olson (Lights Out Baltimore, Baltimore Bird Club), A. Prince (Chicago Bird Collision Monitors, Chicago Audubon Society), K. Russell (Audubon Pennsylvania), and D. Willard (The Field Museum). A. Bracey, J. Ducey, M. Etterson, S. Hager, A. Harrington, D. Horn, G. Niemi, and T. O'Connell provided access to unpublished or otherwise unavailable data. R. Schneider and J. Rutter provided assistance with data collection and management; E. Bayne, C. Machtans, and C. Wedeles

provided access to unpublished manuscripts; and M. Lynes and C. Sheppard assisted in locating datasets. We give special thanks to D. Klem for providing access to nearly all of his window collision data, investing significant effort along with P. Saenger to digitize historical records, and for pioneering the study of bird–window collisions. S.R.L. was supported by a postdoctoral fellowship funded by the U.S. Fish and Wildlife Service through the Smithsonian Institution's Postdoctoral Fellowship program. The findings and opinions expressed in this paper are those of the authors and do not necessarily reflect the opinions of the U.S. Fish and Wildlife Service or the Smithsonian Institution.

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Window Area and Development Drive Spatial Variation in Bird-Window Collisions in an Urban Landscape

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Abstract

Collisions with windows are an important human-related threat to birds in urban landscapes. However, the proximate drivers of collisions are not well understood, and no study has examined spatial variation in mortality in an urban setting. We hypothesized that the number of fatalities at buildings varies with window area and habitat features that influence avian community structure. In 2010 we documented bird-window collisions (BWCs) and characterized avian community structure at 20 buildings in an urban landscape in northwestern Illinois, USA. For each building and season, we conducted 21 daily surveys for carcasses and nine point count surveys to estimate relative abundance, richness, and diversity. Our sampling design was informed by experimentally estimated carcass persistence times and detection probabilities. We used linear and generalized linear mixed models to evaluate how habitat features influenced community structure and how mortality was affected by window area and factors that correlated with community structure. The most-supported model was consistent for all community indices and included effects of season, development, and distance to vegetated lots. BWCs were related positively to window area and negatively to development. We documented mortalities for 16/72 (22%) species (34 total carcasses) recorded at buildings, and BWCs were greater for juveniles than adults. Based on the most-supported model of BWCs, the median number of annual predicted fatalities at study buildings was 3 (range = 0–52). These results suggest that patchily distributed environmental resources and levels of window area in buildings create spatial variation in BWCs within and among urban areas. Current mortality estimates place little emphasis on spatial variation, which precludes a fundamental understanding of the issue. To focus conservation efforts, we illustrate how knowledge of the structural and environmental factors that influence bird-window collisions can be used to predict fatalities in the broader landscape.

Citation: Hager SB, Cosentino BJ, McKay KJ, Monson C, Zuurdeeg W, et al. (2013) Window Area and Development Drive Spatial Variation in Bird-Window Collisions in an Urban Landscape. PLoS ONE 8(1): e53371. doi:10.1371/journal.pone.0053371

Editor: Brock Fenton, University of Western Ontario, Canada

Received September 7, 2012; **Accepted** November 28, 2012; **Published** January 9, 2013

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Funding: The authors received $2,400 from the Quad City Audubon Society (www.quadcityaudubon.org/) for travel expenses for carcass surveys. There is no grant number. The lead author (SBH) was awarded $1,000 Presidential Scholarship from Augustana College (www.augustana.edu). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have the following interests. Mr. McKay is the owner of BioEco Research and Monitoring Center. He conducts consulting work for businesses and agencies requiring ecological assessments of birds. Mr. McKay has never consulted on nor anticipates future business related to the research in this manuscript. This does not alter the authors' adherence to all the PLOS ONE policies on sharing data and materials.

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Introduction

Urbanization fundamentally changes ecosystem function and structure and has profound effects on wildlife populations. Urban development alters avian community structure by reducing overall richness and diversity of species and increasing densities of synanthropic species [1–3]. Birds that reside in urban settings face numerous human-related threats to survival, including mortality from bird-window collisions (BWCs) [4]. Window glass is an invisible barrier to birds, and collisions occur as birds attempt to fly through what appear to be reflections of open space and vegetation [5–6]. BWCs are suspected to be ubiquitous across the urban landscape, and current estimates assert that 1–10 birds die from a window strike at every building each year in the United States, including structures that range from small houses to large skyscrapers [7].

Understanding the magnitude and drivers of BWCs is important because urbanization is accelerating faster than human population growth [8], and knowledge of how the urban environment affects bird survival is needed for conservation and management. For example, mortality from power line collisions increased extinction risk for Ludwig's Bustard (*Neotis ludwigii*) in South Africa [9], and mortality from window strikes may be affecting birds in similar ways [10], but see [11]. Furthermore, cities display complex spatial patterns of development, which is affected by historic landscape configurations and current social, economic, and political climates [8], [12–13]. This results in patchily distributed resources and developed space creating the expectation that the magnitude and species affected by window collisions should vary across the landscape.

Environmental resources have been hypothesized to be a primary driver of BWCs. Quality vegetation and artificial feeding stations increase bird density by providing food and shelter [14–17], and the number of fatalities is predicted to be proportional to species abundance [5]. For example, houses maintaining feeder stations during the winter attract high numbers of sparrows and

finches, which account for more strike-related deaths than other species [5–18]. However, some species with low abundance die at high rates (e.g., Ovenbird) and several abundant species are not susceptible to collisions (e.g., House Sparrow) [19–20]. It remains equivocal that the environmental resources hypothesis explains BWCs across the urban matrix because most research has been restricted by low replication of buildings and buildings with known mortalities [4]. If the environmental resources hypothesis is supported, the magnitude of fatalities should be related to factors that increase bird density and richness.

The amount of sheet glass in buildings is also hypothesized to influence BWCs. Support for the window area hypothesis comes from localized studies reporting high mortality at large commercial buildings [19–23]. However, urban landscapes have variable patterns of development that often include a core commercial district composed of many large buildings and clusters of mixed-use development where office space and residential areas coexist [24]. Currently, ~20% of the total building area of commercial space in the United States may be found in suburban areas [24]. This suggests that fatalities should be highest at the largest buildings in the urban matrix, whereas small residential buildings with low window area should pose the lowest risk. However, we are unaware of studies that have evaluated the relative magnitude of BWCs among buildings of varying size.

We characterized bird community structure and documented the number of BWCs (hereafter synonymous with mortality) at 20 buildings of variable size in an urban landscape in northwestern Illinois, USA. Our primary objective was to test the environmental resources and window area hypotheses. We first evaluated how bird abundance, richness, and diversity were related to environmental factors. We then tested whether BWCs were related to environmental factors that influence community structure and to building window area. The potential for imperfect detection of carcasses was evaluated experimentally by estimating carcass persistence times [25] and detection probabilities by field workers, and we used those estimates to design a sampling scheme that minimized detection bias. We illustrate how knowledge of the structural and environmental factors that create spatial variation in BWCs can be used to focus conservation efforts in high-risk settings. The utility of these factors, rather than direct estimates of bird abundance and diversity, is that they are readily available in print and digital media to parties interested in predicting BWCs, but whose expertise lies outside of ornithology.

Methods

Ethics

Protected species were not sampled and we followed the recommendations of Fair et al. [26] in reducing impacts to birds resulting from investigator presence during point count surveys. Carcasses collected during field surveys and those used in experiments were salvaged under state Scientific Permit (#NH11.0313), Illinois Department of Natural Resources, and federal Salvage Permit (#MB08907A-0), U.S. Fish and Wildlife Service. We consulted Fair et al. [26] for recommendations related to collecting procedures of bird carcasses.

Study Buildings

We conducted the study at 20 buildings in Rock Island and Moline in northwestern Illinois. This 9,330-ha urban area is bordered to the north and west by the Mississippi River and to the south by the Rock River, and it is located in the Dissected Till Plains Physiographic Area [27]. We used stratified random sampling in ArcGIS (ESRI, Redlands, California, USA) to select 20 study points distributed among four land cover categories: (1) High Urban Density (>50% covered with structures), (2) Low/Medium Urban Density (up to 50% covered with structures), (3) Urban Open Space (parks, golf courses, cemeteries, and other grassland-like cover within urban and built-up areas), and (4) Forested Land and Floodplain Forest (undeveloped land that occasionally includes buildings) [28]. A stratified design ensured selection of a sample of buildings with sufficient variation in land cover. We obtained permission to use buildings on private and public land closest to each point. Two property owners denied permission, and we obtained permission to access the next closest building. Buildings ranged in size from small single-family residential to small commercial (110–700 m^2 floor area). However, large commercial buildings were less common in our study area and were not represented in the initial sample of 20 points. Therefore, we opportunistically selected five large buildings (3750–14950 m^2 floor area) within Urban Open Space (N = 2), High Density (N = 2), and Forest (N = 1), which replaced five randomly selected small buildings in the same land cover categories. Median distance between buildings was 917 m (range 356–1976 m).

Point Count Surveys

We used 50-m radius point counts of 5-min duration to characterize the avian community at each study building in 2010 [29–30]. Three surveys were completed in each of three one-week sampling periods in each season for a total of nine counts/season (Table S2). Each point count location was ≤50 m from the edge of a study building and >50 m from public roadways. All sites were surveyed on a single survey day, and surveys began at sunrise and were completed within 5 h. We assigned each building a number from 1–20, and we randomly selected the starting location each day. Subsequent locations were sampled in numerical order. Varying survey order decreased the likelihood of missing species that may vary in daily activity [31]. Point counts were conducted by one of us in a season (BB in spring, KJM in fall, and SBH in winter and summer) and during favorable weather conditions [31]. Seasonal variation in community structure may have been affected by observer differences, but scheduling issues precluded sampling by just one person for all seasons.

We identified and counted all birds seen and heard during each survey. For each building and season, we calculated abundance as the sum of the maximum number of individuals counted within each of the three sampling weeks [30]. Species richness was the total number of species observed in each season, and diversity was measured using the Shannon diversity index [32]. The following species were excluded from analyses: birds flying over the site, migratory flocks, waterfowl, raptors, and species seen on <2 surveys/season [33]. Scientific names of birds documented during point counts and listed in the text are found in Table S4.

Carcass Surveys

For each building and season, we completed 21 daily carcass surveys during three weekly sampling periods concurrent with point count surveys (Table S2). During each survey, a trained observer walked a complete transect around the building and searched for bird carcasses within a 2-m buffer from the building's edge [20]. A bird carcass consisted of a full body, partial carcass, or feather piles [25]. Observers actively searched through woody vegetation located within the transect because birds may fall into a shrub after a window collision. All surveys in the winter coincided with post-snowfall events and, thus, detection of carcasses was high due to the hole created in the otherwise unbroken snow layer from a falling bird. Surveys in the fall were completed before the first hard freeze and extensive leaf drop by deciduous trees and shrubs.

Carcasses and corresponding identification tags were placed in food-grade, zip-lock plastic bags. We stored carcasses on ice until placement in a freezer <6 hours after collection, and we identified carcasses to species in the laboratory. Partial carcasses were categorized as "unidentified" if species-important anatomical features were missing due to scavenging. Birds were classified as adult or juvenile based on plumage and degree of cranial pneumatization [34].

Surveying a subsample of days limited a full representation of carcasses that might have arisen from window strikes. However, we attempted to reduce this bias by completing surveys during times of important bird activities (Table S2) [35]. We also minimized bias associated with imperfect detection of carcasses by using a sampling design that was informed by estimates of carcass persistence before scavenging [25] and carcass detection probability by field workers (Text S1, Table S1, Figure S1). Specifically, carcass survival in relation to scavengers was estimated for each building-season combination in 2010 [25]. Using an exponential model of survival time, we found that carcasses generally persist at buildings for ≥3.5 days. Detection of carcasses in the field was related to carcass observability and field worker. However, the overall average detection probability was very high (0.88, SE = 0.01; Figure S1). Given the long persistence time and high detection probability of carcasses, the likelihood of not detecting a carcass using daily surveys was low. Carcasses found on day 1 of all survey periods were collected, but they were not included in analyses. Because scavenging pressure varied among buildings [25], including fatalities from surveys on day one may have introduced detection bias.

Environmental and Building Covariates

Land cover attributes were digitized for study buildings and point counts from a Bing Map high-resolution aerial photograph in ArcGIS taken during the growing season of 2010 (ESRI, Redlands, California, USA). We characterized land cover in a 50-m buffer zone extending from exterior walls of buildings and from the center point of count circles for bird surveys [36]. We considered quantifying habitat in varying buffer distances, but land cover in our 50-m buffer zones was highly correlated with land cover at larger scales (r >0.80 for all 50-m intervals up to 250 m) [28]. Percent area was estimated for (1) canopy (canopy cover of trees and large shrubs), (2) exposed habitat (grass/lawn, landscaped ground cover, and open water), (3) structures (buildings), and (4) pavement (roadways, sidewalks, and parking lots). A 50-m buffer captured detailed and ecologically relevant attributes related to the distribution and activity of urban birds at a local scale, e.g., [15]. Moreover, urban bird diversity and abundance consistently correlates positively with vegetated features and negatively with impervious surfaces, e.g., [37]. Thus, we combined digitized land cover categories into two broader classes: undeveloped (canopy and exposed habitat) and developed (structures and pavement), e.g., [38]. Only proportion of developed land was used in analyses. Because birds also respond to landscape-scale feature such as vegetated patches within the urban matrix e.g., [16–39], we calculated the average distance between point count locations and all vegetated patches >0.5 ha in the study area [39]. A taped rule was used to measure the area of windows in each building.

Buildings were classified as having feeder stations if at least one active feeder was visible within 50-m of a building's edge. We used this classification for two reasons. First, identifying feeders within 50 m is consistent with our test of the environmental resources hypothesis, which predicts that bird-friendly resources that increase bird density will influence collision fatalities. Second, birds that visit feeders appear to strike windows at a nearby building during a panic flight, or the explosive flight away from the feeder in response to the sudden appearance of a potential predator [5]. Fatal collisions occur at distances ≤10 m, although mortality is highest at 10 m [40]. It is thought that birds flushed by a predator from feeders at 10 m gain enough momentum (via high flight speed) to strike a window resulting in fatal injury [40]. Using this information, we assumed that birds flying toward a window from >10 m also have comparable flight speeds that would make them vulnerable to dying from a window strike. Thus, birds flushed from a feeder at <50 m of a building's edge should be vulnerable to BWC's. Table S3 lists minimum distance to feeders for study buildings.

Data Analysis

We used linear and generalized linear mixed models (GLMM) to evaluate how bird abundance, species richness, and diversity were related to environmental factors. A random intercept was estimated for each building. A Poisson distribution with a log link function was specified for abundance and species richness, and a Gaussian distribution with an identity link function was specified for diversity. We constructed models that included different combinations of environmental factors as predictor variables. Environmental factors included presence of feeder station (F), proportion of developed land (D), and average distance to vegetated patches (I). We assumed *a priori* that the response variables varied among seasons, so we included an effect of season (S) in each model. We parameterized 21 models, and the candidate set was the same for each response variable. The first 8 models included an effect of season alone (S) and additive effects of each factor (S+F, S+D, S+I, S+F+D, S+F+I, S+D+I, S+F+D+I). We also evaluated the support of 12 models that included interaction effects between season and each environmental factor (S+F+S*F, S+D+S*D, S+I+S*I, S+F+S*F+D, S+F+S*F+I, S+D+S*D+F, S+D+S*D+I, S+I+S*I+F, S+I+S*I+D, S+F+S*F+D+I, S+D+S*D+F+I, S+I+S*I+F+D). Finally, we included an intercept-only model.

We used GLMMs to evaluate whether the number of carcasses at each building depended on environmental factors (F, D, I) and building window area (W). A random intercept was estimated for each building, and we specified a Poisson distribution with a log link function for the response variable. We evaluated the support of 11 models that included different combinations of covariates. The first 10 models included individual factors (W, F, D, I) and additive effects of each factor (W+F, W+D, W+I, F+D, F+I, D+I). We also included an intercept-only model. The natural logarithm of window area was used to improve linearity. We did not include an effect of season in models because of the relatively low number of collisions observed during each season.

For both bird community structure and BWCs, we used the Akaike Information Criterion corrected for small sample size (AIC_C) to evaluate the relative support of each model in each candidate set [41]. We calculated the difference between AIC_C of each model and AIC_C of the most-supported model (ΔAIC_C), and we considered models to have competitive support when $\Delta AIC_C \leq 2$. We also calculated Akaike weights (w_i) for each model. The lmer function in package lme4 [42] in program R [43] was used to fit all models.

Predicted Annual Fatalities

We created a map of annual predicted fatalities to visualize spatial variation in collision risk in our study area. We intended to predict annual fatalities at all buildings in the study area using factors from our most-supported model of BWCs (i.e., window

area and proportion of development; see Results). However, information on window area and proportion of development was not readily available at all buildings. Instead, we used surrogate features, which were easily obtained from local and federal agencies. Due to their high correlations, we used floorspace (i.e., the total usable living and office space contained within a building) as a surrogate for window area ($r = 0.99$) and impervious development measured from the National Land Cover Database (NLCD) [44] as a surrogate for development ($r = 0.88$; Table S3). We fit a generalized linear mixed model (i.e., the 'surrogate' model) of observed mortalities using floorspace and NLCD development as predictors.

We obtained floorspace for 1,956 buildings (hereafter referred to as 'model buildings') in Rock Island and Moline from the Rock Island County GIS Department. Floorspace was restricted to parcels containing single buildings only. The City of Moline GIS Department provided digitized building footprints for Moline (n = 996) and we manually digitized footprints for Rock Island buildings (n = 960). Proportion of NLCD development within a 50 m buffer surrounding each building footprint was calculated using ArcGIS (ESRI, Redlands, California, USA). We used beta coefficients from the surrogate model to predict number of fatalities at model buildings. Predicted fatalities at model buildings were then spatially interpolated for the study area using ordinary kriging in ArcGIS (ESRI, Redlands, California, USA).

Results

Avian Community Structure

We documented 23 species in winter, 57 in spring, 38 in summer, and 49 in the fall for an annual total of 72 species among study buildings (Table S4). The most-supported model was consistent for all community indices and included effects of season, development, and distance to vegetated lots (Table 1). In general, abundance, richness, and diversity were greatest in spring, fall, and summer, and lowest in winter (Fig. 1, 2). Abundance was related negatively to development (Fig. 1A; beta estimate from most-supported model = −0.73, SE = 0.25) and distance (Fig. 2A; beta estimate from model with season and distance only = −0.11, SE = 0.03). However, the effect of distance depended season. The negative relationship between abundance and distance was strongest in winter and weaker in spring and fall (Fig. 2A). There was no relationship between abundance and distance in summer. There was competitive support for a model that included a positive effect of feeder presence on abundance (Table 1; beta estimate from most-supported model with feeder presence = 0.16, SE = 0.11). The House Sparrow was the most abundant species within and among seasons and at buildings maintaining feeders (Table S4). Other relatively abundant species included American Robin, American Goldfinch, Black-capped Chickadee, and European Starling.

Richness was related negatively to development (Fig. 1B; beta estimate from most-supported model = −0.92, SE = 0.20). Richness was also related negatively to distance (beta estimate from model with season and distance only = −0.14, SE = 0.03), but the effect of distance on richness depended on season. The relationship between richness and distance was weaker in summer than winter, spring, and fall (Fig. 2B).

Diversity was related negatively to development (Fig. 1C; beta estimate from most-supported model = −1.16, SE = 0.29) and distance (beta estimate from model with season and distance only = −0.16, SE = 0.04), but the effect of distance on diversity depended on season. The negative effect of distance on diversity was considerably stronger in winter than other seasons, and there

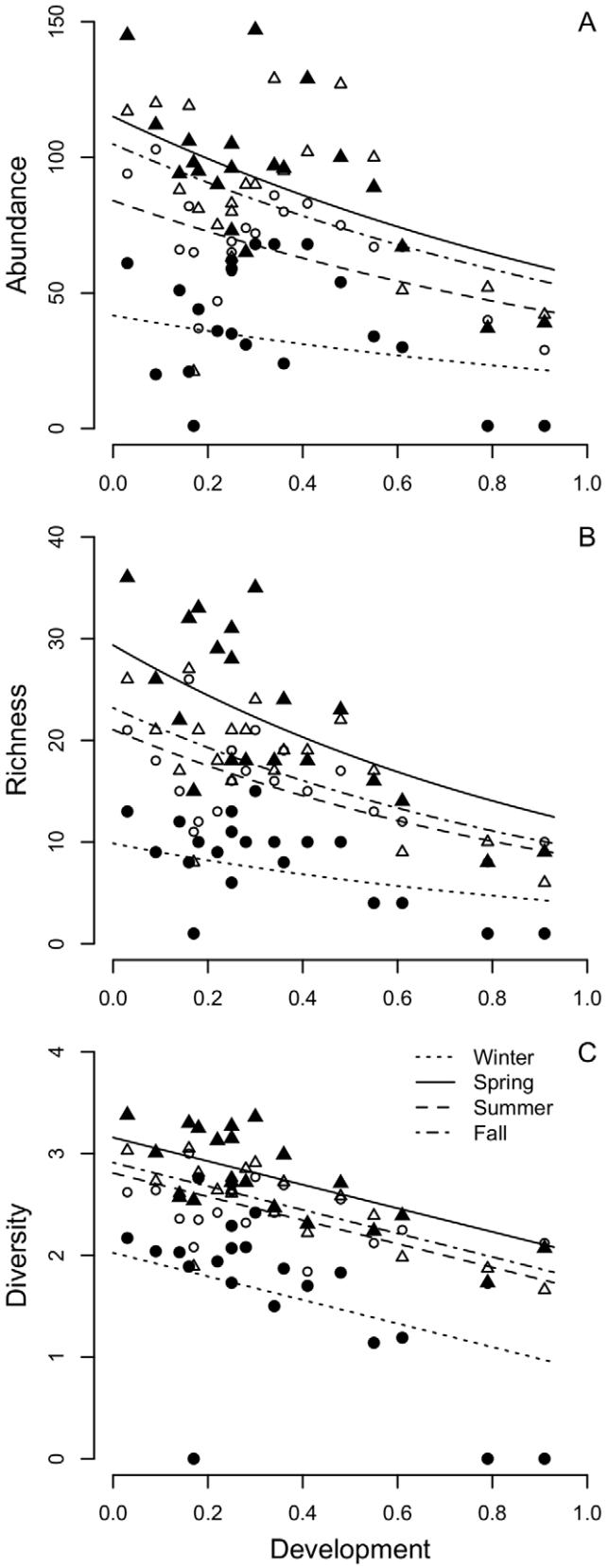

Figure 1. Effect of proportion of developed land on avian community structure. Relationships of avian (A) abundance, (B) richness, and (C) diversity are characterized for winter (closed circles), spring (closed triangles), summer (open circles), and fall (open

triangles). Best-fit lines are indicated for each season and are based on parameter estimates from the most-supported models of each response variable (see Table 1).
doi:10.1371/journal.pone.0053371.g001

was no relationship in summer (Fig. 2C). Interestingly, there was competitive support for an interaction effect between season and development, in which the negative effect of development on diversity was stronger in winter than other seasons (Fig. 2C).

Carcasses at Buildings

Overall, we collected 46 carcasses resulting from BWCs, and BWCs were observed at 50% of study buildings. Of the 46 total carcasses collected, 34 carcasses were located during days 2–7 of survey periods and retained for data analyses. Only passerine and near passerine species (N = 16) were collected and these tended to be low to moderately abundant or were never detected during point counts (Table 2, Table S4). Abundant birds that did not die included the House Sparrow, American Goldfinch, and Black-capped Chickadee. Post-fledgling individuals represented 81% of the BWCs in summer and fall (Table 2). Mortality was observed at 50% of buildings that maintained feeder stations (n = 8), and only half of the species that died at these sites are known to visit feeders (Table S4).

The most-supported model of collision mortality included the effects of building window area and proportion of developed land (Table 3). The number of fatalities was related positively to window area (Fig. 3A; beta estimate from top model = 0.83, SE = 0.14) and negatively to proportion of developed land (Fig. 3B; beta estimate from the model = −4.32, SE = 0.98). Both relationships resembled space-filling distributions, in which window area and development set upper bounds on the number of carcasses [45]. We observed no fatalities at buildings with <22 m^2 of sheet glass or constructed in >66% development (Fig. 3).

The median number of predicted annual fatalities at study buildings based on (a) factors from the most supported model was 2.6 (range = 0.3–52.1) and (b) surrogate factors (i.e., floorspace and NLCD development) was 2.4 (range = 0.1–38.4; Table S3). The median predicted collision fatalities at 1,956 model buildings was 1.3 (range = 0.04–200.7). Spatially interpolated predicted fatalities at model buildings depict several small patches of high mortality where large buildings and low development coexisted, many small to large areas of moderate mortality, and low BWCs in the majority of the landscape (Fig. 4).

Discussion

We assessed BWCs at buildings of various sizes and in a mix of habitats across an urban landscape. To our knowledge, the results reported here represent the most precise estimates of collision mortality to date, which were derived from a random sample of study sites and using a sampling protocol that reduced bias associated with imperfect detection. We found that BWCs were correlated positively to window area and negatively to development, which together created strong spatial variation in the number of fatalities. Previous estimates place a relatively constant and wide-ranging mortality at all buildings, e.g., 1–10 fatalities/building/year [7]. However, applying the drivers of BWCs to annual mortality estimates suggests that each building in the landscape has its own mortality 'signature'. Furthermore, multi-year local studies indicate that this signature value varies little among years, e.g., [20]. Thus, knowing of the drivers of BWCs allows one to predict the magnitude of mortality for each building

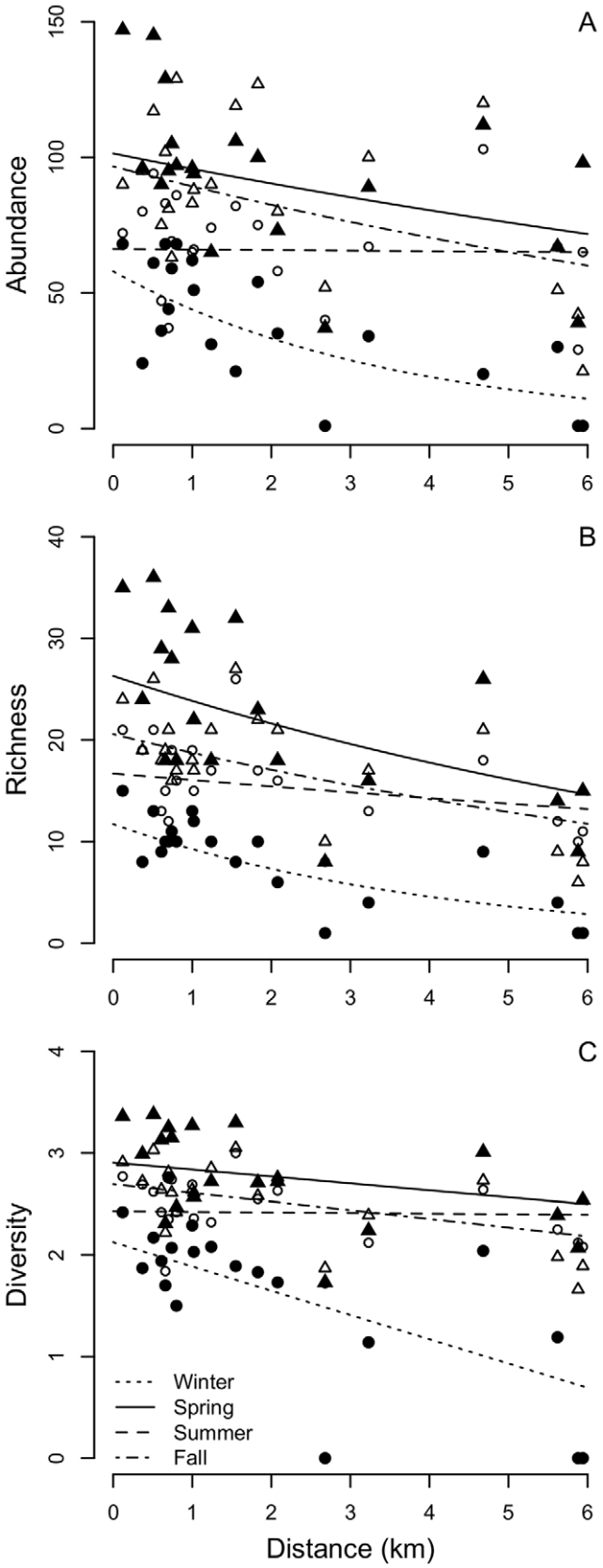

Figure 2. Effect of distance to vegetated lots on avian community structure. Relationships of avian (A) abundance, (B) richness, and (C) diversity are characterized for winter (closed circles),

spring (closed triangles), summer (open circles), and fall (open triangles). Best-fit lines are indicated for each season and are based on parameter estimates from the most-supported models of each response variable (see Table 1).
doi:10.1371/journal.pone.0053371.g002

across the landscape, which is fundamental to conservation efforts aimed at reducing collision-related impacts.

The environmental resources hypothesis predicts that biotic resources that increase bird density and diversity will affect BWCs. We tested this hypothesis for each season of a year. Our results demonstrated that birds responded positively at sites with low levels of development and close to forested patches. These biotic factors are known to correlate with abundance and richness of breeding and winter residents [33], [36–37]. Migrating birds respond in similar ways, and vegetated lots ≥1 ha are valuable stopover locations during migration [38], [46–48].

Furthermore, we found that BWCs were affected by the proportion of development in the immediate vicinity of a building, but not by distance to vegetated patches. The influence of distance on community indices depended on season and, generally, the effect was greater in winter than non-winter. Indeed, winter mortality from window collisions was observed at only two buildings close to vegetated patches. Few carcasses were observed throughout the winter in general, which is consistent with other studies [20], [21–23]. These results suggest that BWCs are primarily affected by environmental resources at small scales.

The window area hypothesis predicts that collision mortality will be proportional to the amount of sheet glass installed in the exterior walls of a building, and our results supported this prediction. Windows are considered invisible barriers to birds in flight [7]. However, the problem of windows has been inferred from the human perspective rather than bird vision and flight behavior [6]. Specifically, a flying bird understands the world via acute lateralized vision, optic flow fields, and head movements, whereas a human perceives the external environment with highly acute binocular vision in the frontal space. Martin [6] argues a sensory ecology approach that emphasizes bird vision and flight behavior may yield the most fruitful understanding of why birds collide with structures. This has been applied to species vulnerable to collisions with other obstacles, such as power lines, and future work should examine avian sensory ecology in reference to sheet glass in urban systems.

Although BWCs depended on development and window area, the relationships resembled space-filling distributions (Fig. 3). These patterns arise when the predictor variable sets an upper limit on the response variable and other factors are likely important at certain levels of the predictor variables [44]. For example, fatalities were infrequent at low window area, and no fatalities were observed below a threshold window area of 22 m^2. However, when window area was high, the number of fatalities was variable. Development also set an upper limit on BWCs. Collisions generally decreased as development increased, but there was wide variation in the number of fatalities when development was low. BWCs were also not observed at sites constructed in >66% impervious surfaces, suggesting that birds are at low risk of collisions at buildings in high development. Although window area and development set upper bounds on BWCs, other factors, such as degree of reflectivity and tinting of windows may explain additional variation in fatalities. There was a range of window types in study buildings that included clear panes in small residential structures and highly reflective and tinted glass in commercial buildings. Limited research suggests no differences in BWCs between observer-defined clear and reflective glass panes [22]. However, controlled experiments are needed to clarify the role of window treatment on collisions.

Site-specific comparisons between birds observed during point counts and those documented as carcasses suggest that most species never die from window collisions. The small percentage of birds found as carcasses included the American Robin, Cedar

Table 1. Most-supported models of avian abundance, richness, and diversity at 20 buildings in 2010 in Illinois, USA.

Avian Community	Model[a]	ΔAIC_C	ω_i	L	K
Abundance	S+I+S*I+D	0.00	0.54	−157.77	10
	S+I+S*I+D+F	0.73	0.38	−156.79	11
	S+I+S*I	4.65	0.05	−161.40	9
Richness	S+I+S*I+D	0.00	0.49	−29.29	10
	S+D+I	1.99	0.18	−34.10	7
	S+I+S*I+F+D	2.09	0.17	−28.98	11
	S+F+D+I	3.86	0.07	−33.80	8
	S+D+S* D+I	4.34	0.06	−31.46	10
Diversity	S+I+S*I+D	0.00	0.42	−26.85	10
	S+D+S*D	1.24	0.23	−28.78	9
	S+D+S*D+I	1.46	0.20	−27.58	10
	S+I+S*I+F+D	3.60	0.07	−27.30	11

Summary includes the relative difference between model AIC_C and the best model (ΔAIC_C), Akaike weights (ω_i), log-likelihood (L), and number of parameters (K). Only models with $\Delta AIC_C \leq 5$ are included.
[a]Main effects include season (S), feeder station presence (F), proportion of development (D), and average distance to closest vegetated patches (I).
doi:10.1371/journal.pone.0053371.t001

Table 2. List of carcass species (N = 16) collected at 20 study buildings for each season in 2010 in Illinois, USA.

Species	Winter	Spring	Summer	Fall
Mourning Dove			1(1)	
Yellow-bellied Sapsucker				1(1)
Downy Woodpecker			1(1)	
Blue Jay				1(1)
Swainson's Thrush		1(0)		
Hermit Thrush				2(2)
American Robin			2(2)	1[a]
Gray Catbird		1(0)		
European Starling				1(0)
Cedar Waxwing			1(0)	3(2)
Common Yellowthroat				1(0)
White-throated Sparrow				2(2)
Dark-eyed Junco	1(0)			
Northern Cardinal	1(0)		1(0)	
Indigo Bunting		1(0)		
Common Grackle			2(2)	
Unidentified[a]	3	4		2
Total Individuals	5(0)	7(0)	8(6)	14(8)

Numbers in parentheses represent a count of hatch-year individuals of each season's total.
[a]Carcass(es) partially scavenged and age-related features were not present.
doi:10.1371/journal.pone.0053371.t002

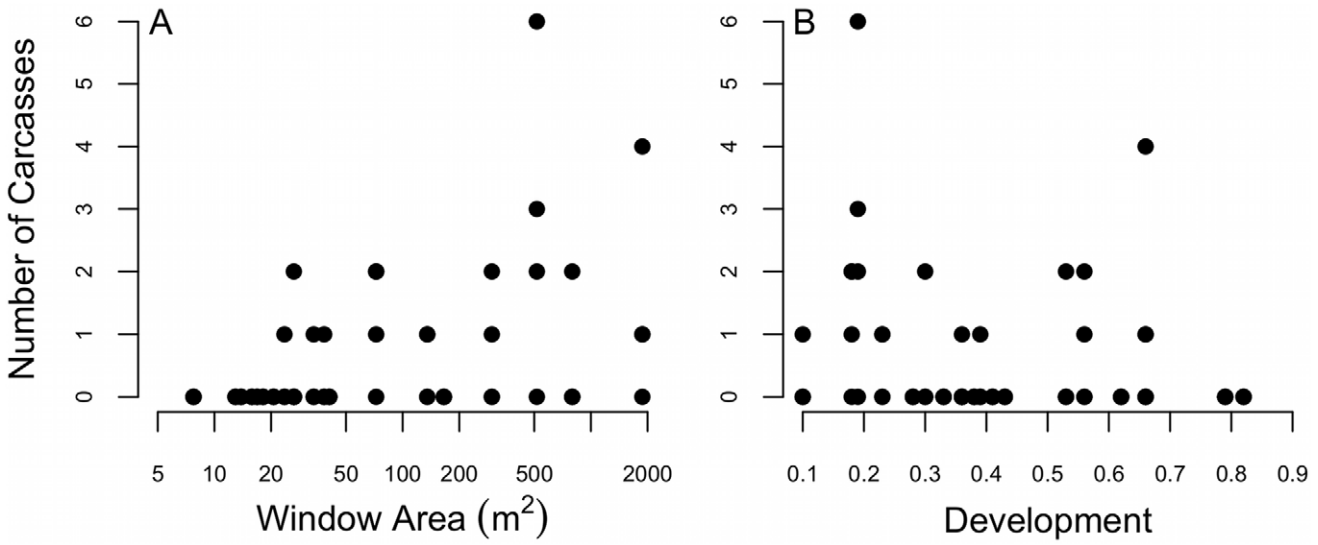

Figure 3. Factors driving bird-window collisions. The most-supported model explaining mortality included the effects of (A) window area and (B) development (% impervious surfaces) (see Table 3).
doi:10.1371/journal.pone.0053371.g003

Waxwing, and White-throated Sparrow, which ranged from low to high relative abundance. Species recorded as fatalities have also been documented in local studies [5], [18–20], [22–23] and are common in urban areas. This similarity may be explained via faunal homogenization where urban-adapted bird species among established urban landscapes converge at the continental scale [2], [36–49]. If so, the effects of windows on population persistence in these species warrants further investigation, especially as this relates to higher mortality in juveniles than adults [50].

Presence of feeder stations at study buildings correlated positively with relative abundance, which is consistent with bird communities in other urban areas [17]. However, feeders at study buildings did not influence BWCs, which is consistent with Dunn [18] who found that 91% of 5,500 houses with feeders had no mortality from window strikes. Moreover, ~20% of 995 fatalities reported by Dunn [18] were focused at just 8 residences in areas of low development. Houses constructed in exurban areas, i.e., 'rural development', contain almost no adjacent impervious surfaces, and our results suggest that only modest levels of window area in this environmental context will result in relatively high BWCs. House Sparrows were one of the most abundant species at study buildings with feeders, but were not documented as a collision fatality, which Dunn [18] also found. Interestingly, invasive populations of this species exclude up to 30% of other urban species [37]. Thus, high abundances of House Sparrows might aid in reducing collision risk at structures by inhibiting the presence of vulnerable species.

Table 3. Most-supported models of avian mortality resulting from window collisions at 20 buildings in Illinois, USA, 2010.

Model[a]	ΔAIC_C	ω_i	*L*	K
W+D	0.00	0.999	−29.35	4
W+I	10.59	0.005	−34.64	4
W	11.49	0.003	−36.20	3
W+F	12.69	0.002	−35.69	4
D+F	22.99	0.000	−39.33	4

Summary includes the relative difference between model AIC_C and the best model (ΔAIC_C), Akaike weights (ω_i), log-likelihood (*L*), and number of parameters (K). The top five most-supported models are included.
[a]Main effects include window area (W), proportion development (D), and average distance to closest vegetated patches (I).
doi:10.1371/journal.pone.0053371.t003

Overall, our results suggest that mortality resulting from window collisions is an important conservation issue at buildings with high window area and constructed in areas of low development. As landscapes become increasingly developed, it will be important to continue to evaluate the magnitude and patterns of BWCs and assess how urban populations respond to this source of mortality. Future studies should employ experimental designs that account for biases known to affect detection probability of carcasses. We are unaware of studies that have assessed the fate of birds that are not immediately fatally injured following a window strike [22], which is another form of bias leading to imperfect detection. Research is needed on how BWCs compare to other anthropogenic threats and whether multiple threats interact to affect bird populations, as has been shown for some amphibians [52]. Birds tracked through the urban landscape via radio telemetry are known to die more from predation by cats, disease, and vehicle collisions than from BWCs [53–56]. However, the localized nature of BWCs suggests that this threat is context-dependent, and studies should address how both environmental and structural factors drive variation in mortality.

Conservation Implications

Current estimates of BWCs assert a modest level of within-site variation in mortality (1–10 fatalities/building/year) and this range was used to extrapolate an overall estimate of fatalities to all existing buildings in the United States, which implies little to no variation in BWCs among all buildings [7]. Interest groups and municipalities primarily use these estimates for planning and implementation of preventative measures, e.g., the recently passed 'Standards for Bird-safe Buildings' in San Francisco, California, USA [57]. Because overall mortality estimates for broad geographic scales fail to convey spatial variation in mortality, relatively equal conservation efforts end up being applied among

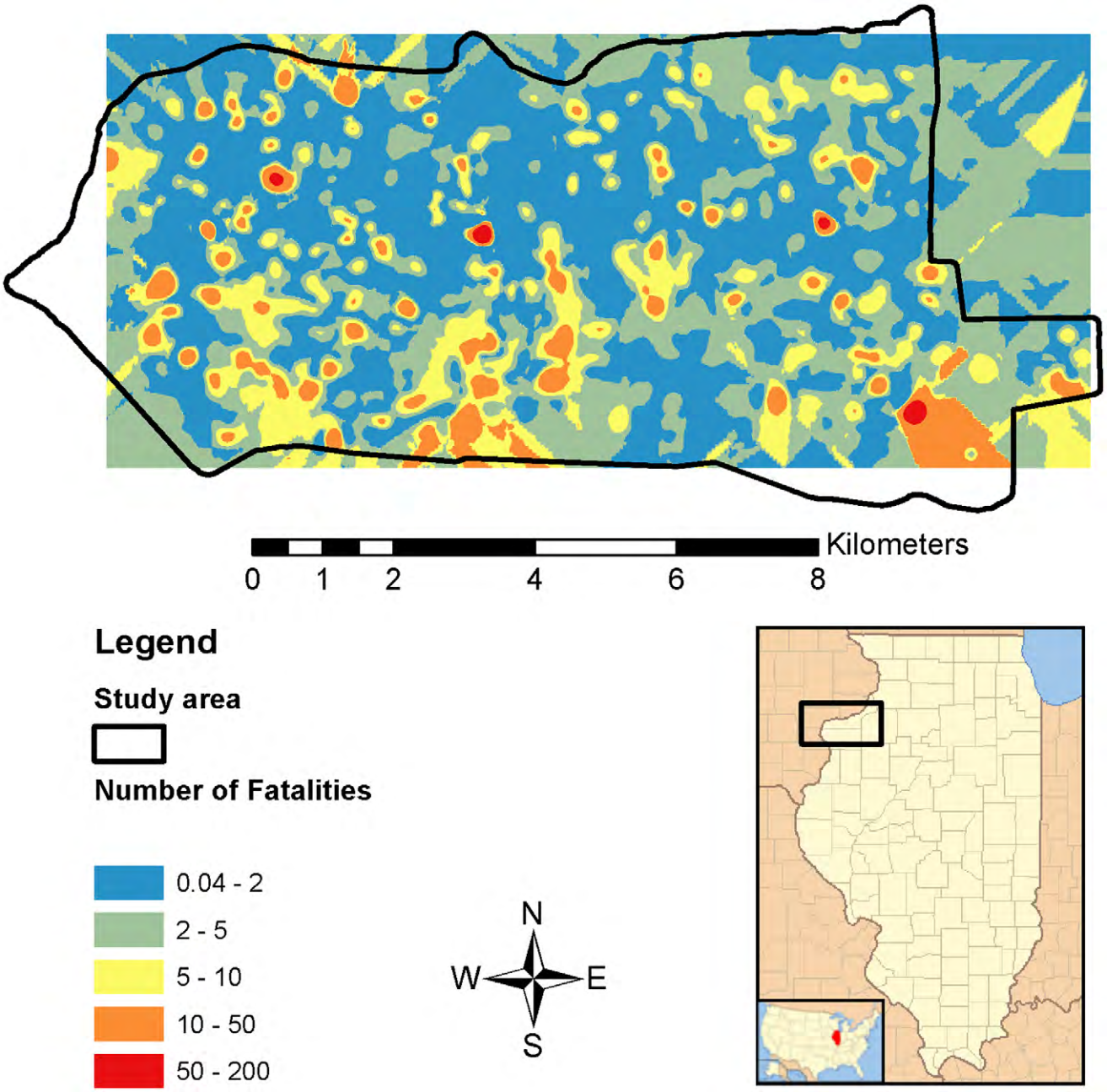

Figure 4. Predicted annual fatalities for the study area in Illinois, USA. Predicted fatalities were spatially interpolated from 1,956 model buildings using ordinary kriging.
doi:10.1371/journal.pone.0053371.g004

sites of unequal numbers of fatalities. That is, hotspot areas with excessive collision mortality may receive insufficient resources to reduce the effects of mortality, and unneeded resources may be applied to sites with little to no mortality. These implications call into question the practical uses of overall imprecise mortality estimates and prompt the need for a stronger emphasis on understanding spatial variation in BWCs.

We demonstrated how one might use factors known to influence window collisions in modeling variation in risk for a given landscape. For proposed development, urban planners could minimize future collision mortality by mapping proportion of impervious development for the landscape, and identify areas of high development, e.g., >66% impervious surfaces, in which to construct buildings. Mapping predicted fatalities for the landscape can be a powerful tool in evaluating risk and making informed decisions about where to focus resources aimed at prevention. For example, wildlife managers could focus prevention measures aimed at minimizing collisions at high-risk sites, which appear to cause relatively high mortality and affect species of conservation concern (e.g., many species of long-distance migrating wood warblers). Therefore, modeling spatial variation in collision mortality derived from data-driven experimental designs would improve evaluations of population impacts and allow conservation resources to be applied in a triage manner by implementing effective preventative measures in the most pressing settings [50].

In light of our results, land use legacies and the nature of urban growth, such as transient dynamics [13], across broad geographic scales should affect variation within and among landscapes in the numbers of individuals and species impacted by window collisions. We currently have a biased understanding of the spatial and temporal aspects of BWCs since previous research has been confined to large commercial and high-rise buildings [4–50]. At a broader scale, study sites have generally been located in areas important for bird migration, such as along major migratory pathways and at urban sites at the edges of large bodies of water where staging areas (migration stopover locations) concentrate migrants [11–19], [20–22], [23–51], this study. These studies report that window collisions disproportionally affect short- and long-distance migrant species and occur more during spring and fall migration than in summer and winter. Indeed, the cities in which these studies have been conducted include not just skyscrapers, but also a range of building sizes and vast areas of residential development [24]. Future studies should focus on how the pattern and magnitude of BWCs among urban areas reflect landscape structure and functional connectivity as was recently demonstrated for avian mortality at communication towers [58]. For example, large cities settled along migratory paths should display high variation in BWCs across the landscape, whereas low variation in BWCs would be expected at villages consisting of only small buildings (i.e., low window area) outside of migratory routes.

Supporting Information

Figure S1 Relationship between carcass observability and mean (±1 SE) detection probability of carcasses for two field workers at 20 buildings.
(PDF)

Table S1 Most-supported models of carcass detection probability at 20 buildings in an urban landscape in Illinois, USA, 2010.
(PDF)

Table S2 Seasonal sampling structure that corresponded to migration strategy and timing of breeding in Illinois, USA, 2010.
(PDF)

Table S3 List of study buildings, land cover categories, window area, development, presence of feeder stations, and number of carcasses documented and predicted in Illinois, USA, 2010.
(PDF)

Table S4 Maximum number of individuals observed for each species during point count surveys and total carcasses (shaded and in parentheses) resulting from window collisions at each study building and season in Illinois, USA, 2010.
(PDF)

Text S1 Analysis of detection probability.
(PDF)

Acknowledgments

We are deeply grateful to all landowners for granting us permission to conduct this research on their property. The helpful comments by Dr. Brock Fenton and two anonymous reviewers greatly improved an early draft of the manuscript. Kirsten Bjornson, Pheng Xiong, Henry Lapka, Carl Mohler, Matt Craig, Conrad Newell, Freja Hager, and Taylor Hager assisted with fieldwork. Reuben Heine kindly provided support for ArcGIS. We thank Josh Boudi (Rock Island County GIS Department) and Todd Green (City of Moline GIS Department) for structural data on buildings.

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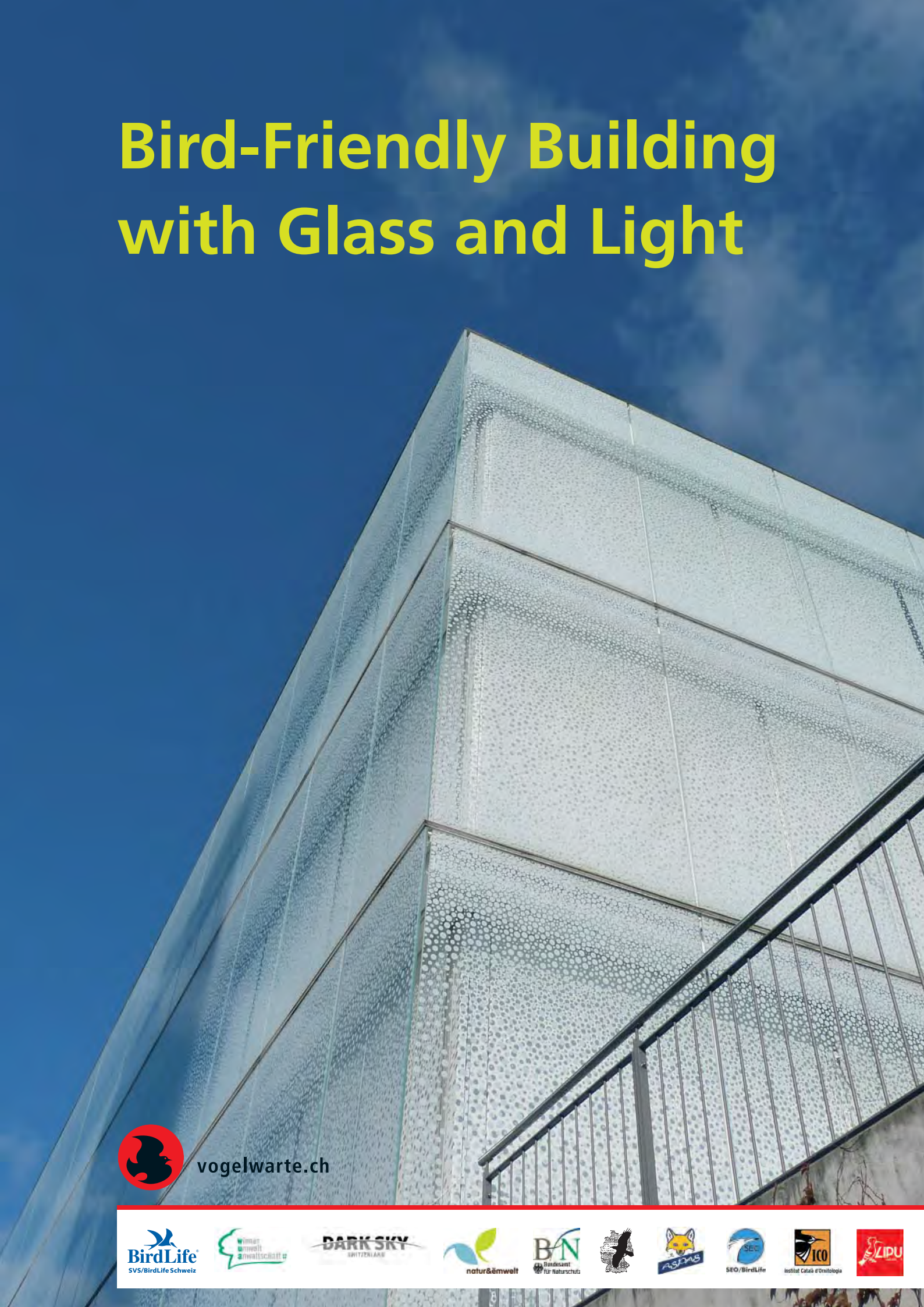
Bird-Friendly Building with Glass and Light



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Impressum

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We would like to thank the following institutions, companies and people for their support, specialist advice, and comments on the manuscript, permission to publish illustrations, etc:

Arlette Berlie, Nyon; BF berger & frank ag, Sursee; Alain Chappuis, Bernex; Création Baumann, Langenthal; Dark-Sky Switzerland; Marco Dinetti, LIPU, Parma; Endoxon AG, Lucerne; Irene Fedun, FLAP, Toronto; Martin Furler, Bubendorf; Glas Trösch AG, Buetzberg; Christa Glauser, Schweizer Vogelschutz SVS/Birdlife Switzerland, Zurich; Roman Gubler, Eschenbach; Jean Pierre Hamon, Wikimedia Commons; Carlos Hernaez, SEO, Madrid; Herzog & de Meuron, Basel; David Jenny, Zuoz; Peter Meier, Sursee; Sebastian Meyer, Lucerne; Martin Melzer, Cham; Jean Mundler, St-Sulpice; Rietberg Museum, Zurich; Nacàsa & Partners Inc., Tokyo; Elmar Nestlen, Singen; Pirmin Nietlisbach, Schenkon, Okalux GmbH, Marktheidenfeld; Werner Rathgeb, Environmental Department, Stuttgart City; Klaus Richarz, Vogelschutzwarte, Frankfurt; Max Ruckstuhl, GrünStadt Zurich; Susan Salinger, Berlin; Reinhold Schaal, Stuttgart; Peter Schlup, Erlach; Gaby Schneeberger, Flawil; Iris Scholl, Uster; Sefar AG, Heiden; Christine Sheppard, New York; Kelly Snow, Toronto; Reto Straub, Kehrsatz; Christophe Suarez, Annecy; Samuel Wechsler, Oberkirch; Cathy Zell, LPO Alsace, Strasbourg; Hannes von Hirschheydt, Isabelle Kaiser, Jonas Kaufmann, Matthias Kestenholz, Maria Nuber, Gilberto Pasinelli, Christoph Vogel, all Swiss Ornithological Institute Sempach.

Photos:
Archive Swiss Ornithological Institute/ENDOXON (4 [1]), Archive Swiss Ornithological Institute (10, 27 [1], 18, 22, 42 [2], 40 [4]), Arlette Berlie (5 [2]), Alain Chappuis (5 [1]), Création Baumann (34 [1], 33 [2]), Dark Sky (38 [1]), Marco Dinetti (9 [1], Wilfried Doppler/Viennese Environmental Ombudsman (33, 34 [1], 9, 37, 38, 43, 49 [2], 22, 23, 46 [3], 44 [4], 17 [5]), FLAP (3 [1]), Glas Trösch (48 [2]), Roman Gubler (4 [1]), Jean Pierre Hamon (51 [1]), Heiko Haupt (54 [2]), Daniela Heynen (9 [1], 39 [2]), David Jenny (7, 34 [1]), Jonas Kaufmann (5 [1]), Peter Meier (41 [1]), Sebastian Meyer (36 [1]), Martin Melzer (53 [3]), Nacàsa & Partners Inc. (30 [2]), Elmar Nestlen (51 [1]), Pirmin Nietlisbach (26 [1]), OKALUX (24, 25 [1]), Martin Rössler (9 [1], 18–21 [all]), Gaby Schneeberger (23 [1]), SEFAR (33 [1]), Klemens Steiof (42 [1]), Reto Straub (22 [1]), Christophe Suarez (50 [1]), Hannes von Hirschheydt (9 [1]), Petra Waldburger (23 [1], 25 [2]), Samuel Wechsler (34 [2]), Cathy Zell (23 [1]), all others: Hans Schmid.

Proposed Citation Text:
Schmid, H., W. Doppler, D. Heynen & M. Rössler (2013): Bird-Friendly Building with Glass and Light. 2., revised Edition. Swiss Ornithological Institute, Sempach.

ISBN-Nr.: 978-3-9523864-4-6

This Booklet is also available in German, French and Italian. Copies can be obtained on request from the Swiss Ornithological Institute Sempach or downloaded from www.windowcollisions.info. Modified publications are available for Luxembourg and Spain.

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Publisher: Swiss Ornithological Institute Sempach

Bird-Friendly Building with Glass and Light

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Swiss Ornithological Institute Sempach, 2013

Contents

Preface 3

Introduction 4
- Birds – our nearest Neighbours 4
- How does a Bird perceive its Environment? 5
- Three Phenomena and their Consequences 6

Glass as a Hazard for Birds 8
- Transparency 8
- Reflectivity 12

Bird-Friendly Solutions 15
- Reducing Transparency 15
- Pattern Testing in Flight Tunnels 18
- Alternative Materials and Construction Methods 24
- Reducing Reflectivity 32
- Retro-fitting Protective Measures 34
- Environmental Design 36

Case Studies 37
- Contemporary Solutions 37

Current Research 46

Light as Hazard for Birds and Insects 50
- Like Moths to a Flame 50

Animal Friendly Solutions 52
- Technical Solutions 52
- Operational Solutions 54

Key Points 55

Bibliography, Products and Further Information 56

Contact Addresses for Specialist Advice 57

Sponsors

We would like to thank the following Institutions for financially supporting the publication of this Booklet:

Department of Nature Protection (BfN), Bonn
Styner Foundation, Bern

Preface

We´re on the way! In 2008, when we made the first edition of this publication available and sent it to many architects and all the local Swiss building authorities, we had no idea what we would set off. This booklet was translated into Spanish and Italian, and in the meantime France, Germany and Luxembourg have published their own versions.
Our guidelines met with much goodwill in the building trade and enquiries into bird-friendly building solutions have markedly increased since then. Happily, many of our recommendations have been taken up and new ideas have been implemented. Progressive councils have begun to check building applications for bird-friendliness, and here and there, have requested improvements. Increasingly the media have written on this subject and highlighted the many victims – victims, which with better planning could have been avoided. The glazing industry is going to great lengths to develop products which will significantly reduce the rate of collisions. And in research and development too, new advances are being made.
This provides us with more than enough reasons to update our booklet. We have taken the opportunity to include new examples and developments, to expand others and to update our recommendations to the newest standards.
Despite clear progress we have to conclude that there is still a long way to go. Daily, buildings are erected where a bird-lover can only ask "how can anyone do that?" It remains our goal to reduce unnecessary bird hazards and, at the same time, to protect builders, glazing manufacturers, architects and planners from criticism. In addition we want to promote the development of more aesthetic solutions, showing the way to the future. We are working on it. Keep supporting us!

Dr. Lukas Jenni
Director, Swiss Ornithological Institute Sempach

Hundreds of coal tits died on just this building in Basel, Autumn 2006. Feathers and traces of collisions are lasting reminders of the many dramas on our windows.

Surface collision victims collected in one migration season from skyscrapers in Toronto´s downtown financial district.

Introduction

Birds – our nearest Neighbours

We share living space with birds. Central European housing developments with green spaces frequently accommodate 30 or more bird species. It is up to us to protect them from unnecessary dangers.

The kingfisher is an endangered species, but one which is common in housing developments. Many are killed through hitting glass whilst flying at speed low over the ground.

Birds have lived on our planet for 150 million years. In contrast, humans have only been around for 160 000 years. Since the development of agriculture, we often live in close proximity to them. And in the last few hundred years more and more bird species have become adapted to civilisation. For example, the ubiquitous blackbird used to be a shy forest bird. Its adaption to urban living is, however, playing with fire: advantages such as a favourable microclimate and a rich supply of food are in stark contrast to the considerable dangers posed by traffic, glass bottles and the density of cats. In contrast, the species which have not managed to adapt are threatened by increasing urbanisation and are suffering habitat loss. Thus we have a responsibility, at the very least for those species which have adapted to live with us, to provide suitable living space. As part of that, we need to protect them from unnecessary man made dangers. Otherwise we will pay for it with the loss of birdsong and with it, some of our quality of life.

Birds and people today share the same living space. Around 400 pairs of birds from 40 different species live in this location in central Switzerland - and this on an area of around one square kilometre. The territory of the 15 most common species are here indicated with coloured dots (red: pied wagtail, black redstart and house sparrow; light blue: tits, nuthatches and finches; yellow: thrushes and warblers).

How does a Bird perceive its Environment?

Do we see the world as it really is? Or do birds have a different view? In either case, birds have a few noteworthy abilities that people don´t have.

Birds are very visual creatures. Their eyes are highly developed and are vital for their survival. In most bird species they are set in the sides of the head. This gives them a «wide-angle», in some species even a 360°, view, which enables them to recognise approaching enemies and potential mates or rivals. The disadvantage is a comparatively small area of view is covered by both eyes: stereoscopic vision and with it, spacial perception, are therefore limited. The two eyes often undertake different tasks concurrently: one is focussed on a worm, while the other surveys the surroundings. The resolution is phenomenal: whilst we can just about process 20 pictures per second, a bird can manage around 180. Notable differences are also seen in colour recognition: birds differentiate green tones better than we are able to. And in addition, birds have a fourth colour channel that enables them to see in the UV-A range. The buzzard is struck by the mouse's urine trace and can accurately estimate whether an attack is likely to be successful. However, despite the excellent optical abilities of birds in their natural environment, glass is invisible to them. Although much is known about the sensory abilities of the eye, many questions remain unanswered, such as the effects of optical triggers in the brain. To imagine you are a bird and to understand how it comprehends its environment and interprets signals is only possible at a rudimentary level. For example, it is not satisfactorily explained whether birds are repelled by UV images on a glass plate, or in fact attracted to them. That requires extensive testing in order to develop effective anti-collision solutions (see page 46).

For most birds, like the blue tit here, the eyes are positioned on the sides of the head. This allows an almost 360 degree view. But the consequence is less stereoscopic vision.

The eyes of the common snipe each cover an angle of view greater than 180 degrees. Thus the bird has a small amount of stereoscopic vision both front and back.

Many birds, like this great tit, are accustomed to fly through dense branches. Even tiny ´holes´ are regarded by them as flight paths.

Palm Area Rule:
As a rule, the size of the palm of the hand can be used to estimate if an opening is big enough for a bird to fly through.

Three Phenomena and their Consequences

Until recently, birds could move unhindered in the air. Obstacles were always visible and the birds could skilfully avoid them. But evolution has not equipped them with the ability to see glass walls. There are three particular phenomena which lead to collisions with glass.

Transparency

The most well known cause of glass collisions is its transparency. The bird sees the tree, the sky or an attractive landscape through the glass and flies straight for it, colliding with the pane of glass in the process. The danger is increased with increasing transparency and size of the glazed area.

Trees, an attractive habitat, free space to fly in and a plate of transparent glass in between: this is the danger for birds.

Reflectivity

The second phenomenon is reflectivity. The type of glazed surface, the light and the environment behind the glass all determine how strongly and how clearly the surroundings are reflected. If a park environment is reflected, the bird is deceived into thinking it sees a pleasant environment. It flies directly towards it, without realising that this is only a reflection. Reflective surfaces placed in the landscape have the same effect.

Sun-protection glass and many other types of glass have a high reflectivity index. The stronger the reflection and the more attractive the environment reflected, the greater the number of collisions.

Source of Danger: Light

In central Europe, less well known – but still a major issue – for nocturnal migratory birds is the false guidance provided by artificial lighting. Often, birds are attracted to the light, become disoriented and lose their route, or indeed, collide with obstacles. This danger is increased in poor weather and fog. It is known to occur at lighthouses, gas and oil platforms (gas flaring), skyscrapers, lighted buildings on alpine passes, lampposts and other exposed structures. The current trend for more high-rise buildings increases this danger.

Strong lighting is also a disaster for other animal species, in particular insects, and there is controversy over the potential negative influence on our own health from night lighting, as the exchange of the important hormone Melatonin is reduced. Melatonin promotes sleep, regulates physical health and the immune system and triggers hormone production in humans, animals and plants.

Internal lighting in a building: lights which shine strongly upwards, e.g. lighthouses, etc. confuse migratory birds flying at night, particularly in fog or bad weather. They are attracted to the light and collide with the building or the light source. The taller the building, the greater the danger.

➤ **Essentially, collision dangers are everywhere.**

The danger of collisions with glass is practically everywhere. This highly reflective «Monolith» was installed by an artist at the base of the Morteratsch Glacier in the Graubunden Alps, 2,100 meters above sea level. Although the surroundings look inhospitable, even here there are traces of bird collisions on the mirrored surfaces.

Glass as a Hazard for Birds

Overview of the hazards in a modern development: ***1*** *Bicycle stand in transparent material;* ***2*** *Reflective façades (glass, metal, etc.);* ***3*** *Trees in front of reflective façades;* ***4*** *Attractive green spaces in front of reflective façades;* ***5*** *Transparent noise barriers with ineffective black silhouettes;* ***6*** *Glazed entrance to the underground parking;* ***7*** *Transparent aerial walkway;* ***8*** *Reflective façades;* ***9*** *Garden sculptures made of reflective or transparent material;* ***10*** *Transparent corners;* ***11*** *Winter garden;* ***12*** *Glass balcony walls;* ***13*** *Transparent corners;* ***14*** *Plants behind transparent surfaces. For information on how to make this development bird-friendly, see page 15.*

Transparency

Where are the danger zones? The most obvious and well known hazards are those which are often known from childhood: for example, the windbreak on the house corner, or the glazed corridor between two school buildings.

Positions of windows on corners.

There are countless situations where surfaces, which permit a view of the environment behind them, become a problem for birds. Glazed house corners, wind and noise barriers, corridors, conservatories, etc. are some of the danger zones. The dangers are increased in confined spaces (for example, a glass wall between two large buildings) or dead ends. For the same reasons internal courtyards, particularly landscaped ones are also problematic. With thoughtful planning many of these problems can be eliminated, or at least greatly reduced, in advance. Windows which will later provide a view should not be placed on corners. Bevelled corners, however, are not a problem as long as the bordering walls are visible (see diagrams left). Transparency on balcony walls, corners of conservatories, glazed walkways, acoustic insulation barriers, etc, should be avoided wherever possible, or clearly marked from the beginning. Or an alternative material, such as ribbed, corrugated, matt, sanded, etched, coloured, laser marked or printed glass should be used.

Transparent corner construction

Completely glazed waiting room

Wind barrier with virtually useless bird of prey markings

Wind- and noise barrier between buildings

Transparent noise barriers

Glazed footbridge

Glazed balcony walls and noise barriers

This block of flats contains many transparent glazed balcony balustrades and barriers

Glazed retro-fitted extension to a train station concourse

Valley station of a mountain cable car, glazed on three sides: birds fleeing late snowfall fly into the building and hit the windows - usually from the inside.

Transparent bicycle shelter

The practically invisible plexiglass walls on this shopping trolley shelter are dangerous

Glazed stairwell

Transparent corridor

Reception building for a large industrial company. The optical conjunction of the interior and exterior spaces is extremely dangerous for birds. Just as perilous are buildings by water or in green spaces, when reflective façades integrate into the environment.

A cosy space in the outdoors. The hedges contribute to the corridor-effect created by the panes of glass. The raptor silhouettes on the glass show that the problem is recognized. But they certainly will not resolve it.

➤ **Markings e.g. on glass doors – at least those at eye level – are also helpful for the visually impaired!**

➤ **Raptor silhouettes have not had the desired effect (see page 15).**

Reflectivity

Reflections of the environment are created as part of the architectural design. In addition, strong reflections minimize sunlight ingress. However reflectivity is just as dangerous for birds as transparency.

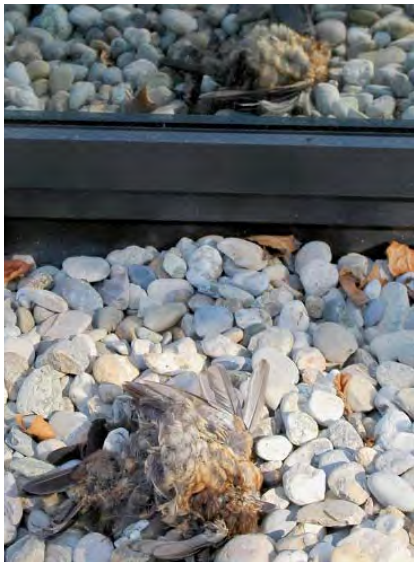
It is easy to see why reflections confuse birds. The degree of external reflection of glass panes and the design of the surrounding environment are of great importance. Strongly reflective sun protection glass panels are therefore particularly dangerous. Reflectivity, even at moderate levels, such as on normal window panes poses a danger, particularly when the room behind is dark. In recent years triple glazing has become industry standard: it saves energy and is pleasing to the eye. However, its construction makes it more reflective than standard glazing, which is why the danger for birds is accentuated.

A uniformly coloured sky is the principle danger for aerial hunters, such as raptors, swifts and swallows. Overall, however, trees and shrubs in the nearby surroundings are much more problematic, because they attract more birds of more species. It is therefore important to pay special attention to reflective surfaces when designing the environment (see page 36). This also applies to strongly reflective metal surfaces.

Reflectivity depends on a number of factors such as, for example, the lighting in the interior space behind. The same glass produces stronger reflections with increasing darkness of the background.

Sun protection glass produces high quality reflections of the environment as a result of its high reflectivity index. The danger is particularly great where it reflects trees or natural landscapes.

On this bank, the Departement for the Preservation of Historical Heritage imposed conditions. A strongly reflective glass façade should highlight the neighbouring church…



…an idea that has already claimed many victims (here a young blackbird).

This association between old and new may be pleasing from an aesthetic point of view, but from the birds perspective it should never have been permitted.

A sports hall: one wall runs parallel to a forest border. There is no pressing need to have such highly reflective glass on this west-facing façade.

Large façades, strongly reflective glass, in the middle of a landscaped environment – a death-trap, which, from the financial cost alone, cannot be rectified.

A new school building with a wide, two story glass façade. Because of the highly reflective glass there were continual collisions. The coloured silhouettes were created by the pupils and the biology teacher in an act of desperation. The collision hazard was reduced, but the issue is neither pleasingly nor effectively resolved.

➤ **No reflective façades next to trees or in landscapes that are atrractive for birds!**

Bird Friendly Solutions

This picture shows which methods can be used to minimise bird hazards (comparison page 8). ***1*** *Bicycle stand in semi-transparent material;* ***2*** *Glass with highly effective patterns;* ***3*** *Reduction of transparent corners;* ***4*** *Modified landscape (no attractive green spaces and trees close to potential hazards);* ***5*** *Noise barriers: surface patterns or semi-transparent material;* ***6*** *Underground parking entrance: surface patterns or semi-transparent material;* ***7*** *Aerial walkway: reduction of transparency, e.g. through design elements in the construction;* ***8*** *Living Walls (façade covered with living plants);* ***9*** *Garden sculptures made of non-transparent material;* ***10*** *Non transparent building corners;* ***11*** *Winter gardens and* ***12*** *Glazed balcony balustrades: surface patterns or semi-transparent material, e.g. patterned glass;* ***13*** *Non-transparent balcony corners (screens, blinds, curtains, etc);* ***14*** *Plants placed only behind semi-transparent surfaces.*

Reducing Transparency

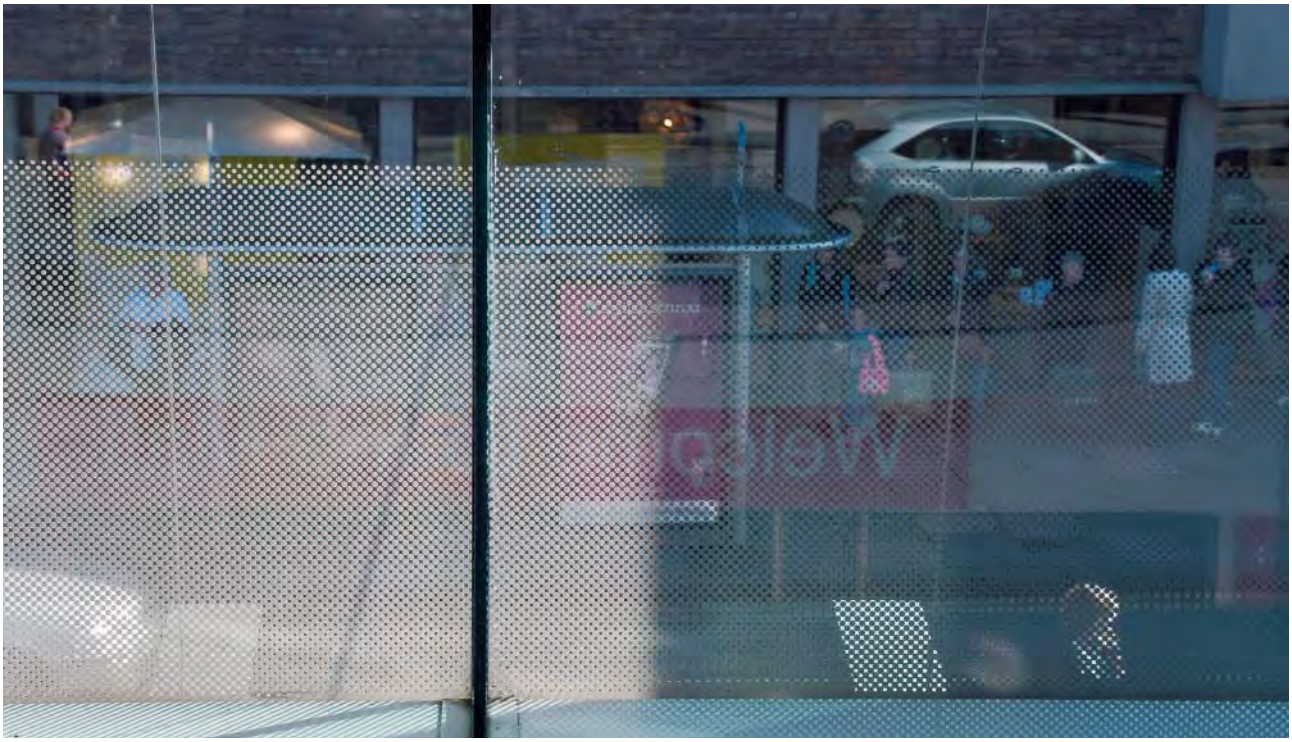
If transparent surfaces on exposed areas cannot be avoided, then it is essential that the through visibility is reduced. The use of semi-transparent material or extensive surface marking is the most effective method. This is true not only for glass but also for other transparent materials, such as polycarbonate.

Black Silhouettes are ineffective

Up front: despite the fact that these silhouettes are regrettably still available in the shops this is no proof of their effectiveness. They are not recognised as predators by birds. In addition, they do not provide sufficient contrast to a dark background. Often, traces of bird collisions are found right next to the stickers. Therefore we strongly advise against using them.

Dots, Grids and Lines

To prevent collisions effectively, transparent surfaces must be made visible to birds. Many new products are now available that promise protection from UV rays with patterns which are largely invisible to human eyes. So far there has been no evidence of sufficient effectiveness. Therefore, we cannot recommend UV-Protection Glass. Thus we have to accept a reduction in transparency will also affect our view. In brief, there are two options: patterns over the whole surface (for example, stripes or dots) or alternative materials, such as opaque,



Patterns have different effects depending on the lighting. This shop window is covered with a very dense dot pattern. Whilst the right-hand section in shade is semi-transparent, and some things can be seen, the left-hand side is much more diffuse. The grid does not need to be this dense in order to provide effective collision prevention.

light-permeable material, e.g. frosted glass. The effectiveness of the patterns is related to percentage coverage, contrast and the reflectivity of the glass. Technically, there are many ways to make effective patterns. If you want to use marked glass, we advise having the glass screen printed during manufacture. Glazing manufacturers often offer a variety of patterns and colours "off the shelf". Lamination, which is very durable, permits two different patterns to be featured in the glass.

Recommendations

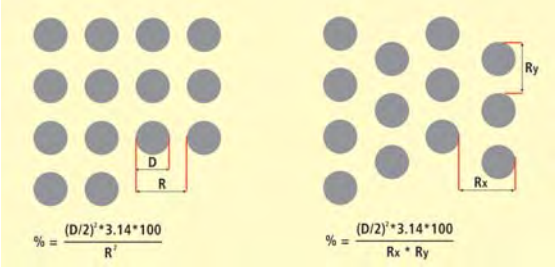
Clear borders and strongly contrasting lines are the most effective patterns. In tests, red and orange patterns are markedly more effective than the same patterns in blue, green or yellow tones. Vertical lines have slightly better results than horizontal ones. Markings placed on the outside surfaces are more effective because they break up reflections. Generally, we recommend using tested patterns and, at least on large projects, obtaining specialist advice. Even small changes to the pattern can bring large changes in effect. In working spaces Local Regulations and recommendations for workplace design should be followed.
Rules for linear patterns: the line must always have a minimum diameter of 3mm (horizontal lines) or 5mm (vertical lines). To be on the safe side, coverage should be a minimum of 15 %. Try to ensure maximum contrast in all lighting, so that the coverage can be minimised.
Dot grids should provide at least 25% coverage. Only if the dot diameter exceeds 30 mm can the coverage be reduced to 15 %. Ideally, the dots should not be too small (minimum Ø 5 mm). Dot grids should also be high contrast compared to the background.

➤ **Wherever possible, place markings on the external surface!**

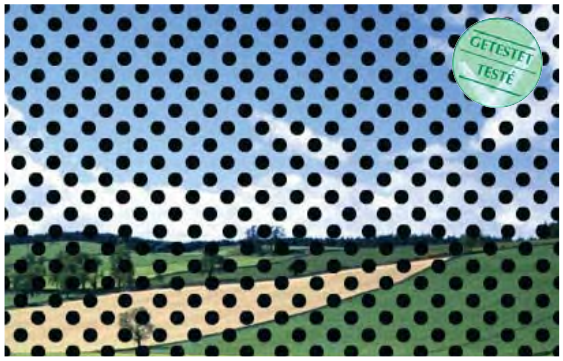
Nuisance – or Accent?

The human eye accustoms itself to many things. Initially a patterned surface can be distracting, but through clever pattern selection and lighting, one can very quickly become accustomed to it. Also, residents often feel the need for privacy, e.g. on balconies, so that complete transparency is unwanted. And: when the reason for the markings is explained, often acceptance follows.
Freeing the imagination provides the chance to turn the glazed surfaces into a decorative element, or even advertising.

➤ **Dot grid: coverage: min 25 % for small dots, min 15 % for dots Ø ≥ 30 mm.**



Calculation of the coverage afforded with a dot grid



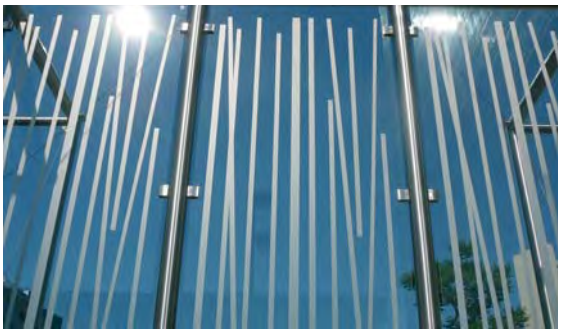
Dot pattern with 27 % coverage, Ø 7,5 mm.

➤ **Horizontal lines: min 3mm diameter with 3cm spacing, min 5mm diameter with 5cm spacing. Vertical lines: min 5mm width, max spacing 10cm. Requirements: good contrast to background, otherwise wider lines are required.**

Classic example of vertical lines: noise barriers along a traffic artery.

Linear patterns are established prevention. Crystal coloured film contrasts well against most backgrounds.

Variations on a theme are permitted! Small breaks reduce the severity of vertical lines.



It is not necessary to make the lines strictly vertical!

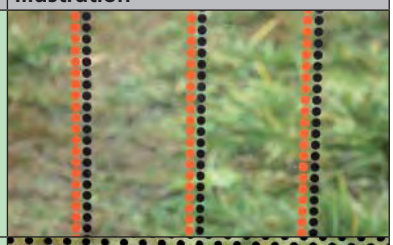
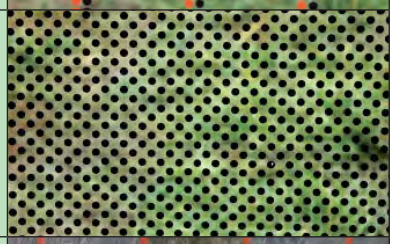
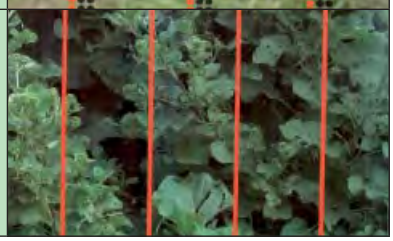
Horizontal black lines, 2 mm in diameter and with a 28 mm interval had very good Flight Tunnel test results – against all expectations. Where it is important to have the best possible visibility, in front of light backgrounds, this is an acceptable compromise. We would, however, recommend that the lines are at least 3 mm wide.

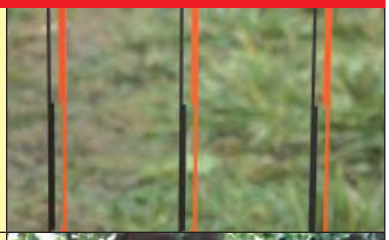
Pattern testing in Flight Tunnels

Martin Rössler has been performing standardised flight tunnel tests (ONR 191040, see Page 47) since 2006 at the biology station Hohenau-Ringelsdorf (Austria). These tests are accepted as the most comprehensive and methodologically sound empirical safety tests on the effectiveness of patterns on glass. 30 of the 38 patterns tested are listed below. 2.4 % approaches means that given a choice only 2.4 % of the birds flew towards the patterned glass panel but 97.6 % flew towards the unmarked control glass panel.

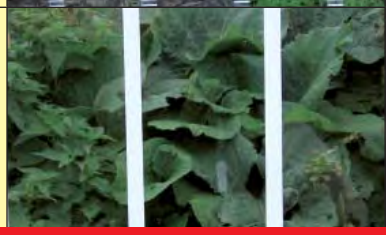
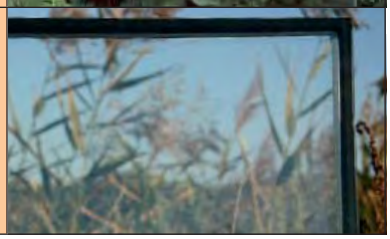
From many years of experience and through discussion with international experts 3 categories of effectiveness have been defined:

Category	Effectiveness of the Pattern/Marking	% of approaches to the test panel
A	Highly effective – "Bird Safety Glass"	Less than 10
B	Suitable in some circumstances	10–20
C	Unsuitable	20–45

Nr.	Approaches	Description	Illustration
1	2.4 %	**Dots black-orange R2** Coverage: 9 % Vertical rows, printed, black and orange Dot Ø: 8 mm Spacing between lines: 10 cm	
2	2.5 %	**Dots black RX** Coverage: 27 % Diagonal dot grid, printed, black Dot Ø: 7.5 mm Diagonal space between centre of dots: 12.7 mm	
3	3.9 %	**8.4v // orange vertical** Coverage: 7.4 % Vertical stripes, printed, orange Line width: 6 mm Spacing between lines: 8.4 cm	
4	5.2 %	**Dots black R2** Coverage: 9 % Vertical rows, printed, black dots Dot Ø: 8 mm Spacing between lines: 10 cm	
5	5.6 %	**Dots Black-Orange R3** Coverage: 12 % Vertical rows, printed, black and orange Dot Ø: 8 mm Spacing between lines: 10 cm	
6	5.8 %	**10v // 5 orange Duplicolor** Coverage: 4.8 % Vertical stripes (enamel spray Duplicolor Platinum, RAL 2009 traffic orange, three coats) Line width: 5 mm	

Nr.	Approaches	Description	Illustration
7	5.9 %	**Glass Decoration 25** Coverage: 25 % Lines of irregular width with irregular edges (adhesive film Oracle Etched Glass Cal 8510, matt, translucent) Line width: 15-40 mm Interval between line edges: max. 11 cm	
8	6.2 %	**Glass Decoration 50** Coverage: 50 % Lines of irregular width with irregular edges (adhesive film Oracle Etched Glass Cal 8510, matt, translucent) Line width: 10-80 mm Spacing between lines: max 6.5 cm	
9	7.1 %	**2.8h // black filament in Plexiglas** Coverage: 6.7 % Plexiglas ® Soundstop with embedded horizontal black polyamide threads Thread diameter: 2 mm Interval between rows: 28 mm	
10	9.1 %	**1.3v // 13 white** Coverage: 50 % Vertical stripes, printed, white Line width: 13 mm Spacing between lines: 13 mm	
11	9.4 %	**10v // 5 red Duplicolor** Coverage: 4.8 % Vertical stripes (enamel spray Duplicolor Platinum, RAL 3020 traffic red, three coats) Line width: 5 mm Spacing between lines: 10 cm	
12	9.9 %	**10v white barred lines, double sided** Coverage: ca 5.3 % On each side, vertical discontinuous lines on the front and back. Adhesive film glossy white (Orajet 3621). Line structure: small horizontal bars, diameter 2.5 mm Line width: 20 mm Interval between rows: 10 cm	
13	10.1 %	**Bars black-orange** Coverage: 7.5 % Pairs of vertical stripes of changing diameter (2.5-5 mm), printed, black and orange, (interval between pairs of lines: 7.5 mm) Spacing between lines: 10.5 cm	
14	10.7 %	**2.8h // 2 black Film/Glass** Coverage: 6.7 % Horizontal stripes (glossy black adhesive film) Thickness: 2 mm Interval between rows: 28 mm On Float Glass	

Nr.	Approaches	Description	Illustration
15	11.1 %	**10v // 5 glossy blue Adhesive** Coverage: 4.8 % Vertical stripes (blue adhesive film Avery 741) Line width: 5 mm Spacing between lines: 10 cm	
16	11.5 %	**2.8h // 2 Black** Printed Film/Plexiglas Coverage: 6.7 % Horizontal lines, black Line width: 2 mm Spacing between lines: 2.8 cm Roller printing on laminate film. Plexiglas, strength 1.5cm, printed surface of the film adheres to Plexiglas	
17	12.5 % (2007) 12.8 % (2008)	**10v // 20 white Tesa** Coverage: 16.7 % Vertical stripes (white tape) Line width: 20 mm Spacing between lines: 10 cm	
18	12.9 %	**10v // 5 black Tesa** Coverage: 4.8 % Vertical stripes (black tape) Line width: 5 mm Spacing between lines: 10 cm	
19	13.3 %	**10v // 5 matt yellow Film** Coverage: 4.8 % Vertical stripes (yellow tape Avery 500, matt) Line width: 5 mm Spacing between lines: 10 cm	
20	14.8 %	**10v // 5 white Tesa** Coverage: 4.8 % Vertical stripes (white tape) Line width: 5 mm Spacing between lines: 10 cm	
21	14.8 %	**Dots, white film** Coverage: 6.3 % Circles (white stickers), Ø 18 mm in grid format Distance between circle centres: 8.2 cm	
22	15.1 %	**10v // 20 black-white Tesa** Coverage: 16.7 % Double vertical stripe, tape, 10 mm black, 10 mm white Spacing between lines: 10 cm	

Nr.	Approaches	Description	Illustration
23	15.9 %	**10v // 20 white barred lines** Single-sided Coverage: ca. 5.3 % Vertical discontinuous lines. Adhesive film glossy white (Orajet 3621) Line structure small horizontal bars, diameter 2.5 mm, bar spacing 5 mm Line width: 20 mm Spacing between lines: 10 cm	
24	18.3 %	**15v // 20 white Tesa** Coverage: 11.8 % Vertical stripes (white tape) Line width: 20 mm Spacing between lines: 15 cm	
25	21.5 %	**Stripes, fine, blue** Coverage: ca. 25 % Fine blue horizontal lines on plastic material between double glazing Line thickness 1–2 mm, spacing 2–3 mm	
26	22.1 %	**10h // 20 Tesa** Coverage: 16.7 % Horizontal stripes (white tape) Line width: 20 mm Spacing between lines: 10 cm	
27	24.1 %	**10v // 5 green Duplicolor** Coverage: 4.8 % Vertical stripes (enamel spray Duplicolor Platinum, green, three coats) Line width: 5 mm Spacing between lines: 10 cm	
28	25.0 %	**2.8v // 2 black printed Film on Plexiglas** Coverage: 6.7 % Vertical lines, black Line width 2 mm Spacing between lines: 2.8 cm Roller printing on laminate film. Plexiglas, strength 1.5 cm, printed surface of the film adheres to Plexiglas	
29	35.3 %	**Plexi smoke** Coverage: 0 % Unpatterned, tinted Plexiglas Soundstop® Smoky Brown, darkened, strength 15 mm	
30	37.2 %	**ORNILUX Mikado Neutralux 1.1** (EP2/Ornilux Mikado 4mm 16 EP3/VSG N33 8 mm, 0.76 mm) Double glazing with special coating in the middle, which according to the manufacturer absorbs and reflects UV radiation.	

The sky is the limit...

Let your imagination take flight! The following examples give an idea of how varied bird friendly measures can be. For architects there are few limits to creativity.

Company logo printed on an office building.

Privacy for guests - and advertising at the same time.

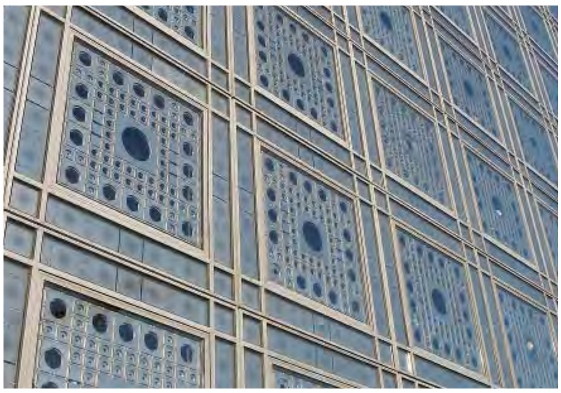
Unfortunately, the Palm Area Rule has not been observed on the unique design on this riding centre.

The decoration on the Rainforest House in the Schoenbrunn Zoo also protects the tropical birds inside from collisions.

The collision risk has been considerably reduced through the artistic design on this façade.

The black grid design on this corridor is an interpretation of the Mollier-Diagram.

Playful staging of the view – and effective bird protection at the same time (erected in front of the glass).



This façade on the Institut du Monde Arabe brings an oriental touch to Paris.

Noise barriers: effective despite the botanical design.

Using art on a building opens unlimited possibilities.

Pedestrian viaduct with two different, but in both cases effective, solutions.

The screen printed pattern guarantees privacy for the terrace users and enhances the 3D structure of the building.

This printed pattern is placed between the panes of double glazing, which is why the reflections remain.

Highly visible leaf patterns on the panes of glass in this corridor between blocks of flats.

Historic motif, laminated into the noise barrier. Regrettably, the neighbouring barriers are transparent.

Highly effective, even when perhaps not in the spirit of the designers original vision.

Alternative Materials and Construction Methods

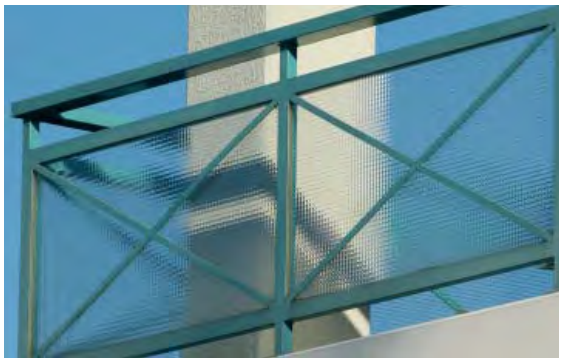
Semi-transparent Surface and Glass Bricks

Semi-transparent glass surfaces, semi-transparent walls and glass bricks are building components which do not pose any danger to birds. Depending on the material used, a good amount of light and an interesting light- and shadow-play can be created. Today, double glazing with capillary inlays is available, which directs light deep into the room, but still offers very good sun and glare protection.

Light dispersing double glazing in double shelled U-profile glass makes use of daylight and significantly reduces heat loss. It provides even lighting for the whole room.

Glass bricks are very bird friendly and, from a bird conservation point of view, can be used without reservation.

Cycle shelter with semi-transparent side walls. The curved transparent roof should not be a problem.



Semi-transparent balcony glazing, here made of moulded glass, is no danger for birds.

Semi-transparent balcony balustrades look fresh and create privacy.

Suspended and Embedded Screens, Louvres, Brise Soleil and Blinds

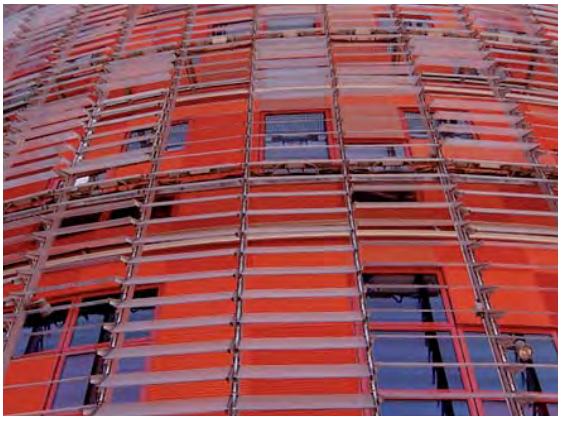
Adjustable or fixed sunshades on the outside of a building don´t just provide protection from overheating. Depending on the type and the installation, one side effect is protection from bird collisions. Double glazing with embedded vertical blinds lets diffuse light into the interior and is also bird friendly. Even horizontal blinds will make the glass hazard visible to birds. Effectiveness is still strongly dependent on surface reflectivity and the position of the blinds. Brises Soleil also reduce light emissions upwards at night.

Louvres and vertical or horizontal blinds shade and structure the façade. If they are installed as densely as in this example, the remaining danger is minimal.

Embedded blinds. When in use, even if set at an angle, they provide a degree of protection.

These horizontally movable blinds protect from overheating and avert bird collisions.

Double Glazing with embedded wooden blinds provides a lovely atmosphere.

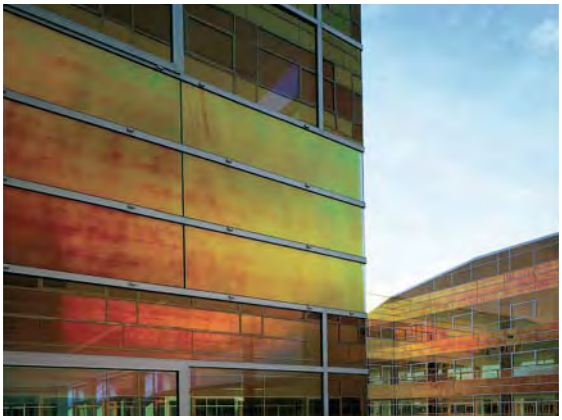


The Torre Agbar in Barcelona, completely enclosed in Brises Soleil.

Track blinds can be fully adjusted to manage lighting requirements.

Coloured Glass

Coloured glass alone does not offer complete protection, though admittedly, there is insufficient data in this area. What is uncontested is that collisions occur even on highly coloured glass if the surface is strongly reflective. Low reflective surfaces in strong colours, as in our examples can, however, be extremely bird friendly.



This strongly coloured, low reflective glass and the opaque corners make this building bird friendly.

Because the glass panes used here are semi-transparent, of small surface area and low reflectivity: birds can see them clearly.

These new developments are quite distinctive!

Innovative Police Headquarters: poses virtually no problems for birds.

This footbridge in Coinbra, Portugal, brings colour into the landscape.

Angled Surfaces and Skylights

Steeply angled glazed surfaces or even whole roofs of glass are generally no problem from the point of view of bird protection. The roofed plaza in front of Berns' main train station (see picture below), which is very large, floats several metres above the ground, and was thought to be a risk for birds that take off vertically, so glass with a dot grid pattern was installed during construction.

Skylights are generally no problem for birds.

The triangular construction creates a lattice effect.

In general, such large glass ceilings are unproblematic. There is a slight risk posed by the edges, as they have a steeper gradient. Thanks to a point grid pattern over the whole surface, which also provides some glare protection, this danger has been removed.

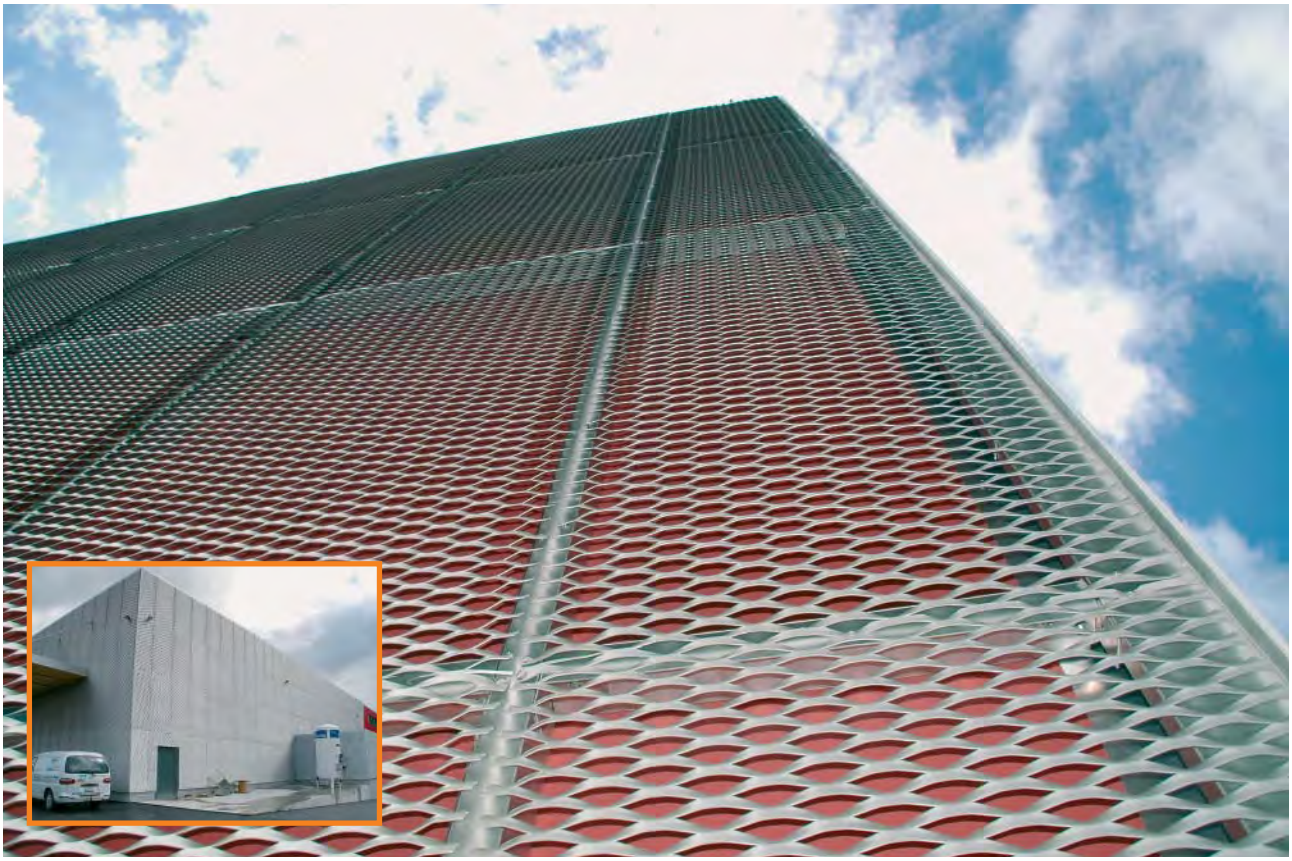
Façades and Buildings constructed from Metal

Building elements constructed of metal or wire mesh are recognised by birds as a barrier. Therefore, these façades are generally not a danger for them. Strongly reflective metal surfaces are, however, an exception. Tests show that these are just as dangerous as similar glass façades. If smaller birds, such as sparrows, should not be able to penetrate the surface, the mesh apertures should not exceed 2 cm. For pigeons, it should not exceed 6cm.

Metal façade erected in front of the building façade

Wire mesh: light-transmissive, economic, bird friendly

➤ **Maximum mesh aperture, so that small birds cannot penetrate the façade: 2 cm (6 cm for pigeons).**



Alternative exterior facing: this factory façade is largely covered in expanded metal and is harmless for birds. With a maximum aperture of 2 cm there is also no danger that birds will penetrate the façade.

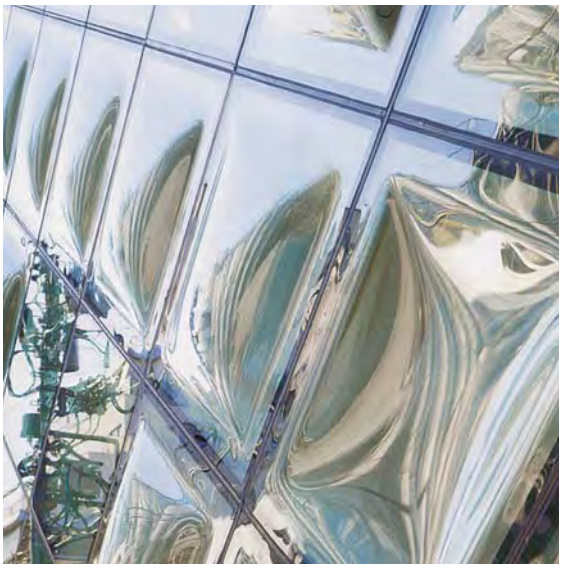
In principle, this façade of strongly reflective metal panels is dangerous for birds. The danger has been reduced through the ornamental holes. There are, however, large spaces of unperforated metal, which remain a collision hazard.

Although this warehouse is almost completely covered in reflective metal, the intense warping makes it harmless for birds.

Contoured surfaces

Strongly contoured or curved glass or metal surfaces should pose only a mild danger even when they are highly reflective, because the reflected image is distorted and often almost unrecognisable. But there is still too little research in this area to be certain.

The reflected Poplars are hardly recognisable on the cylindrical section of this building.



Such curved glass tiles are pretty reflective...

...but as the reflections are broken up the surroundings are hardly recognisable.

Solar Panels on Façades

Solar panels are fashionable right now and further developments, such as the installation of solar modules on balcony balustrades, are on the horizon. Already a wide range of products of varying quality are available. We have not yet observed any problems with birds. But here, too, if there is any doubt about bird-friendliness, we suggest avoiding highly reflective panels – this will also benefit residents and passers-by.

This idiosyncratic hall has a solar roof, which also forms part of the façade. The angled windows below reflect the ground, but whether this is bird friendly is not definitely clear.

Innovative architecture with solar panels mounted on the façade. The solar panels are reflective, but the embedded lines delineate the structure and therefore they are not a bird hazard.

Reducing Reflectivity

Reducing dangerous reflections is a particular challenge because variable light conditions affect reflectivity. Glass with a low coefficient of reflection is a step in the right direction.

To reduce the dangers of reflectivity we recommend only installing glass with an external coefficient of reflectivity of 15 % or less. Increasingly popular, triple glazing often exceeds this value, but triple glazing with a coefficient of reflectivity of 13 % is already available. Such glazing is not completely safe, but for particularly large surfaces, it is an economically attractive and acceptable solution which does not reduce visibility. Light and warmth can be adjusted through clever shade and air conditioning systems. Through night ventilation and heat recovery, etc, overheating in summer can efficiently and economically be reduced. If glare protection glass is unavoidable on a south facing façade, then the reflection can be minimised with a point grid pattern (see page 48).

When installing low reflectivity glass, it is necessary to check that the reduction of reflectivity does not create a new danger in the form of increased transparency. Therefore, glazed corners and other transparent constructions should be minimised through appropriate layout and interior design. The remaining potential flight corridors should be marked as described on page 15.

➤ **External coefficient of reflection: as low as possible, maximum 15 %**

Thanks to low reflection glass it is possible to see into this school building. Only exceptionally would a bird try to fly into this, for it unattractive, building. The saplings will barely be reflected when they are taller.

Integrated shading system in a glass façade. The reflectivity is not completely removed and is increased through the angle of view. Despite this, thanks to the light coloured materials used, the reflection levels are tolerable.

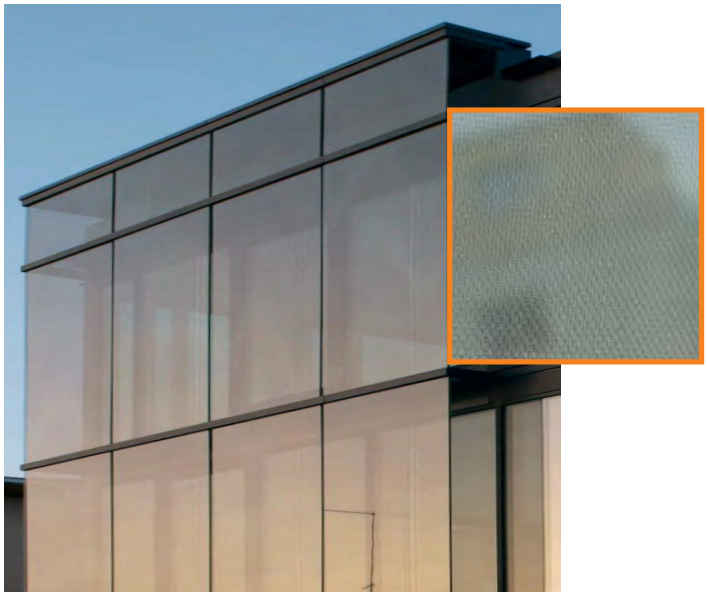
Mounting an external insect screen (window on the right) massively reduces the reflectivity.

Light coloured curtains mounted close to the window reduce reflectivity: the difference is striking.

Sun protection glass in a company reception building. The blinds in the upper storey markedly reduce the reflectivity of the panes.

A solution which has already been frequently commended is adhesive fabrics for windows. If required, they can be removed or re-placed without leaving marks.

These vertical blinds transmit soft light and provide privacy from passers-by. Thread, or fringe, curtains have a similar effect.



Fine textiles laminated into the glass reduces external reflectivity, functions internally as glare protection, but still permits the occupants a view outside (inner is black).

Retro-fitting Protective Measures

With experience, bird hazards can be recognised in the planning stages. If the opportunity to install protective measures during construction is missed, they often have to be added later – an expensive extra.

It is also true of bird safety on buildings that prevention is better than cure – preventative measures integrated up front are often more durable, cheaper and aesthetically more pleasing to than improvised corrections. Therefore we strongly recommend considering collision protection measures in the planning stages.
When retrofitting preventative measures, it is important that the hazard is assessed. Installing a blind won't reduce collisions on if the problem is high reflectivity, whereas with low reflective glass it will help a lot. In general, externally mounted solutions such as those described on page 17 can be retro-fitted using adhesive film. It is important to use high quality, long lasting products. Also advertising media, such as blow-ups and printed panels are effective.
Instant solutions include large or open weave nets, large cloths, thick nylon strings or plastic strips.

Transparent flat blinds are more effective than curtains, because they are always closed. However, they only work on glass with a low reflectivity index.

Printed sheets can be used to cover entire façades with effective advertising. Most are perforated with small holes and so permit an external view.

So called blow-ups are guaranteed attention catchers and are therefore also interesting for advertisers.

A good and cheap solution in this case: vertically tensioned nylon threads.

➤ **Patterns such as those described on page 17 can be retro-fitted (for example, on film).**

Operational Solutions

Operational solutions alone cannot eliminate bird collisions. But with well-chosen measures the dangers can, at least, be temporarily or selectively reduced, often without cost. In particular, in skyscrapers and commercial buildings it is important that the blinds are closed at night, or preferably at the end of the working day, and at the weekend. This is has the additional advantage of saving energy. For buildings with a high rate of bird collisions keeping the blinds closed during the day – preferably horizontal - is a good solution. An intelligent system can be installed to do this automatically. Large plants should be placed away from windows, as they can also lure birds to destruction. And one last, as yet unmentioned solution: the dirtier the windows are the easier they are for birds to see. So: clean your windows less – particularly in migration periods in spring and autumn.

Offices in use at night: where possible, close the blinds (bottom) or use lights which are focused on the workspace (middle). The illumination shown on the top floor should be avoided.

Pot plants do not belong directly behind transparent surfaces, but should be placed further back. Excessive greenery in conservatories and winter gardens is also a danger.

This is exemplary: the blinds are closed automatically at the weekend and at the end of the working day.

Environmental Design

The number and species of birds in the surroundings can be greatly influenced by the design of the environment. The type of trees and shrubs selected and where these are located are deciding factors. And as is often the case: less is more.

The landscape around a building is an important consideration. For us, there are two possibilities:
1. The building is erected in a natural environment (or one which is afterwards landscaped to look natural) and the building itself is as bird friendly as possible
2. The building is created from large expanses of glass, which – for whatever reasons – cannot be made bird friendly. In this case at the very least, it should be ensured that the surroundings are as unattractive for birds as possible. That is:

- As few trees as possible
- As few berry carrying bushes and shrubs as possible
- As few bird feeders as possible and no rubbish
- As few pools and small ponds as possible

Summary: No reflective glass cubes in green spaces and no transparent, unmarked noise barriers in green belts.
When it is really impossible to do without trees, they should be planted in front of non-reflective parts of the building. Also in the interests of bird safety small, unroofed, open courtyards should not have trees.

Extremely problematic: a very natural environment with hedges – and with it, as much transparent glass as possible.

This planting is poor: some trees stand directly in front of sections of the building with highly reflective glass. Hundreds of coal tits died in just one autumn. This obstacle in the landscape, which stands across a migration route, blocks onward flight. The trees´ reflections seem to show the only way through.

Case Studies

Contemporary Solutions

The following examples, from buildings constructed or renovated in recent years, should provide encouragement and motivation to find similar or, if possible better, solutions. Imitation and trend setting are desired.

Implementation

Innovative solutions can be found for both transparent and for reflective glass surfaces, which may improve the value of your property and make it stand out. After all, everyone can do transparent walls...
The solutions presented here use materials which are noteworthy because of their durability. Where possible the patterns are printed during production and are applied externally and/or on both sides.
The Viennese Environmental Department, the Swiss Ornithological Institute or the Nature Conservation Agency were consulted on the development of most of these examples in the planning phase, or at least, their recommendations or information leaflets were consulted. The above institutions are pleased to help on special projects (subject to capacity).

When a large glass surface can't be avoided: Why not include an interesting, or innovative, solution? This example isn't perfect, though, as large areas remain unmarked and thus the Palm Area Rule is not satisfied.

This noise barrier in Theodor-Koerner-Hof in Vienna was erected in 2007 to protect noise plagued residents and to increase their quality of life. It is a model example of bird protection, because the proposed structures were first tested in a flight tunnel, with very convincing results.

Details of the above wall. The pattern - columns of 2 cm wide stripes with 10 cm spacing between columns - is printed on both sides of the glass and in some places on the reverse is somewhat more liberally applied, which increases the 3-D effect on approach.

New housing developments can also incorporate noise barriers with discreet stripes.

In Switzerland, due to a new law on noise protection, countless kilometres of noise protection walls have been erected in recent years. On transparent sections such stripes are an established standard for bird protection.

Bus shelters, small noise protection barriers, wind barriers and balcony balustrades, etc. can also be easily retrofitted with vertical or horizontal stripes. This shelter in Munich was constructed with printed stripes.

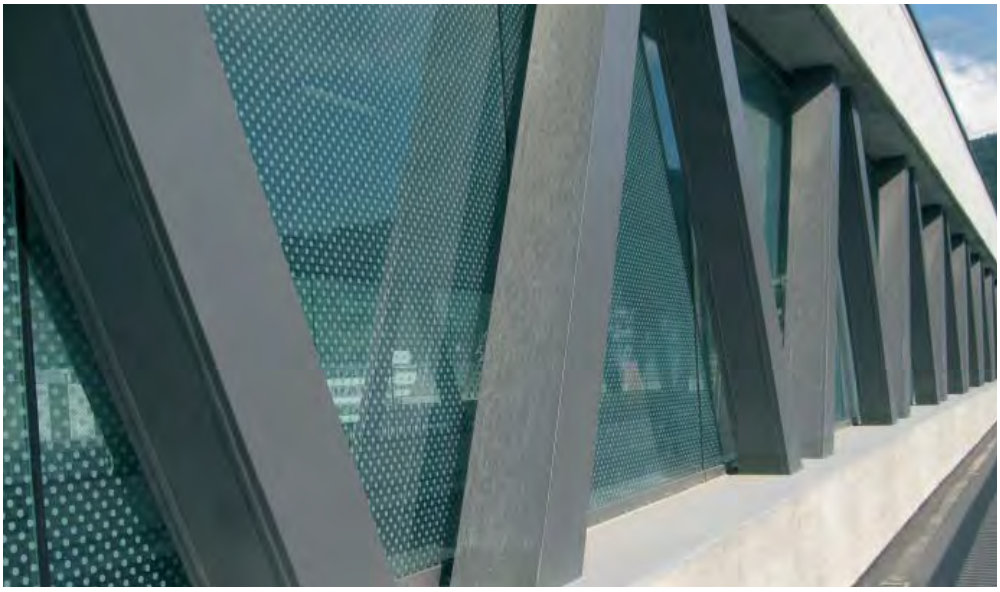
An adventurous solution from Basel. This shelter is covered with white lines of differing thickness.

On this bus stop in Zurich some of the glass panels are printed with the location name. Discreet, but effective, protection.

New standards for train station shelters in Switzerland. Ground level markings are omitted, as through visibility is obstructed by the seating.

This tram stop has been decorated with a black dot pattern. Visibility is not compromised; the pattern is unobtrusive.

On this type of bicycle shelter the vertical walls are particularly problematic. Here, they have been patterned with the company logo.



New bridge for a motorway access road: the panels have been decorated with a relatively large pattern of white dots.

Innovative design to make a highly reflective window visible on the Department for Foreign Affairs, Berlin-Tegel.

The printed design on this bicycle garage reduces bird collisions. Attaching it to the outside surface of the glass has broken up the reflectivity and its effectiveness.

Bridges stand across the flight paths of water birds. Semi-transparent arcs are etched into the balustrade. The decor is elegant and dynamic, and for bird in flight the design resembles chain mail, and therefore should be clearly visible.

This entrance hall at the Rietberg Museum in Zurich, named «Emerald», is located in the middle of a park. It has been created – not least for the protection of the birds – out of printed glass and coloured emerald green. A real jewel!

The window panes on this lakeside restaurant in the Nationalpark Neusiedler See have been printed with regular thin black lines (see page 17).

The view from the restaurant is not compromised by the fine lines of the bird safety glass. And the pattern ensures that guests are spared from seeing dead birds.

Semi-transparent dividing walls

No glazing in building corners

Windows generally low reflective glass, set back in the façade and divided by walls

Unglazed bicycle shelters

Entrance to underground parking is unglazed

Semi-transparent balcony balustrades

Green surroundings are wanted here!

This housing development displays many elements which, from the viewpoint of bird conservation are to be welcomed. The only downside is the transparent panes of glass that some flat owners on the upper floors have installed for wind protection.

Current Research

Despite the size of the problem, until now there has been very little research on birds and glass. There has been little awareness and less money. In recent years, however, a lot of new findings have been made.

Research in America and Canada

It is mainly thanks to Daniel Klem, an American researcher, that the enormous size of the problem has been realised. In his study, begun at the end of the 1980s, he showed that per year and per building on average there are 1-10 collisions. Thus there are annually between 100 Million and 1 Billion victims in America alone. In further research he showed that many birds do not survive a collision, even if they are able to fly off afterwards; most die later from internal injuries. In addition, he made a series of studies of the efficacy of various prevention systems and discovered that surface coverage is important and that vertical markings are better than horizontal ones. Due to the mass collisions, which particularly affect the east coast cities every autumn, the phenomenon of nocturnal collisions with skyscrapers is relatively well studied. In recent years several cities have published guidelines for bird friendly building (see page 56).

Tests in Flight Tunnels

Field tests are very complex and time consuming, and it is difficult to know how many samples to make in order to have replicable results. The alternative is flight tunnel testing. Here, patterns can be tested under controlled circumstances paying attention to bird safety and with acceptable costs; filming allows for later analysis. Ideally, testing would be performed in a flight tunnel and in the field. As yet, the most comprehensive set of standardised tests made to compare various patterns were started in 2006 at the Biology Station in Hohenau-Ringelsdorf in Austria. At this collecting station there is, in summer and autumn, a wide range of wild birds available. The birds are released after one test flight. Martin Rössler and Wolfgang Laube have developed a revolvable tunnel, the panes of which provide symmetrical lighting. In 2011 the testing was broadened to include: 1) visibility without reflection (ONR-Test), 2) Introduction of reflections in front of natural, light backgrounds (comparison to free stan-

Flight tunnel at the Biological Station Hohenau-Ringelsdorf in Austria. The tunnel is mounted on a pivot, so that it can be oriented according to the position of the sun. At the end of the tunnel are two panels: one with markings and one without (see inset picture). A net prevents the bird colliding with the panes of glass.

A series of patterned panels tested in the Hohenau-Ringelsdorf flight tunnel.

ding panels) and 3) in front of dark backgrounds (comparison with windows into interior rooms).

ONR-Testing method

The method of testing used in the flight tunnel is named after the technical regulation ONR 191040, which regulates the testing of marked panels in Austria. It defines when free standing glazing and transparent glass constructions can be called <Bird Safety Glass>. Reflectivity is not covered in this regulation.

Testing Principles:

1) Birds fly from darkness to light towards two parallel panes
2) Selection test: birds decide between flying towards the panes marked with the pattern to be tested and an unmarked control pane. Ineffective patterns: random approach - 50 % fly to marked and 50% to unmarked panes. Increasing effectiveness is marked by decreasing flight approaches to the marked pane.
3) Lighting on the panes; natural sunlight directed through mirrors to the front side of the pane, symmetrical lighting in the tunnel
4) Constant angle to the sun: adjustment of entire apparatus through a pivot or bogey.
5) Natural background: homogenous vegetation, sky, dark tunnel limits visibility to the test panes
6) Control pane: float glass 4 mm
7) Constant flight approach angle of 90°, no reflection on the panes
8) Bird safety: net, 40 cm before the panes (0.1 seconds before collision)
9) Birds' adaption to light levels: natural light (daylight)
10) Documentation: video recording

Interpretation of the Results

The results of the experiments in the flight tunnels need to be carefully interpreted. Flight approaches of 50 : 50 cannot be interpreted simply as 50 % <effective>. In fact, it means the opposite. The patterned panel is ineffective because the birds do not differentiate between it and the control panel, approaching both panels equally frequently. Quantified declarations on a product that it prevents 50 %, 70 %, or more, collisions are misleading: comparable to the suggestion that a particular brand of suntan lotion can reduce the amount of skin cancer developed by a specific percent. Responsible information on sun protection cream, for example, states when correctly applied what percentage of UV rays still penetrate the skin, how much can be prevented, which products provide high protection and which low protection. Likewise, it is only possible to create categories of a range of effectiveness for glass. From this system, only glass which has 10 % or fewer approaches during testing can be categorised as <highly effective> or <Bird Safety Glass> under the ONR-191040 regulations.

Tests with Reflectivity

Prints and patterns placed on the inner side of the pane, so on the non-bird facing side, can be obscured by reflections. To test whether this effect can be so strong that the marking is rendered ineffective the flight tunnel was modified. In these tests, light fell directly on the panes and by varying the darkness of the background differing levels of reflectivity could be created. The first results show:

- Reflectivity in general reduces the effectiveness of markings, independent of whether these are mounted on the front or the back of the panes.
- Light backgrounds reduce the effects of reflectivi ty.
- Darker backgrounds (e.g. façades) show clear differences. That is, markings "behind" the glass are much less effective.

The Spiderweb Effect – a false lead?

Hopes were raised around the Millennium, when a publication recommended using UV-absorbers to mark glazed panels. It is known that birds avoid spiders' webs, which are thought to contain UV absorbing substances. These are visible for birds but not for humans. That many bird species can see in the UVA range is also uncontested, however it is unclear whether, in collision situations, this UVA information is passed to the brain areas which are used for making flight manoeuvres. Since then disappointment has set in. Yes, there are various products on the market, but the manufacturers have failed to provide any evidence for their effectiveness. Therefore, based on current knowledge, we advise in general against installing these products.

Alternative Approaches using Sun Protection Glass

More successful is a special technique, whereby sun protection glass is marked on the outside of the exterior face with (when viewed from the outside) faint stripes. The arrangement of matt and highly reflective stripes gives additional contrast; from the inside the view is only marginally affected. These panels have been tested by the Swiss Ornithological Institute over a period of 1½ years on a sports hall. Panels of glass with and without the matt stripes were installed alternately on one side of the building. During this time at least 34 birds flew towards the unmarked panels, whereas only 4 approached the marked panels. Because it has not been possible to test this pattern in the flight tunnel, it is not yet possible to give a final recommendation.

The Swiss Ornithological Institute tested the matt striped panels on this sports hall, described on the previous page. Marked and unmarked panels were installed alternately on the wall facing the forest edge. From the outside the specially marked stripes have a blurring effect and together with the unmarked areas demonstrate high contrast. From the inside the stripes are much less distracting. This product could be used when highly reflective sun protection glass is absolutely essential.

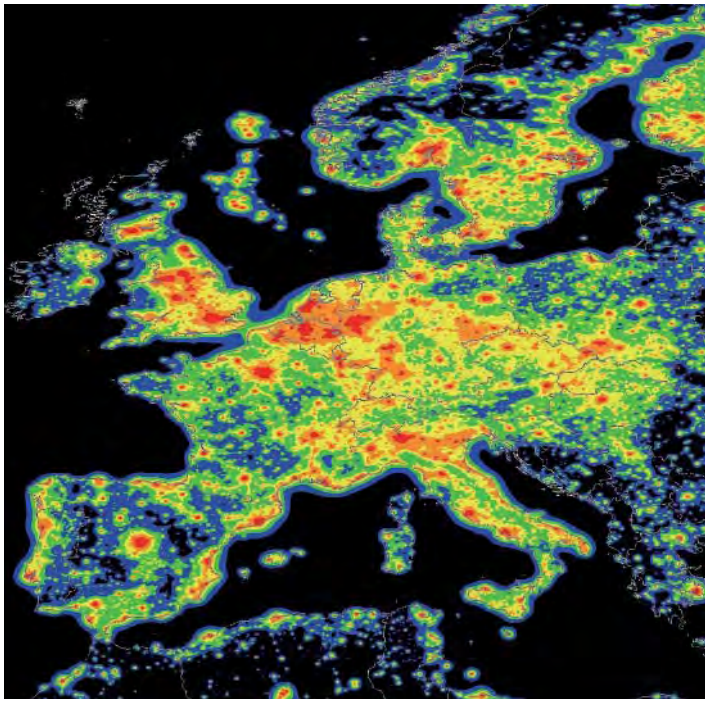
One of the patterns found in the flight tunnel testing to be highly effective is already on offer «off the shelf»; so the printed pattern does not need to be applied to the glass afterwards.

Light as Hazard for Birds and Insects

Like Moths to a Flame...

Birds are attracted to light when flying at low altitudes at night. Many migratory birds lose their orientation when flying in fog and are drawn to urban light islands. Some birds die of stress, many collide with lighted buildings or other obstructions.

Those who fly at night over Europe can see a sea of light below. As long as the night is clear, most migratory birds are not disturbed by it, they can orient themselves using the stars and geographical guidelines. Their difficulties begin when they fly into areas of thick fog or cloud. If, at the same time, they see lights shining up into the sky, their orientation can be affected. They can, for example, be drawn to the city as if bewitched and fly around directionless, often for hours. Some, as a result of stress and exhaustion, fall dead from the sky, others are attracted more and more strongly to lighted buildings, floodlights, or navigation lights, lose all orientation or collide with such structures. This phenomenon is particularly familiar on skyscrapers and TV Towers in North America, on lighthouses and on oil platforms where gas is flared off. The worldwide boom in skyscraper construction and the increasingly extravagant use of light makes it certain that such situations will increasingly be seen elsewhere. There are already similar cases in Europe from nocturnally lit buildings and cliff faces on mountain passes or on the northern edges of the Alps when thick fog prevents the birds from flying on.
The main problem with light smog is not in fact the light source, but strong upward emissions. A lot of energy is squandered and the desired effect is not achie-



The nocturnal picture from space shows how highly illuminated our continent is, in particular, in densely populated central Europe.

© Christoph Suarez 2008 - http://www.webemoi.com.

As pretty as it looks: nocturnal light emissions, as shown here in foggy conditions along the Savoy Alps, can be disastrous for migrating birds. In addition, along the edge of the Alps the topography forces the birds to converge into flocks, similar to the situation at the coast.

ved because the light is not focused, or not focused enough, on the area where it is required. In addition to the usual light sources, in recent years lasers and searchlights have become fashionable. These are mainly used for advertising and art installations. Show and projection laser light installations, which consist of closely packed class 3 and 4 lasers shining into the open sky, can cause burns on eyes and skin if they are intercepted by an organism. Some cities and towns therefore, have started to ban such searchlight and laser installations.

The Effect on Birds

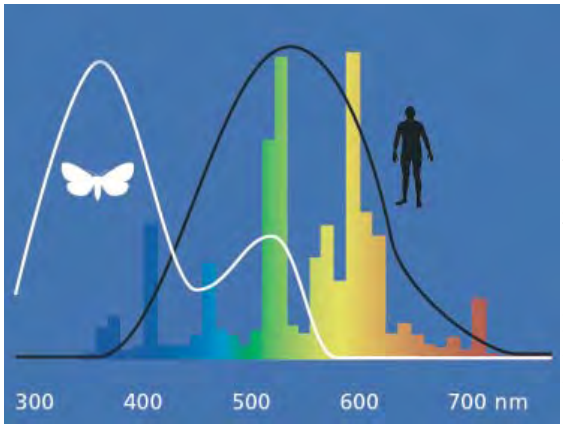
There are individual well documented examples to demonstrate that searchlights have confused birds. In Germany it is known that 2000 cranes made an emergency landing on a castle ruin, drawn there by the floodlights. Many birds flew into the walls and died. The Swiss Ornithological Institute has been able to demonstrate through experiment that searchlights cause strong fear responses, clear, long lasting changes of flight direction and reduction in flight speed in night flying birds. Sleep and resting behaviour disturbance is also recorded for cranes and geese.

Skybeamer: a concentrated beam of light, hundreds of metres high.

Mass fatalities in Insects

Our external lighting is also a huge problem for insects. From the more than 4000 butterfly species in Europe, not less than 85 % are nocturnal. Light hazards, habitat changes and the effects of pesticides have brought not only many moth species but also other insect species to the edge of extinction. But insects have an important role to play, for example, as pollinators and as a link in the food chain. Annual insect deaths due to street lighting are estimated at 150 billion (150 000 000 000 000) insects in Germany alone.
Together with scent, the light of the moon and stars plays an extremely important role in navigation for nocturnal insects and often determines important phases of their development. The most important wavelengths are those in the UV and shortwave regions (violet, blue, green). Insects which navigate by light are known to be drawn to lamps and fly dizzyingly round the source. If the insect does not die from flying into the light, but settles on a lit surface they are often killed by predators, stepped on or driven over. If the lamp cover is open they burn to death on the hot light.

Moths, like this small elephant hawk-moth, suffer enormous losses.



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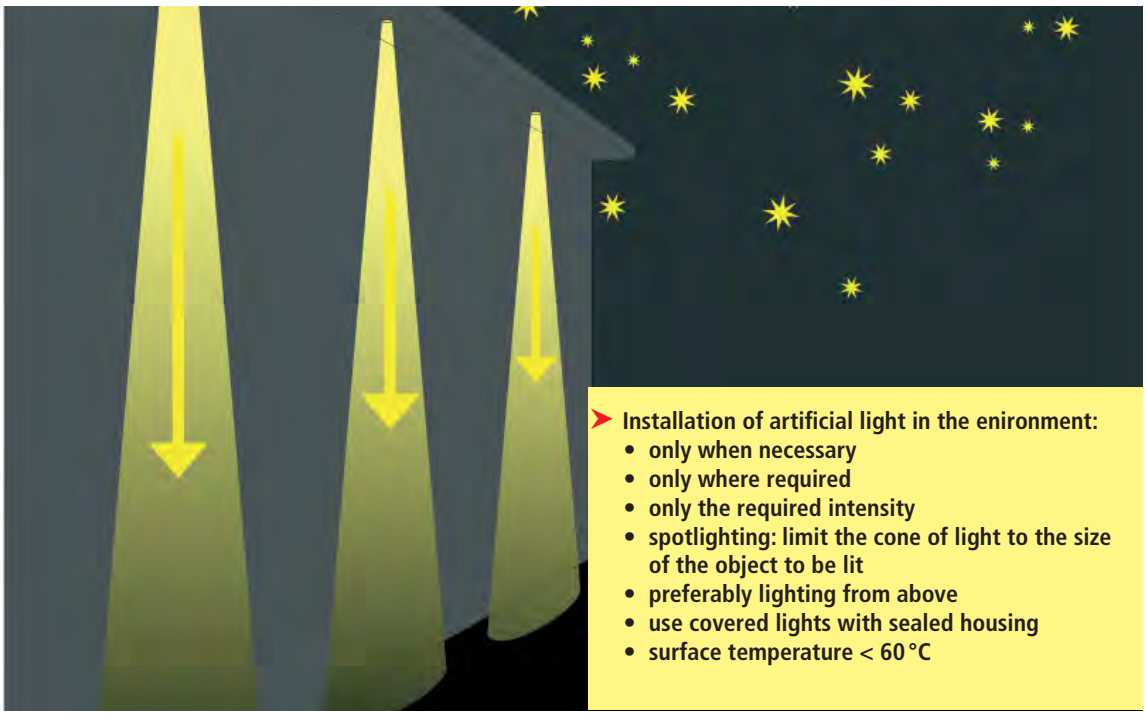
The spectrum of a fluorescent lamp (coloured columns) lies mainly in the visible range for humans (black line). The spectral sensitivity of nocturnal moths is concentrated more to the left (white line), in the UV range.

Animal Friendly Solutions

Technical Solutions

The main problem with light smog is the horizontal emission of light. From the economic standpoint, too, horizontal and upward lighting should be minimised. The goal must be to concentrate the light onto the objects and areas where it is required.



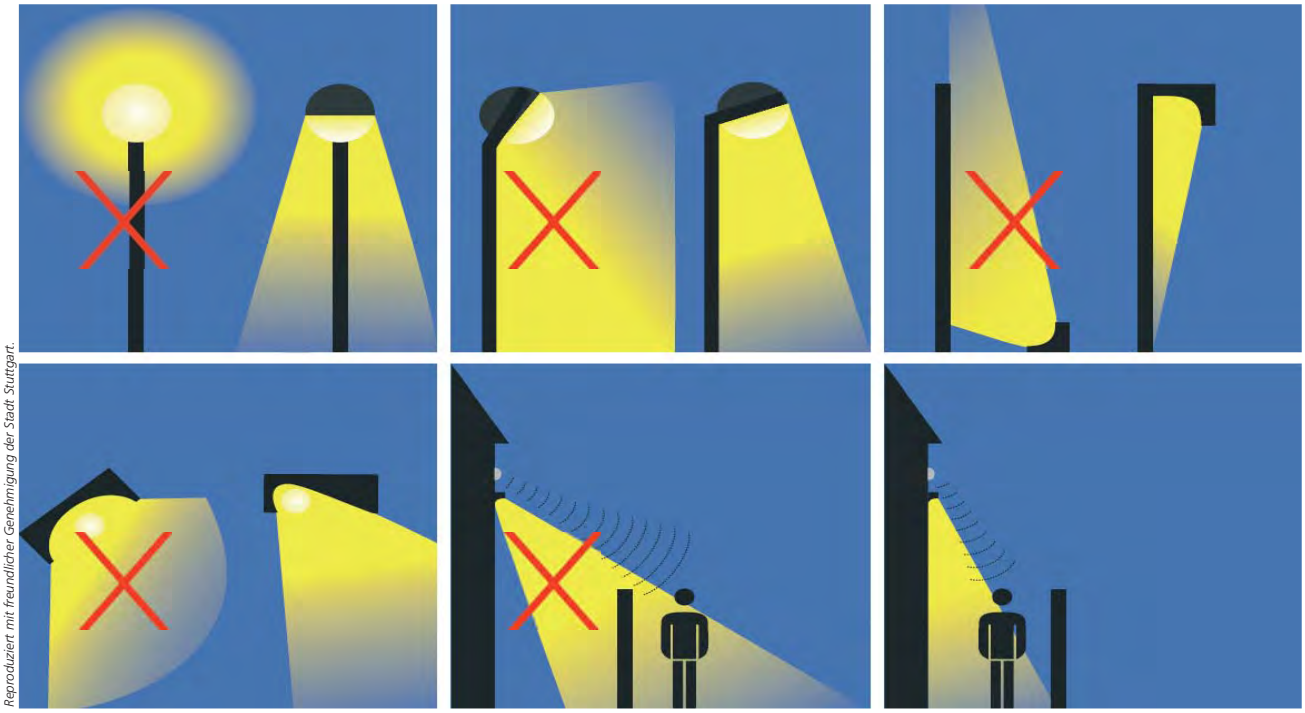
➤ **Installation of artificial light in the enironment:**
- **only when necessary**
- **only where required**
- **only the required intensity**
- **spotlighting: limit the cone of light to the size of the object to be lit**
- **preferably lighting from above**
- **use covered lights with sealed housing**
- **surface temperature < 60 °C**

Desirable: directional lighting from above onto the surface to be lit.

Lighting

Horizontal light rays have the greatest effect over distance and thus the largest effect on insects and birds. It takes the longest route through the atmosphere and is thus the most scattered, resulting in additional serious encroachment on nocturnal skywatching. "Full Cut-Off Lights", which are proven not to emit any horizontal light, are recommended on environmental grounds. Because the height of the light masts are reduced extra lights are required to cover the same area, but glare and diffused light are further reduced. Correct installation is essential to ensure that the reflectors are set optimally and that the lights covers are planar to prevent horizontal light emission.
Certificates for environmentally friendly lighting are awarded by the International Dark Sky Association (IDA). The light colour is mainly determined by the bulbs used. High pressure mercury vapour lamps are particularly attractive to insects because the light contains a high percentage of UV rays. From 2015 they will no longer be for sale due to an European Union Regulation. Already they are often replaced by insect-friendlier yellow high pressure sodium vapour lamps, which are also more energy efficient. Metal halide lamps are often used when white light is required for aesthetic reasons; their attractiveness to insects is dependent on the UV spectrum of the light.
Because they are energy efficient and unattractive for insects, low pressure mercury vapour lamps are particularly recommended. However, the monotone yellow light and poor colour representation restrict their use.
Recently light emitting diodes (LED) lights have been offered for external lighting. LED lights with in warmer shades of white light (2700-3000 Kelvin) seem to be

Modern LED spotlights focus light on the required area, for example, a pedestrian crossing.



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The examples on the right are always the preferred option: downward facing lights, focused where the light is effective and required. Integrating illumination with a motion detector is also sensible.

particularly unattractive to insects. LED technology is developing very quickly; at present expectations are high for these energy efficient lights, but first we need more experience.

Because LEDs have multiple, dot-like light sources, it is particularly important to minimise glare. High quality, well covered lights are especially important when installing LED lighting. LEDs are easily controllable: using dimming and motion sensors it is possible to save energy and at the same time, reduce light pollution. However, it is important that the energy savings are not lost through the installation of more lights.

Finally it is important to note that blue shaded lighting in residential areas can also be problematic for humans. They set our bodies to <wake mode> and can lead to sleep disorders.

A pedestrian and cycle path, furnished with the newest lighting solutions and fitted with motion sensors. Only when a cyclist goes by is the low level lighting activated.

Operational Solutions

Operational solutions are even more important for light than for glass. A well thought out concept can do a lot for nature.

Lights off! or Darkness in Critical Situations

Operational solutions alone cannot eliminate bird collisions due to light smog. But with well chosen measures the dangers can be minimised or at least temporarily eliminated. An extreme example is the Jungfraujoch, an Alpine pass at 3,471 metres above sea level in Switzerland. There, switching off the searchlight which illuminated the Sphinx Observatory on foggy nights has proven itself. Since this simple measure was introduced uncountable birds have been saved from death.
In central Europe the main migrations take place from the middle of February to the middle of May and from August until the middle of November. For these periods we recommend precautionary measures, particularly for topographically exposed buildings, for example, along the coast or on mountain passes, or for areas where it is already known that there are frequent nocturnal collisions. In particular, lights should be turned off between ten o'clock in the evening and sunrise. Where this is not possible, only well focussed light sources should be used, blinds should be closed or other measures to minimise light pollution should be put in place. Extensively lit interior spaces should be avoided.

Less exposed buildings should install motion detectors in reception areas and corridors and dimmers, or systems to automatically turn off lights, after working hours finish. The effectiveness of the installation, lighting and reflectivity should be checked regularly. Air safety lights on tall buildings should be fitted with flashing lights (minimum interval 3 seconds), instead of blinking or rotating lights and in particular instead of fixed floodlights or red lights.
The Swiss Ornithological Institute is currently working on an early warning system. This system should primarily assist in timely shutting down wind turbines on sensitive migration nights. A similar system is conceivable in the mid-term for exposed buildings.

Illuminated advertising should also be environmentally friendly or turned off during critical times. On the Post-Tower in Bonn, Germany, many of the lights are either turned off or screened during the main migratory period (right). The effect is that each year several hundred fewer birds become stranded on this building.

Key Points

- Bird collisions on glass surfaces occur due to transparency, reflectivity or nocturnal lighting.
- Collisions happen almost everywhere and on every type of building, but they can largely be prevented. Our recommendations are also appropriate for other transparent or highly reflective materials.
- It is strongly recommended that the problem is considered in the planning stages and that specialists are consulted on complex projects.

- Where retrofitting is required:
  - first, analyse the problem
  - look for suitable, long-term solutions
  - raptor silhouettes are passé
- Reduce transparency through:
  - appropriate construction
  - selecting semi-transparent materials
  - using interior desingn elements
- Reduce reflectivity through:
  - selecting glass with a reflectivity of less than 15 %
  - installing insect screens
  - dispensing with mirrors in the outdoors
- Patterns to reduce transparency and reflectivity should:
  - cover the entire surface (remember the Palm Area Rule)
  - be attached to the external face of the glass
  - preferably be a tested pattern
  - provide a good contrast to the background
  - have the following dimensions:
    - Vertical lines: minimum 5 mm wide with a maximum interval of 10 cm
    - Horizontal lines: minimum 3mm wide with a maximum interval of 3 cm or minimum 5mm wide with a maximum interval of 5 cm
    - Spot patterns: minimum coverage of 25 % for spots with minimum 5 mm Ø or 15 % coverage for spots < 30 mm Ø.
- Reduce the attractiveness through:
  - placing plants away from glazed areas
  - appropriate, un-wooded environment, particularly where strongly reflective glass is used

- Reduce light smog through
  - only installing artificial light where it is necessary
  - minimising the intensity and duration of illumination
  - using shielded lights and closed light housings
  - preventing horizontal light emissions
  - ensuring the surface temperature does not exceed 60°C
  - limiting lighting to the surface area of the object to be illuminating, preferably illuminate from above
  - automated system control in buildings
  - installing motion sensors
  - banning lasers and advertising searchlights
  - using insect-friendly lighting, with minimal short wave and UV light emissions
  - installing low pressure sodium lighting in sensitive environments, otherwise high pressure sodium lamps or warm white LED lights

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Hotz, T. & F. Bontadina (2007): Allgemeine ökologische Auswirkungen künstlicher Beleuchtung. Unpublizierter Bericht von SWILD als Grundlage für Grün Stadt Zürich und Amt für Städtebau Zürich. 78 S.
Huemer, P., H. Kühtreiber & G. Tarmann (2010): Anlockwirkung moderner Leuchtmittel auf nachtaktive Insekten. Ergebnisse einer Feldstudie in Tirol. Tiroler Landesumweltanwaltschaft & Tiroler Landesmuseen Betriebsgesellschaft, Innsbruck. 33 S.
Klaus, G., B. Kägi, R.L. Kobler, K. Maus & A. Righetti (2005): Empfehlungen zur Vermeidung von Lichtemissionen. Vollzug Umwelt. Bundesamt für Umwelt, Wald und Landschaft. Bern. 37 S.

Products

New products are always being developed. We try to keep a current list on www.vogelglas.info. The following is a small list of well known manufacturers, whose products appear in this brochure:

Self Adhesive Textiles:
www.creationbaumann.com

Silverstar BirdProtect - glass products:
www.glastroesch.ch; www.glastroesch.de

4Bird printed glass:
www.eckelt.at/de/produkte/sicherheit/4bird/index.aspx

All forms of special glass and glazing:
www.okalux.de

SEFAR Architectural solutions (glass with textiles):
www.sefar.com

Ornilux-Special glass:
www.ornilux.de

Scotchcal films for external use:
www.solutions.3mschweiz.ch; www.solutions.3mdeutschland.de

Information about Bird Collisions and Light Smog

Glass

www.abcbirds.org
www.birdsandbuildings.org/info.html (dort gute Übersicht über amerikanische und kanadische «Guidelines»)
www.flap.org
www.sfplanning.org
www.vogelglas.info
www.wua-wien.at

Light

www.bafu.admin.ch/publikationen
www.darksky.org
www.helldunkel.ch
www.hellenot.org
www.lichtverschmutzung.de
www.nycaudubon.org

Contact Addresses for Specialist Advice

The following organisations offer specialist advice, according to the availability of resources. You will need to provide building plans, visualisations and/or pictures of existing buildings (including the surroundings). Glazing should be clearly marked on all plans.

United Kingdom

xxxxxxx

Tel.: 069 / 4201050, E-Mail: .uk

Deutschland

Hessen:
Staatliche Vogelschutzwarte für Hessen, Rheinland-Pfalz und Saarland, Steinauer Strasse 44, 60386 Frankfurt am Main
Tel.: 069 / 4201050, E-Mail: info@vswffm.de

Österreich

Wiener Umweltanwaltschaft, Muthgasse 62, 1190 Wien, Tel. (+43 1) 379 79, post@wua.wien.gv.at

Schweiz

Schweizerische Vogelwarte, Seerose 1, 6204 Sempach, Tel. 041 462 97 00, E-Mail: glas@vogelwarte.ch

Schweizer Vogelschutz SVS/BirdLife Schweiz, Postfach, Wiedingstr. 78, 8036 Zürich, Tel. 044 457 70 20, E-Mail: glas@birdlife.ch

Luxemburg

natur&ëmwelt/ Lëtzebuerger /Natur-a Vulleschutzliga a.s.b.l., 5, route de Luxembourg, L-1899 Kockelscheuer, tél. (+352) 29 04 04 - 1, fax: (+352) 29 05 04, secretariat.commun@luxnatur.lu

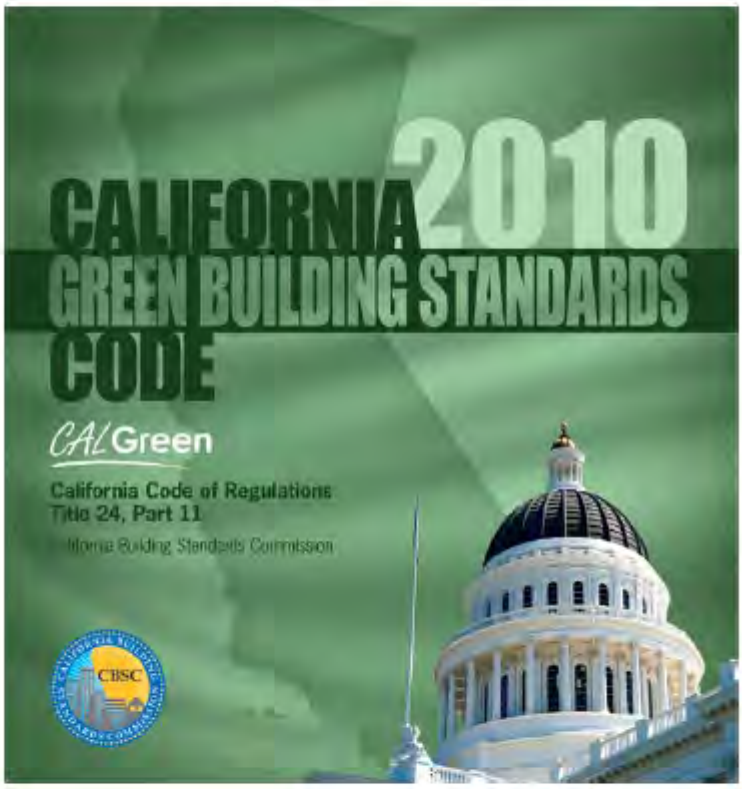
Websites of Related Organisations

www.aspas-nature.org
www.bfn.de
www.birdlife.ch
www.darksky.ch
www.lipu.it
www.naturemwelt.lu
www.ornitologia.org
www.seo.org
www.tbb.ch
www.vogelschutzwarten.de
www.vogelwarte.ch
www.wua-wien.at

vogelwarte.ch

Guide to the (Non-Residential) California Green Building Standards Code

Including changes effective July 1, 2012



An educational publication by the
California Building Standards Commission
Third Edition January 2012

Appendix C: Bird-friendly Building Design

Guidelines in this appendix are supplemental to the California Green Building Standards Code – Nonresidential and are intended to provide additional information that building designers, builders and property owners may wish to consider during the planning, design and construction process.

Why bird-friendly building is "green" design

- Birds serve human society in several important ways
  - They consume tons of insects and rodents annually that could otherwise threaten human populations and structures
  - They pollinate plants, including crops for human consumption, and disperse seeds in natural regeneration of vegetation
  - Birds have fostered a multi-billion dollar industry in professional and recreational birdwatching and associated travel
  - They represent, along with other protected species, a philosophical recognition of the intrinsic value of sentient beings other than ourselves
- Birds, especially migratory songbirds, collide with buildings in great numbers, a possible liability for building owners
  - Estimated numbers of birds that perish in collisions with buildings in this country annually run from 100 million to 1 billion
  - Habitat loss to development forces birds into the built environment on migratory routes
  - Unlike natural predation, buildings threaten strong and healthy birds rather than the weakest among them, compromising their abilities to reproduce
  - Builders and building owners whose buildings attract birds may unwittingly be violating the Migratory Bird Treaty Act, which extends beyond hunting to unintentional deaths deemed to be foreseeable
  - Federal and state wildlife agencies protect wild birds through regulations such as permits for hunting, but they do not have authority to regulate building interaction with birds
  - The Green Globes green building points program of the Green Building Initiative recognizes the dangers some buildings pose to birds and offers credits for bird-friendly building design
- Building to prevent bird collisions is readily achievable, provides creative design opportunities for architects and developers, and can be narrowly focused on sites that present the greatest risk to birds as described in the standards following
  - Large glass surfaces pose the greatest threat to birds and can be mitigated with the use of special glazing or use of other materials in conjunction with glass
  - Nighttime lighting from buildings and grounds also attracts birds, and complying with local dark sky ordinances or CALGreen Code Section 5.106.8, Light Pollution Reduction can diminish this threat
  - Building design, of course, must meet other codes and local ordinances for structural integrity, fire safety and energy efficiency, but can safely comply while incorporating bird-safe features
  - Within the complexity of local conditions in California, building codes are not applied with a "one size fits all" approach; one site may present earthquake, flood, fire, or bird habitat exposure that can be met with code compliant planning and design

August 29, 2014

Debby Fernandez, Associate Planner
City of Santa Clara
Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

Re: Comments to Notice of Preparation of a Draft Environmental Impact Report for the City Place Santa Clara Mixed-use Project

Dear Yen:

Thank you for the opportunity to review the Notice of Preparation (NOP) for the proposed mixed-use project at 5155 Stars and Stripes Drive in Santa Clara. This letter includes all City of Sunnyvale comments to the project NOP.

The following comments cover issues the City of Sunnyvale would like to be discussed in the DEIR:

A. General Questions and Comments:

1. Please provide a discussion of how the proposed project works with the 49er stadium parking and traffic circulation plan, especially during construction of the proposed project.

2. Provide the current Levi Stadium parking plan (as part of the Transportation Management and Operations Plan- TMOP) and envisioned TMOP parking plan at initial and complete project build-out.

3. We also request that the City of Santa Clara provide outreach to Sunnyvale residents, and that the notice area be expanded if the traffic impacts show serious impacts to the nearby Sunnyvale neighborhoods.

B. Traffic and Transportation Input for the Notice of Preparation:

1. The City of Sunnyvale uses criteria found within the VTA Transportation Impact Analysis (TIA) Guidelines as a basis for determining study intersections. It is likely that project trips would travel to and from the west through intersections located within the City of Sunnyvale. Accordingly, municipal and CMP intersections with ten or more project trips per lane added to any intersection movement should be analyzed. The

intersections of Tasman / Lawrence, Tasman/Fair Oaks, Lawrence/ SR 237 Ramps, and Fair Oaks / SR 237 Ramps should be considered for inclusion within the traffic analysis. Traffic conditions at the study intersections are typically conducted for the AM and PM peak hours under existing and future analysis scenarios.

2. Corridor analysis should be considered for Tasman Drive, Lawrence Expressway and Fair Oaks Avenue.

3. The project site is located near the City of Sunnyvale's eastern border. Relevant approved projects within Sunnyvale and other neighboring jurisdictions need to be included in the study estimates of the Background traffic volumes. This is consistent with the VTA TIA Guidelines. Please contact the City of Sunnyvale to get a list of approved projects to include in the study.

4. Similarly, pending projects within Sunnyvale and other neighboring municipalities and/or the application of an annual growth rate need to be incorporated in the Cumulative traffic volume estimates in order to reflect the growth in both the local and regional traffic. Please contact the City of Sunnyvale to get a list of pending projects to include in the study.

5. The project's parking analysis, especially during Levi Stadium events, should ensure any potential parking diversion into the nearby Sunnyvale residential neighborhoods to the south of Tasman Drive is avoided.

6. Since this project is just north of the Levi's Stadium, an event day scenario should be included in the analysis.

7. Evaluation of the alternative modes of transportation should be included in this project's traffic analysis. The VTA CMP Guidelines indicate that traffic analysis must include transit facilities in terms of transit service availability, transit capacity relative to the increased demand, impact of increased traffic delays on the service, and the need for transit access improvements. According to the CMP Guidelines, the traffic analysis must also evaluate bicycle and pedestrian facilities in terms of their availability, project effects on future bike/pedestrian plans, and improvements proposed by the project. Maps and information on existing and planned bicycle facilities within Sunnyvale can be supplied upon request.

The City of Sunnyvale appreciates your consideration of the requested study scope elements described above. Please contact me at 408 730-7707 (aminer@sunnyvale.ca.gov) if you have any questions or concerns about items discussed in this letter.

Sincerely,

Andrew Miner
Principal Planner, Community Development Department

cc: Hanson Hom, CDD Director
Kent Steffens, Director of Public Works
Trudi Ryan, Planning Officer
Carol Shariat, Principal Transportation Engineer
Kevin Riley, Santa Clara Director of Planning and Development
Steve Lynch, Santa Clara City Planner

CITY OF
SAN JOSE
CAPITAL OF SILICON VALLEY

Department of Transportation

August 29, 2014

RECEIVED
SEP 0 4 2014
PLANNING DIVISION

City of Santa Clara
Attention: Debbie Fernandez
1500 Warburton Avenue
Santa Clara, CA 95050
408-615-2450
dfernandez@santaclaraca.gov

SUBJECT: Comments on the Notice of Preparation for an EIR for City Place Santa Clara

The City of San Jose has reviewed the Notice of Preparation of an EIR for the City Place Santa Clara project and has the following comments:

1. This EIR should follow VTA's technical standards and guidelines to scope and complete a transportation impact analysis, and identify feasible mitigations or improvements. Contact City of San José for the latest available traffic data for traffic analysis. All traffic data, including but not limited to TRAFFIX database and Approved Trip Inventory provided by San José should not be altered.
2. Impacts to San Jose's facilities should be evaluated according to San Jose's transportation impact policy - San José's adopted CEQA impact thresholds.
3. The lead agency should identify feasible improvements for impacts to City of San José's facilities. The lead agency should either construct the identified improvements or propose a fair-share mitigation contribution for the proposed improvements.
4. For impacts identified at San José's facilities with planned improvements, the lead agency should propose a fair share contribution to the City of San José.
5. Pipeline projects in San José should be included in the analysis of near term future (Background) or Cumulative conditions. The list of approved projects should include approved development in North San Jose. Please contact City of San José for a list of projects.

Sincerely,

Pratyush Bhatia, PE
Associate Transportation Specialist
City of San Jose,
Department of Transportation

Steven Chang
4946 Calle de Escuela
Santa Clara, CA 95054

August 24, 2014

RECEIVED
AUG 24 2014
PLANNING DIVISION

Debby Fernandez, Associate Planner
City of Santa Clara
Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

This correspondence is in regard to the project "City Place Santa Clara Project" file PLN2014-10440, notice mailed to residents. This project proposes to replace open green space with 8.34 million gross square feet of commercial development. I believe the project should be rejected for the following reasons:

Toxic Materials:

The landfill was in use until the about 1990. Over the decades there was little control over the material thrown into the dump. The plan proposes to remove the plant cover and expose the surrounding residential neighborhoods to hazardous dust and gasses.

Noise Pollution:

High density development, especially "retail and entertainment" facilities plus auto and truck traffic will increase the background ambient noise levels. Noise pollution is known to contribute to stress.

Light Pollution:

Retail and residential development will add significant light pollution, and let us not forget the new street lights that will be on throughout the night.

EMF Pollution:

To support the needs of 8.34 million gross square feet of development, high capacity power lines will have to be brought into this neighborhood. This brings up the issue of the power infrastructure. The recent power outage on the Northside demonstrates the problem, not to mention that the stadium and 49er's training facility had lights burning while the rest of us were in the dark. Is this the proiority that the city gives to favored businesses? Will a new gas fired power plant be built near the older neighborhoods (mostly minority residents I might add) so that the new residents will not have to look at it?

Traffic Pollution:

Traffic will be concentrated in Lafayette Street and even more in Great America Parkway. No point in discussing mass transit. Mass transit in the south bay is a joke. As usual, the focus will be on freeway access. During commute hours Highway 237 is backed up past Lawrence Expressway in one direction, and Milpitas in the other direction. Highway 101 is just as bad.

How many more cars can 237 support? If several hundred more cars each day sit in lengthy stop-and-go traffic, consider the increase in exhaust pollution, especially from commercial trucks. Want examples? Look at how bad the traffic is around Santana Row and Rivermark.

Trash:

There is a positive correlation between the amount of commercial development and the amount of litter that spreads through the surrounding neighborhoods. I imagine the city does not think this is much of a problem because, well, the city never cleans the streets on the Northside.

Water and Water Pollution:

What about the leaking fluids and brake dust that the extra vehicles will put on the roadways, only to be washed into the drainage system? Can the water system handle it?

Where will the needed water come from? You propose to add 8.34 million gross square feet of development when, due to Global Warming, California is entering a permanent period of lower precipitation. The Sierras can't satisfy the extra water demand. Moreover, the extra demand can't be met through pumping ground water because that will cause subsidence and property damage.

Poor Planning:

Let's face facts. The city is not up to handling large development projects, especially thinking about cause and effect and consequences. Why else would a stadium be built without an associated parking facility? Very smart. The side streets around the stadium are now jammed with traffic, and police, at considerable expense, have to block off residential streets.

Crime:

More people, more crime. Higher density, more crime. It is well known that sports facilities attract drug trafficing and prostitution. Now you want to add more "entertainment facilities".

The Pollution of Corruption:

The development as described will hardly create a lot of middle class jobs. More than likely the bulk of the jobs will be lower paying, and the people will have to commute into the area because then can't afford to live here. Does the city seriously think that gentrification is not an issue?

What about the tax breaks and subsidies to be handed out, popularly known as "welfare for the wealthy" and "corporate welfare"? I'm sure that the officers of the city were watering at the mouth at the prospect of getting chummy with wealthy developers and big corporations. Great for building a political career. I guess there wasn't enough time to think of the increased burden that will be placed on ordinary citizens.

Sincerely,

Steven Chang

Steven Chang

RECEIVED
AUG 29 2014
BUILDING INSPECTION DIVISION
CITY OF SANTA CLARA

RECEIVED
AUG 29 2014
PLANNING DIVISION

29 August 2014
Jan Hintermeister
2342 Castro Place
Santa Clara, CA 95050

Debby Fernandez, Associate Planner
1500 Warburton Avenue
Santa Clara, CA 95050

Dear Debby and City Planning Staff,

I'm responding to the Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the City Place Santa Clara Project, File No. PLN2014-10440. It is my understanding that this project will cover the old landfill on which a BMX track was built and Santa Clara Golf & Tennis Club.

In late 1999 and early 2000, the City was considering the development of 103 acres of City-owned property in the North Bayshore Development Area. As part of that consideration, the City Council set up a Burrowing Owl Habitat Committee to address multiple goals, including locating a total of 103 acres of Burrowing Owl habitat to mitigate for loss of habitat in the Development Area. The Committee met several times and recommended a total of 103 acres of City-owned property and land out in the Byron Conservation Area to be used as Burrowing Owl mitigation lands. The City-owned property included:

1. Closed Landfill adjacent to PAL BMX track
2. Closed landfill slopes for the new golf holes
3. Portion of the San Jose/Santa Clara Treatment Plant Property.

Since these lands, in particular 1 and 2, have been set aside by the City as Burrowing Owl habitat, how can the City now perform commercial development on those areas? This subject should be addressed in the EIR. Is some additional replacement mitigation being proposed?

The City Council made these and other commitments in their May 2, 2000 meeting. What is the status of the commitments made by the City Council in their May 2, 2000 and other related meetings?

Jan Hintermeister

JL

Debby Fernandez

From: Sudhanshu Jain <sudsjain@mail2web.com>
Sent: Monday, August 11, 2014 12:40 AM
To: Debby Fernandez; Kevin Riley
Subject: My Public comments for EIR for City Place Santa Clara

Dear Debbie Fernandez and Kevin Riley,

Please enter these comments concerning the EIR for the City Place Santa Clara project into the public record. I understand that public comments will be accepted until August 29th, 2014.

I would like to see more detailed documentation for this project placed on the City's website so that the public can better evaluate this project.

I'm very concerned about the lack of housing associated with this project. The document posted on the City's website (http://santaclaraca.gov/modules/showdocument.aspx?documentid=11671) states that there will be no more than 540 housing units on this project which is over 8 million gross square feet.

Many officials have stated that this project will bring a development surpassing that at Santana Row to Santa Clara. This project will be over 5 times larger than Santa Row which has 622 housing units and very little vacancy. Scaling Santana Row to the size of City Place would result in over 3000 housing units which our City desperately needs.

I've heard that construction over a landfill limits the amount of housing that can be built. To date I haven't heard the specific concerns. Is it methane or toxic fumes? In either case, I don't understand how we can exclude people from living there but then say it's fine for people to work there 8-12 hours per day. Please give me an explanation of the limitations.

I'm also concerned that there is no mention as to whether any of the planned housing units at City Place will be designated (moderate, low, very-low) income housing. I would like to see these categories spelled out in the EIR.

I would also like to see the development be LEED certified to at least Gold level.

It is very important to consider and to minimize the Carbon Footprint of the construction and operation phases of this project so I want to see a CO_2 emissions analysis in the EIR.

Thank you,

Sudhanshu Jain
sudsjain@mail2web.com

From: Kirk Vartan [mailto:kirk@aSliceOfNY.com]
Sent: Friday, August 29, 2014 2:27 AM
To: Debby Fernandez
Cc: Kirk Vartan
Subject: City Place Santa Clara Project (PLN2014-10440) - EIR comments

Hello Ms. Fernandez,

I would like to add the following items for comment on the proposed project (PLN2014-10440):

1. There should be on the order of 3,000-5,000+ residential apartments on this property. It is an ideal place to increase the inventory of market rate and affordable apartments (whether rental or condo). The City should push to make sure these types of increases are included. It is a great way to have a work-live environment.

2. Parks and open space should be a large and significant aspect of a development of this size. It is being built on recreation spaces and should be able to replace that use with other public space uses. Pedestrian paths and other non-lawn based open spaces and gathering areas should be encouraged.

3. Rooftop gardens, CSA, and other agricultural based amenities should be showcased and implemented, allowing for locally grown food to be used by residents and visitors. Off loading some food production for new residents should be a goal for the project, thus reducing the dependency on bringing in all food needs by vehicles.

4. Drought resistant and native plants should be utilized whenever possible

5. Utilize latest technology for water conservation/watershed management.

6. Utilize sustainable landscape technology.

7. Technology to monitor and help maintain peak performance of the property should be utilized.

8. Recycled materials for construction and other energy efficient techniques should be utilized in both office and residential building. How can this development be as carbon neutral as possible.

9. Look into a methane power-plant to generate energy for the project.

10. Include all forms of renewable energy to make the project as energy independent as possible.

11. Strive for LEED Platinum in both office and residential structures

12. Look at ways for co-housing and shared serviced to reduce parking requirements (e.g., fleet of shared vehicles, incentives for residents that do not own cars, etc.)

13. Explore green buildings/green walls and creating solutions that embrace green and living elements as part of the designs.

14. Incorporate an urban farm on-site with a daily farmer's market for residents and office workers to patronize as well as to create a destination for visitors to enjoy and support.

15. Develop programs for residents to help maintain and manage parts of the property (e.g., part of the open space, the farm, activities, etc.) in exchange for reduced rent or discounts on produce.

I personally think this is a wonderful development idea, with huge potential for great success. I hope that some of the commercial elements are offset with public amenities and sustainable designs that will allow the community to grow with it. I believe this project will be one of Santa Clara's best developments ever. It should be treated as a one in a generation development, with all of the elements that you would want to include in a signature project like this. Think about what is needed in the City and what a 230 acre development can do. Santa Clara is very fortunate that a company with the experience and vision like Related is interested in doing something on this scale here in the Bay Area. These types of developments are usually reserved for cities like New York, San Francisco, or Los Angeles.

Best of luck with this inspirational project!

Kirk Vartan
kirk@asliceofny.com
San Jose, CA (business owner in Santa Clara)
--
A Slice of New York
New York pizza in the Bay Area
3443 Stevens Creek Blvd. (San Jose)
1253 W El Camino Real (Sunnyvale)
SJ: (408) 24-SLICE / SV: (650) 938-NYNY
www.aSliceOfNY.com
www.911memorial.org

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Centennial Gateway NOP and Comments Received

Notice of Preparation for an Environmental Impact Report for the City of Santa Clara

Centennial Gateway Mixed-Use Project

July 10th, 2014

Introduction

The purpose of an Environmental Impact Report (EIR) is to inform decision-makers and the general public of the environmental effects of a proposed project that an agency may implement or approve. The EIR process is intended to provide information sufficient to evaluate a project and its potential for significant impacts on the environment; to examine methods of reducing adverse impacts; and to consider alternatives to the project.

The EIR for the proposed project will be prepared and processed in accordance with the California Environmental Quality Act (CEQA) of 1970, as amended. In accordance with the requirements of CEQA (Guidelines Sections 15120-15132), the EIR will include the following:

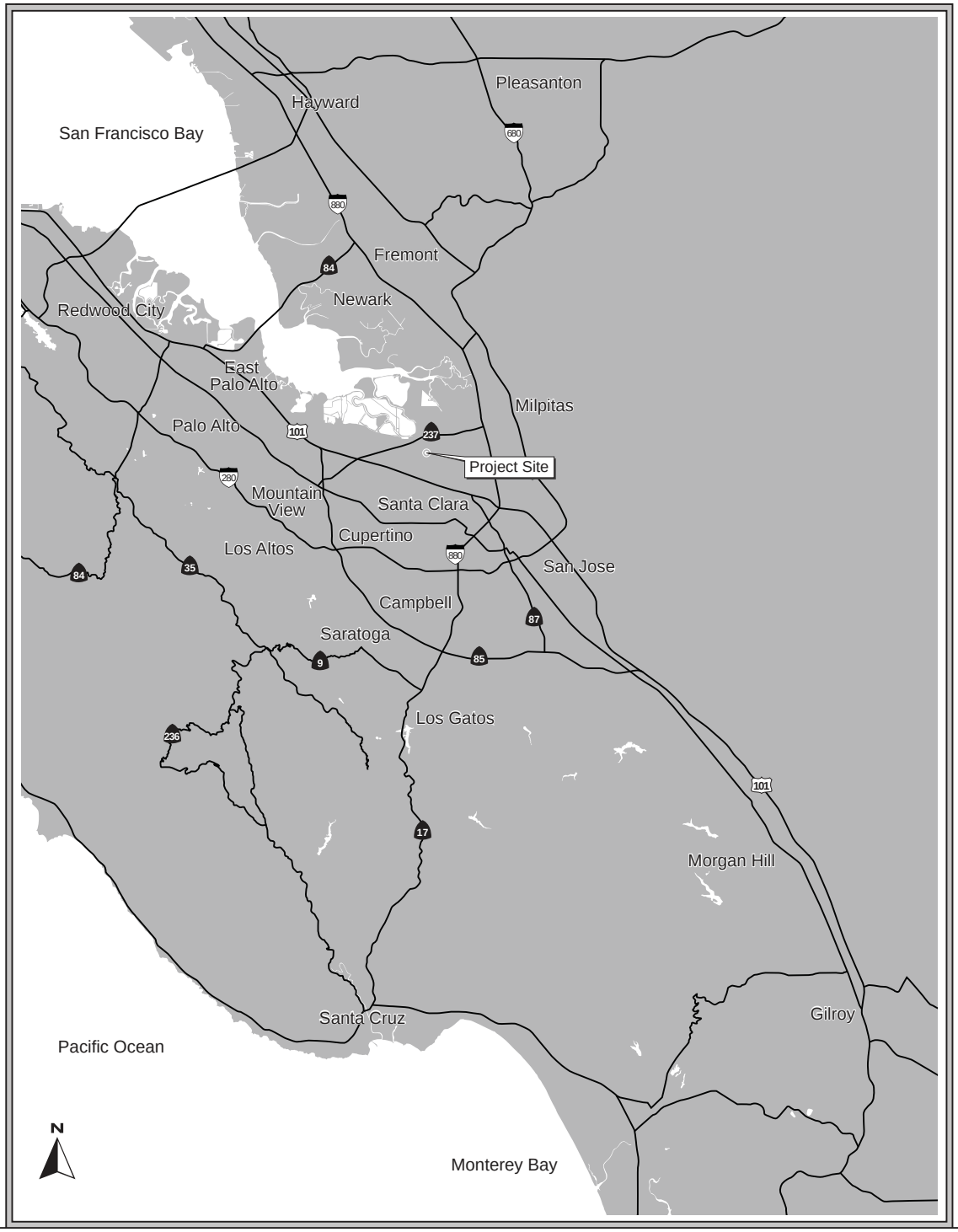
- A brief summary of the project;
- A project description;
- A description of the existing environmental setting, environmental impacts, and mitigation measures for the project;
- Alternatives to the project as proposed; and
- Environmental consequences, including (a) any significant environmental effects which cannot be avoided if the project is implemented; (b) any significant irreversible and irretrievable commitments of resources; (c) the growth inducing impacts of the proposed project; and (d) cumulative impacts.

Project Location

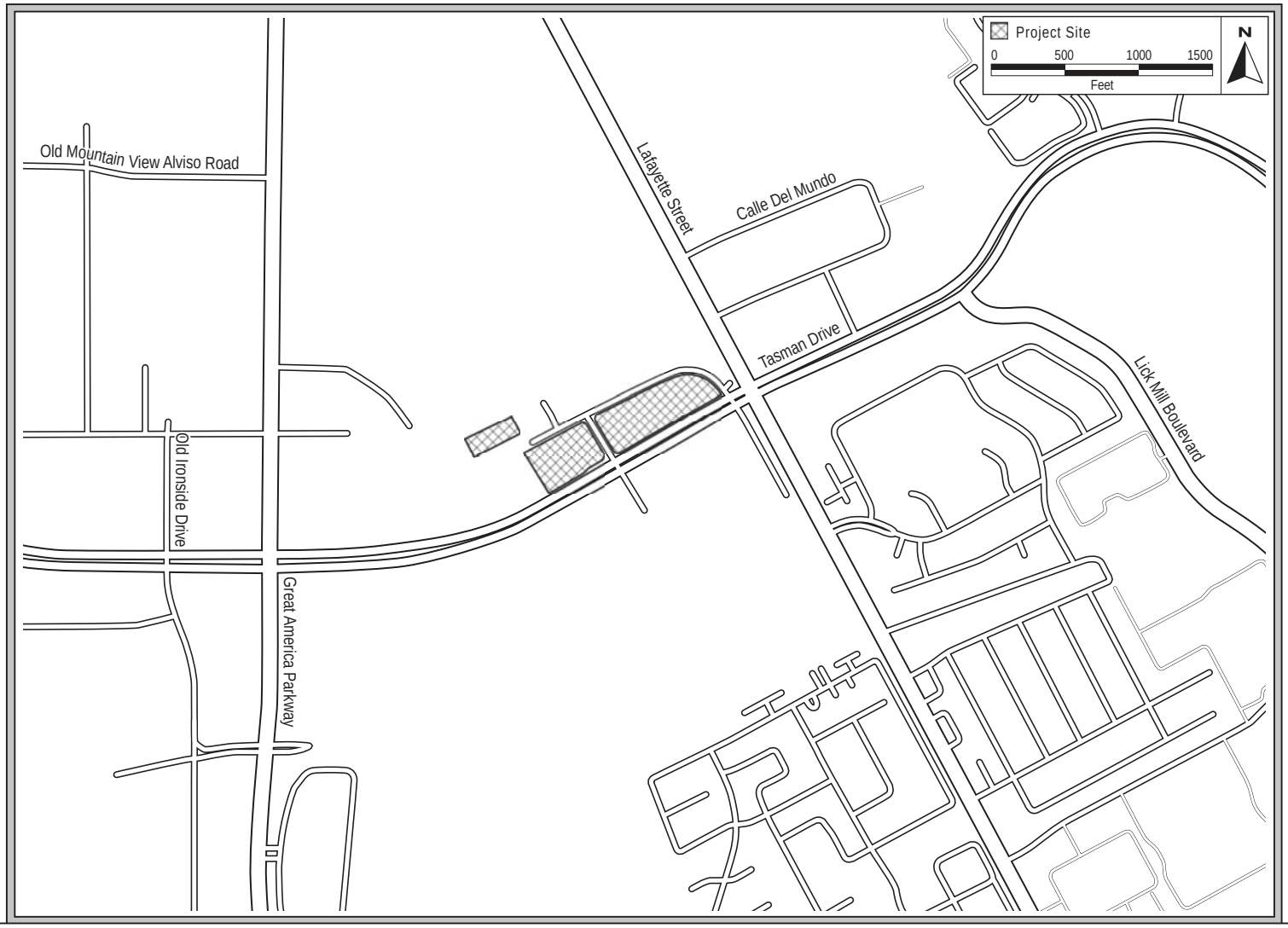
The 9.48-acre project site is located in the City of Santa Clara and is comprised of two City-owned parcels (APNs 104-03-038 and -039) located immediately north of Tasman Drive, on the east and west sides of Centennial Boulevard and a portion of another parcel (APN 104-03-036) located immediately northwest of the other project parcels. (see Figures 1 and 2).

Project Description

Parcels 1 and 2 are currently undeveloped. The portion of Parcel 3 that would be part of the proposed project is currently the tennis courts of the adjacent Santa Clara Golf and Tennis Club. The project site is accessed by Centennial Boulevard (via Tasman Drive) which runs between the two parcels on Tasman Drive. The entire project site is designated Regional Commercial in the General Plan. Parcels 1 and 3 are zoned *B – Public/Quasi Public* and Parcel 2 is zoned *CP – Commercial Park*.



REGIONAL MAP FIGURE 1



VICINITY MAP

FIGURE 2

The project, as proposed, would remove the existing tennis courts and construct between 600,000 and 825,000 square feet of mixed-use development on the project site as outlined below.

Proposed Land Use	Range of Development
Hotel	200,000 – 240,000
Retail/Restaurant	50,000 – 125,000
Office	350,000 – 460,000

The total floor area ratio (FAR) of the site would not exceed 2.0. Parcel 1 is proposed to be developed with an eight-story office building and retail space. Parcel 2 is proposed to be developed with a five-story hotel and retail space. The project site is at a lower elevation than Tasman Drive. The buildings are proposed to be constructed on an elevated podium which would be at grade with Tasman Drive.

Parking would be provided within a parking structure adjacent to (and possibility connected to) the existing City parking structure, a parking structure on Parcel 1, and under the elevated podium on Parcels 1 and 2.

The City of Santa Clara anticipates that discretionary approvals by the City, including but not limited to the following, will be required to implement the project addressed in this EIR:

1. General Plan Amendment
2. Rezoning
3. Site and Architectural Review
4. Tentative Map and/or Lot Line Adjustment
5. Issuance of grading, building, and occupancy permits.

Potential Environmental Impacts of the Project

The EIR will discuss the environmental effects anticipated to result from development of the project as proposed and will include a discussion of the following specific environmental categories as related to the project:

1. Land Use

The project site is located in a developed urbanized area surrounded by recreational, office, and residential land uses. The EIR will describe the existing land uses adjacent to and within the project area. Land use impacts that would occur as a result of the proposed project will be analyzed. The effect of the project on the City's jobs/housing balance will also be analyzed. Mitigation measures will be identified for significant impacts, as warranted.

2. Visual Resources

The project will replace two dirt lots and a set of tennis courts with parking structures, a hotel, and office/retail buildings. The EIR will describe the existing visual setting of the project area and the visual changes that are anticipated to occur as a result of the proposed project. The EIR will also discuss possible light and glare issues from the development. Mitigation measures will be identified for significant impacts, as warranted.

3. Air Quality

The EIR will address the regional air quality conditions in the Bay Area and discuss the proposed project's impacts to local and regional air quality according to the Bay Area Air Quality Management District (BAAQMD) guidelines and thresholds. Temporary construction related impacts such as construction vehicle exhaust and air-borne particulates (i.e., dust) will also be discussed. Mitigation measures will be identified for significant impacts, as warranted.

4. Noise and Vibration

The EIR will include a discussion of site-specific noise impacts from nearby noise sources on the site, including local roadways, aircraft fly-overs, nearby rail lines, and operation of the nearby amusement park and stadium. The EIR will also discuss noise that will result from operation of the proposed project, as well as temporary construction noise. Noise levels will be evaluated for consistency with applicable standards and guidelines in the City of Santa Clara. Mitigation measures will be identified for significant noise and vibration impacts, as warranted.

5. Cultural Resources

This area of Santa Clara is a sensitive area for subsurface prehistoric and historic resources as a result of prehistoric occupation of the area. The EIR will address the potential for redevelopment of the project site to impact known and unknown subsurface cultural resources. Mitigation measures will be identified for significant impacts, as warranted.

6. Geology

The project site is located in the most seismically active region in the United States. The EIR will discuss the possible geological impacts associated with seismic activity and the existing soil conditions on the project site. Mitigation measures will be identified for significant impacts, as warranted.

7. Hydrology and Water Quality

Based on the Federal Emergency Management Agency (FEMA) flood insurance rate maps, the EIR will address the possible flooding issues of the site as well as the effectiveness of the storm drainage system and the project's effect on storm water quality consistent with the requirements of the Regional Water Quality Control Board. Mitigation measures will be identified for significant impacts, as warranted.

8. Biological Resources

The project site is almost entirely undeveloped. Landscaping is limited to trees and shrubs around the perimeter of the site. The EIR will identify and discuss potential biological impacts resulting from construction of the project. Mitigation measures will be identified for significant impacts, as warranted.

9. Hazards and Hazardous Materials

The EIR will summarize hazardous materials conditions on and adjacent to the project site and will evaluate the potential for hazardous materials contamination to impact workers or future site users. The project site is in the flight path for Mineta San Jose International Airport. The EIR will also address the effects of the project on the operations of the airport and the project's consistency with Federal Aviation Administration (FAA) regulations. Mitigation measures will be identified for significant impacts, as warranted.

10. Energy

Implementation of the proposed project will result in an increased demand for energy on-site. The EIR will address the increase in energy usage on-site and proposed design measures to reduce energy consumption. Mitigation measures will be identified for significant impacts, as warranted.

11. Transportation and Circulation

The project site is located in a highly developed area of Santa Clara and, as can be expected, existing roadway volumes in the project area are high. The EIR will examine the existing traffic conditions in the immediate vicinity of the project site and the effects of project generated traffic on the operating conditions of local intersections and nearby freeways. The EIR will also address project specific access and circulation impacts. Mitigation measures will be identified for potential significant impacts, as warranted.

12. Global Climate Change

The EIR will address the proposed project's contribution to regional and global greenhouse gas emissions based on conformance to the City's Climate Action Plan. Proposed design measures to reduce energy consumption, which in turn would reduce greenhouse gas emissions, will be discussed. Mitigation measures will be identified for significant impacts, as warranted.

13. Utilities

Implementation of the proposed project will result in an increased demand on utilities and public facilities compared to existing conditions. The EIR will examine the impacts of the project on public services, including utilities such as sanitary and storm drains, water supply, and solid waste management. A Water Supply Assessment will be prepared in conformance with SB 610. Mitigation measures will be identified for significant impacts, as warranted.

14. Public Services

Implementation of the proposed project will not directly increase the population of the City, but due to the increase in local jobs, could result in an increased demand on public services including police and fire protection. Because of the proposed project, usage of local parks and other recreational facilities could also increase. The EIR will address the availability of public facilities and services and the potential for the project to require the construction of new facilities. Mitigation measures will be identified for significant impacts, as warranted.

15. Alternatives

The EIR will examine alternatives to the proposed project including a "No Project" alternative and one or more alternative development scenarios depending on the impacts identified. Alternatives discussed will be chosen based on their ability to reduce or avoid identified significant impacts of the proposed project while achieving most of the identified objectives of the project.

16. Significant Unavoidable Impacts

The EIR will identify those significant impacts that cannot be avoided, if the project is implemented as proposed.

17. Cumulative Impacts

The EIR will include a cumulative impacts section that will address the potentially significant cumulative impacts of the project when considered with other past, present, and reasonably foreseeable future projects in the development area.

In conformance with the CEQA Guidelines, the EIR will also include the following sections: 1) consistency with local and regional plans and policies, 2) growth inducing impacts, 3) significant irreversible environmental changes, 4) references and organizations/persons consulted, and 5) EIR authors.

Yen Chen, Associate Planner,
City of Santa Clara

September 8th, 2014

Re: Scoping comments Re: Notice of Preparation for the Centennial Gateway Mixed-Use Project, 5120 Stars and Stripes Drive

Dear Ms. Fernandez,

Santa Clara Valley Audubon Society, the Loma Prieta Chapter of the Sierra Club, the California Native Plant Society, Santa Clara Valley Chapter and the Citizens Committee to Complete the Refuge are local environmental organizations concerned with land use choices and their impact on our region's biological and natural resources. This letter provides our scoping comments for the proposed City Place Santa Clara Project (Project).

The project proposes redevelopment of two City-owned open space lots and a portion of a developed parcel on the north side of Tasman Drive west of Lafayette Street in the City of Santa Clara. The development includes demolition of the existing tennis courts and construction of parking structures, a hotel, and office/retail buildings. The project proposes construct between 600,000 and 825,000 square feet of mixed-use development on the project site, including an eight-story office building and retail space and a five-story hotel and retail space.

Please accept the following scoping comments:

1. Burrowing Owls
We believe that construction of the project has the potential to forever eliminate the recovery for this species in Santa Clara Valley.

Based on extensive surveys and best available science, the Santa Clara Valley Habitat Conservation Plan / Natural Communities Conservation Plan (HCP) identifies open spaces along Highway 237, including landfills and golf courses, as essential to the recovery of burrowing owls in Santa Clara County and the region. Parts of the Project site have been historically set aside to mitigate impacts of previous City of Santa Clara projects on burrowing owls and thus should not be available to development.

While the City of Santa Clara is not a partner agency, the Project's properties are included in the Burrowing Owl Extended Study Area. The properties are included in Burrowing Owl nesting area fee zone (http://www.hcpmaps.com/habitat/).

The HCP includes detailed scientific study of burrowing owl populations in Santa Clara County and the South Bay, and it provides the most appropriate mitigation measures in a Burrowing Owl Recovery Strategy (Appendix M of the HCP).

Please provide analysis of the compatibility of the Project with the HCP. Please consider that since the Project consumes a portion of the land that the HCP expected to be used for the recovery of the species in the region, mitigation requirements for this Project should be set higher than those allowed in the HCP. Please do not consider mitigation outside of the immediate area, since such mitigation provides no benefits to burrowing owls locally or statewide.

2. Nitrogen deposition

Nitrogen is a powerful fertilizer that triggers growth among a wide variety of vegetation types. The fertilizer encourages invasive plant growth that crowds out native plants. The Wildlife Agencies and scientific researchers agree that vehicle exhaust includes nitrogen oxide that is airborne and then settles. A 2006 report from the California Energy Commission, *Impacts of Nitrogen Deposition on California Ecosystems and Biodiversity*, addressed the impacts of nitrogen deposition. Also, a notable number of applicable research studies have identified nitrogen deposition impacts for locations outside California including other parts of the world. The HCP provides state-of-the-art scientific analysis of the impacts of vehicular emissions, specifically nitrogen emissions, on sensitive species and habitat.

Nitrogen from vehicle exhaust that settles on the ground also negatively impacts other land cover types in Santa Clara County including California Annual Grassland, Northern Mixed Chaparral / Chamise Chaparral, Northern Coastal Scrub / Diablan Sage Scrub, Valley Oak Woodland, Mixed Oak Woodland and Forest, Blue Oak Woodland, Coast Live Oak Forest and Woodland, Foothill Pine - Oak Woodland, Mixed Evergreen Forest, Redwood Forest, Coastal and Valley Freshwater Marsh, Seasonal Wetland, and Pond habitat.

Serpentine land cover in Santa Clara County has been shown to experience adverse indirect impacts due to nitrogen deposition. This land cover type supports host plants of the threatened Bay checkerspot butterfly. As such, loss of serpentine vegetation results in loss of habitat for the butterfly, which is a violation of the federal Endangered Species Act. In the vicinity of the project area, nitrogen emission may impact grasslands (including land set aside for restoration of habitat for burrowing owl habitat and for preservation of the Congdon's Tar Plant at the San-Jose Santa-Clara Regional Waste Water Facility), vernal pool, wetland and marsh habitat (including the Don Edwards National Wildlife Refuge near Alviso and the Warm Springs Unit, as well as the Salt

Pond restoration Project, hosting a number of endangered species including but not limited to the California clapper rail and the salt marsh harvest mouse).
Please analyze impacts of nitrogen deposition to baylands, marshlands, grasslands, and serpentine soil habitats.

The traffic generated by the Project will add to the cumulative impacts of N-deposition on sensitive habitats. Please provide analysis of increased vehicle trips and vehicle miles traveled, and an estimate of NO_x and NH_3 emissions from those vehicle trips. Appropriate mitigations similar in scale to those provided for power plants and for the Santa Clara Valley Habitat Plan should be developed.

3. Impacts of glass surfaces on resident and migratory birds
Scientific studies show that collisions with glass surfaces kill 300 million to a billion birds in the country every year (Loss et. al. 2014, Hager et. al. 2013, attached). Attraction to lights causes additional mortality. A six-year study at the California Academy of Sciences estimates the toll at 54 birds per year – all at one building. It seems that many of the fatalities were fledging birds, with little experience of flight and with less agile navigation skill in their environment. The building that was monitored does not have expansive glass surfaces, so it is possible that buildings with more glazing would exert a higher toll. The California Academy of Sciences study (Jack Dumbacher, personal communication) as well as Hager et. al. 2013 (attached) show that spatial building configuration and building window area are primary concerns and should be considered in the design of buildings, landscaping and their configurations.

Please provide analysis of cumulative impacts to birds, and mitigate by requiring design criteria that avoid reduce light pollution impacts and the risk of collision. Please see:

- https://dl.dropboxusercontent.com/u/56352315/Bird-friendly Building engl.pdf
- http://www.abcbirds.org/abcprograms/policy/collisions/pdf/Bird-friendly_Building_Guide_WEB.pdf

4. Energy efficiency of glass building envelops
Please analyze energy expenditure associated with glass building envelops, and minimize the impact by requiring design criteria that reduce the expanses of glass. See attached:

- http://urbangreencouncil.org/high-cholesterol-buildings

5. Segmentation of CEQA review
The Centennial Gateway Mixed-Use Project at 5120 Stars and Stripes Drive and the City Place Santa Clara Project at 5155 Stars and Stripes Drive should be considered together because their cumulative impacts are likely to be synergistic, and because they would utilize the same infrastructure and services. Additionally, Water Supply Assessment should be prepared for both projects together.

We thank you for your consideration. Please put us on the notification list for any updates or public opportunities to participate and comment as the project moves forward.

Respectfully,

Shani Kleinhaus, Environmental Advocate
Santa Clara Valley Audubon Society
22221 McClellan Rd, Cupertino, CA 95014

Mike Ferreira, Chapter Conservation Chair
Sierra Club Loma Prieta Chapter
3921 E Bayshore Rd, Palo Alto, CA 94303

Linda Ruthruff, Conservation Committee Chair
California Native Plant Society, Santa Clara Valley Chapter
3921 E Bayshore Rd, Palo Alto, CA 94303

Eileen McLaughlin, Board Member
Citizens Committee to Complete the Refuge
San Jose

STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY EDMUND G. BROWN Jr., Governor

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August 11, 2014

SCL237204
SCL/237/PM R6.1
SCH# 2014072024

Mr. Yen Han Chen
Planning Division
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050

Dear Mr. Chen:

Centennial Gateway Mixed-Use Project – Notice of Preparation (NOP)

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the project referenced above. We have reviewed the NOP and have the following comments to offer.

Traffic Impact Study (TIS)
One of Caltrans' ongoing responsibilities is to collaborate with local agencies to avoid, eliminate, or reduce to insignificance potential adverse impacts by local development on State highways. We recommend using the Caltrans *Guide for the Preparation of Traffic Impact Studies* (TIS Guide) for determining which scenarios and methodologies to use in the analysis. The TIS Guide is a starting point for collaboration between the lead agency and Caltrans in determining when a TIS is needed. The appropriate level of study is determined by the particulars of a project, the prevailing highway conditions, and the forecasted traffic. The TIS Guide is available at the following website address:
http://dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa_files/tisguide.pdf.

The TIS should include:

1. Vicinity map, regional location map, and a site plan clearly showing project access in relation to nearby State roadways. Ingress and egress for all project components should be clearly identified. The State right-of-way (ROW) should be clearly identified. The maps should also include project driveways, local roads and intersections, parking, and transit facilities.

2. Project-related trip generation, distribution, and assignment. The assumptions and methodologies used to develop this information should be detailed in the study, and should be supported with appropriate documentation.

3. Average Daily Traffic, AM and PM peak hour volumes and levels of service (LOS) on all roadways where potentially significant impacts may occur, including crossroads and controlled intersections for existing, existing plus project, cumulative and cumulative plus project scenarios. Calculation of cumulative traffic volumes should consider all traffic-generating developments, both existing and future, that would affect study area roadways and intersections. The analysis should clearly identify the project's contribution to area traffic and any degradation to existing and cumulative LOS. Caltrans' LOS threshold, which is the transition between LOS C and D, and is explained in detail in the TIS Guide, should be applied to all State facilities.

4. Schematic illustration of traffic conditions including the project site and study area roadways, trip distribution percentages and volumes as well as intersection geometrics (i.e., lane configurations) for the scenarios described above.

5. The project site building potential as identified in the General Plan. The project's consistency with both the Circulation Element of the General Plan and the Congestion Management Agency's Congestion Management Plan should be evaluated.

6. Identification of mitigation for any roadway mainline section or intersection with insufficient capacity to maintain an acceptable LOS with the addition of project-related and/or cumulative traffic.

7. The intersection of Great America Parkway and the State Route (SR) 237 westbound (WB) off-ramp is operating with one signal controller which is currently degrading the efficiency of the corridor. We request that the traffic engineer for the TIA consult with us regarding the signal operation assumptions for the analysis. Caltrans may ask that a second controller be added.

8. The following freeway on-ramps are expected to be significantly impacted by the proposed project during ramp metering hours:

   - Northbound (NB) U.S. Highway (U.S.) 101 at the Great America Parkway diagonal on-ramp;
   - Southbound (SB) U.S. 101 at the Great America Parkway loop on-ramp;
   - SB U.S. 101 at the Montague Expressway diagonal on-ramp;
   - WB SR 237 at the Great America Parkway diagonal on-ramp;
   - Eastbound (EB) SR 237 at the Great America Parkway diagonal on-ramp.

   The existing on-ramp queues will likely be lengthened with additional traffic demand and may impact traffic operations on the local streets. We request that the provision of additional storage on the on-ramps and/or local streets be proposed to prevent secondary impacts from ramp-meter queuing, including a High Occupancy Vehicle (HOV) preferential lane for the freeway onramps.

Caltrans has existing Traffic Operation Systems (TOS) and ramp metering equipment along U.S. 101 and SR 237. This equipment must be maintained and kept operational during all phases of the proposed project. Should they be impacted as a result of the proposed project, including project mitigation, the applicant or the entity responsible for mitigating the project's impacts will need to obtain Caltrans approval for equipment relocation and/or replacement.

Lead Agency
As the lead agency, the City of Santa Clara (City) is responsible for all project mitigation, including any needed improvements to State highways. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

This information should also be presented in the Mitigation Monitoring and Reporting Plan of the environmental document. Required roadway improvements should be completed prior to issuance of the Certificate of Occupancy. Since an encroachment permit is required for work in the State ROW, and Caltrans will not issue a permit until our concerns are adequately addressed, we strongly recommend that the City work with both the applicant and Caltrans to ensure that our concerns are resolved during the environmental process, and in any case prior to submittal of an encroachment permit application. Further comments will be provided during the encroachment permit process; see the end of this letter for more information regarding encroachment permits.

Vehicle Trip Reduction
Caltrans encourages you to locate any needed housing, jobs and neighborhood services near major mass transit centers, with connecting streets configured to facilitate walking and biking, as a means of promoting mass transit use and reducing regional vehicle miles traveled and traffic impacts on the State highways.

We also encourage you to develop Travel Demand Management (TDM) policies to promote usage of nearby public transit lines and reduce vehicle trips on the State Highway System. These policies could include lower parking ratios, car-sharing programs, bicycle parking and showers for employees, and providing transit passes to residents and employees, among others. For information about parking ratios, see the Metropolitan Transportation Commission (MTC) report *Reforming Parking Policies to Support Smart Growth* or visit the MTC parking webpage: http://www.mtc.ca.gov/planning/smart_growth/parking.

In addition, please ensure secondary impacts on pedestrians and bicyclists resulting from any traffic impact mitigation measures are analyzed. The analysis should describe any pedestrian and bicycle mitigation measures and safety countermeasures that would in turn be needed as a means of maintaining and improving access to transit facilities and reducing vehicle trips and traffic impacts on State highways.

Traffic Impact Fees
Please identify traffic impact fees to be used for project mitigation. Development plans should

require traffic impact fees based on projected traffic and/or based on associated cost estimates for public transportation facilities necessitated by development. Scheduling and costs associated with planned improvements on State ROW should be listed, in addition to identifying viable funding sources correlated to the pace of improvements for roadway improvements, if any.

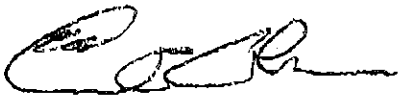
Voluntary Contribution Program
U.S. 101, SR 237, and other State facilities near the site are critical to regional and interregional traffic in the San Francisco Bay region. They are vital to commuting, freight, and recreational traffic and are among the most congested regional facilities. Given the scale and location of the proposed project and the traffic generated, along with other projects in the vicinity, this project will have a cumulative significant regional impact to the already congested State Highway System.

Caltrans encourages the City to participate in Santa Clara Valley Transportation Authority's (VTA) voluntary contribution program (Program) and plan for the impact of future growth on the regional transportation system. Contributions would be used to help fund regional transportation programs that improve the transportation system to lessen future traffic congestion, improve mobility by reducing time delays, and maintain reliability on major roadways throughout the San Francisco Bay Area.

Reducing delays on State facilities will not only benefit the region, but also reduce any queuing on local roadways caused by highway congestion. The VTA is developing two Express Lane projects in the vicinity: (1) the U.S. 101 Express Lane project; and (2) the SR 237 Express Lane project. We request that the applicant be asked to contribute to the Program for these two projects as mitigation for expected freeway segment impacts.

Should you have any questions regarding this letter, please contact Brian Brandert of my staff at (510) 286-5505 or brian.brandert@dot.ca.gov.

Sincerely,



ERIK ALM, AICP
District Branch Chief
Local Development - Intergovernmental Review

c: Scott Morgan, State Clearinghouse
Robert Swierk, Santa Clara Valley Transportation Authority (VTA) – electronic copy
Robert Cunningham, Santa Clara Valley Transportation Authority (VTA) – electronic copy

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From: Rummel, Chris [mailto:Chris.Rummel@deh.sccgov.org]
Sent: Friday, August 08, 2014 7:51 AM
To: Yen Chen
Cc: Chau, Stan; Alfred Worcester (alfred.worcester@calrecycle.ca.gov); Narala, Devender@Waterboards (devender.narala@waterboards.ca.gov)
Subject: Centennial Gateway Mixed-Use Project

Dear Ms. Chen,

Attached please find the final comment letter from our Department. I had previously mailed a similar letter dated July 17, 2014. That letter is hereby retracted and is to be replaced with this letter. Please do not submit the letter from our department dated July 17, 2014 along with the public comments for this project. This revised letter more accurately reflects our role in the process and concerns that should be addressed. Thank you for your consideration of this matter. Feel free to call me if you have any questions.

Chris Rummel, R.E.H.S, Acting Program Manager
Santa Clara County Dept. of Environmental Health
Solid Waste Program, LEA
(408) 918-1964; fax: (408) 280-6479
chris.rummel@deh.sccgov.org
1555 Berger Dr., Ste 300
San Jose, CA 95112-2716

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County of Santa Clara

Department of Environmental Health

1555 Berger Drive, Suite 300
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(408) 918-3400
www.EHinfo.org

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August 8, 2014

Ms. Yen Chen, Associate Planner
City of Santa Clara
1500 Warburton Ave.
Santa Clara, CA 95050

RE: File #CEQ2014-01178 – Centennial Gateway Mixed-Use Project

Dear Ms. Chen:

The County of Santa Clara Department of Environmental Health (Department), acting as the Local Enforcement Agency (LEA), received a notification that an EIR is being prepared for the above project. The impacts studied in the EIR for Hazards and Hazardous Material and other appropriate sections, must include descriptions and mitigations for the possible adverse effects from the City of Santa Clara All-Purpose Landfill. Our department has been delegated by the State of California EPA to regulate this landfill in accordance with Title 14 and Title 27 of the California Code of Regulation.

The project is within 1000 feet of a closed landfill. Parcel 3 is immediately adjacent to the closed landfill and several million tons of buried mixed municipal solid waste. Landfills can produce explosive methane gas and other toxic gases that can migrate away from their boundaries and across property lines in the soil. Similarly, liquid waste called leachate, can also migrate through the soils to neighboring properties.

The LEA provides the following comments regarding the proposed EIR:

1. The Project description does not mention the proposed use for Parcel 3 with the existing tennis courts, which is part of APN 10403-036. This "Parcel", although not a separated property, is part of the City of Santa Clara All-Purpose Landfill, which closed in the late 1980's. This property is primarily an unlined landfill containing several million tons of mixed municipal solid waste. Any structure proposed or any alteration of the existing use must be reviewed and approved by two agencies within the California EPA and this Department. We will determine compliance with the pertinent regulations concerning public protection for the threats of methane and other gases as well as the exposure to leachate liquids. The project must also protect the integrity of the close landfill, as well

as prevent the movement of landfill waste byproducts away from the existing containment area.

2. There is a discussion of a proposed new parking structure which is to be connected to an existing parking structure. This new structure for parking would necessitate below grade excavations connecting to Parcels 1 and 2, as inferred by the statement that the connections would be under the podium foundations. The EIR should make clear the extent and estimated depth of any below grade excavations, which could potentially intercept soil lenses containing landfill gases or leachate liquids.
3. The parcels 1 and 2, since they are on parcels adjacent to the closed landfill, should have construction features that include gas migration control engineering features with explosive gas sensors. Typically this involves the construction of deep impermeable walls below grade, also known as 'cut-off walls', or any other engineered feature that would prevent explosive gas or toxic leachate from entering the parking garage or buildings.

The LEA, CalRecycle and the RWQCB will all be responsible agencies for this project, by virtue of the inclusion of Parcel 3, which is the landfill parcel. The City, as lead agency, should not approve the Environmental Impact Report for this project without considering the concerns and findings by these Responsible Agencies. Please send to us any draft and final EIR, Initial Studies, or any supporting documentation for this project.

Thank you for the opportunity to comment on this NOP. We value working together in addressing the concerns for potential risks this project poses for the environment and the community.

If you have any questions, please feel free me (408) 918-1964 or Stan Chau at (408) 918-1961. I can also be reached at chris.rummel@deh.sccgov.org

Sincerely,

Chris Rummel

Chris Rummel
Acting Program Manager
Solid Waste Programs
Hazardous Materials Compliance Division

Cc: Stan Chau, Senior Environmental Health Specialist, stan.chau@deh.sccgov.org
Alfred Worcester, Calrecycle, Alfred.worcester@calrecycle.ca.gov
Devender Narala, RWQCB, Devender.narala@waterboards.ca.gov

County of Santa Clara
Roads and Airports Department

101 Skyport Drive
San Jose, California 95110-1302
1-408-573-2400

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AUG 08 2014
PLANNING DIVISION

August 5, 2014

Yen Chen
Associate Planner
1500 Warburton Avenue
Santa Clara, CA 95050

SUBJECT: Notice of Preparation (NOP) of an Environmental Impact Report Centennial Gateway Mixed-Use Project

Dear Yen Chen:

The County of Santa Clara Roads and Airports Department appreciates the opportunity review the NOP and is submitting the following comments.

A Transportation Impact Analysis (TIA) should be prepared for the proposed project following the latest adopted Congestion Management Program (CMP) TIA Guidelines to identify significant impacts for the DEIR. The TIA should include, but not be limited to, all signalized, unsignalized, CMP and non-CMP intersections on Montague Expressway between North First Street and US-101, and Lawrence Expressway between SR-237 and Arques Avenue. The TIA should also include queueing analysis at the Lawrence Expressway/Tasman Drive intersection. The TIA should be conducted using County signal timing for County study intersections and the most recent CMP count and LOS data for CMP intersections. Please contact the Senior Traffic Engineer, Ananth Prasad, at Ananth.Prasad@rda.sccgov.org for the correct signal timing settings for the TIA.

The *Comprehensive County Expressway Planning Study - 2008 Update* adopted by the Board of Supervisors in March 2009 should be consulted for a list of mitigation measures for significant impacts to the expressways. Should the *Expressway Study* not include an improvement that would mitigate a significant impact, the TIA should identify mitigation measures that would address the significant impact. Mitigation measures listed in the TIA should be incorporated into the EIR document.

If you have any questions or concerns about these comments, please contact me at (408) 573-2465 or dawn.cameron@rda.sccgov.org.

Sincerely,

Dawn S. Cameron
County Transportation Planner

cc: Masoud Akbarzadeh, *County Traffic Engineer*

Board of Supervisors: Mike Wasserman, Cindy Chavez, Dave Cortese, Ken Yeager, S. Joseph Simitian
County Executive: Jeffrey V. Smith

Map of Project Area

- Plant (80m)
- Plant (specific)
- Plant (non-specific)
- Plant (circular)
- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)
- Terrestrial Comm. (80m)
- Terrestrial Comm. (specific)
- Terrestrial Comm. (non-specific)
- Terrestrial Comm. (circular)
- Aquatic Comm. (80m)
- Aquatic Comm. (specific)
- Aquatic Comm. (non-specific)
- Aquatic Comm. (circular)
- Multiple (80m)
- Multiple (specific)
- Multiple (non-specific)
- Multiple (circular)

1:36,112

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

August 25, 2014

Author: djohnston
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State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bay Delta Region
7329 Silverado Trail
Napa, CA 94558
(707) 944-5500
www.wildlife.ca.gov

EDMUND G. BROWN JR., *Governor*
CHARLTON H. BONHAM, *Director*

August 28, 2014

Mr. Yen Han Chen
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050

Dear Mr. Chen:

Subject: Centennial Gateway Mixed-Use Development, Notice of Preparation of a Draft Environmental Impact Report, SCH #2014072024, City and County of Santa Clara

This letter is in response to the Notice of Preparation (NOP) of a draft Environmental Impact Report (EIR) for the Centennial Gateway Mixed-Use Project (Project), received by the California Department of Fish and Wildlife (CDFW) on July 14, 2014. The Project will consist of the construction of between 600,000 and 850,000 square feet of new hotel, retail, restaurant, and office space within an 8.4-acre development envelope. The Project is located at the corner of Tasman Drive and Centennial Boulevard in the City and County of Santa Clara.

CDFW is identified as a Trustee Agency pursuant to the California Environmental Quality Act (CEQA) §15386. As a trustee for the State's fish and wildlife resources, CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants and the habitat necessary for biologically sustainable populations of those species pursuant to California Fish and Game Code §1802. In this capacity, CDFW administers the California Endangered Species Act (CESA), the Native Plant Protection Act, the Lake and Streambed Alteration Program and other provisions of the Fish and Game Code that afford protection to the State's fish and wildlife trust resources.

CDFW is aware the suggested timeframe to provide comments on the NOP has passed. However, CDFW anticipates the recommendations below will be beneficial and respectfully requests they be included in the CEQA document prepared for this Project. Therefore, CDFW is offering the following comments, and recommendations regarding the proposed Project.

Burrowing Owl

Once one of the most common birds in the state, burrowing owl numbers have declined significantly since the 1940s with an increasing downward trend from the 1970s onward. The burrowing owl population in the entire South San Francisco Bay Area was probably around 1,000 pairs in the 1970s and by 1980, there were perhaps only 250 pairs remaining (Albion Environmental, Inc. 2000).

The first comprehensive surveys of burrowing owls in the Bay Area took place beginning in 1991 (DeSante et al. 1997; DeSante et al. 2007) and yielded estimates of 153 pairs (1997) and 165 pairs (2007) for the Bay Area as a whole. Results of a larger statewide survey suggested that there had been approximately 50% declines in both the numbers of owls and the number of

breeding groups in the San Francisco Bay Area from the period 1986–1991. A report by Albion Environmental, Inc.(2000) estimated that the Santa Clara County burrowing owl population in 1997 consisted of between 120 and 141 pairs, most of which were found in 12 discrete locations.

As part of the development of the conservation strategy for the Santa Clara Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) (Plan), the Plan area was surveyed for breeding burrowing owls from May 26 to July 23, 2008 (Albion Environmental, Inc. 2008). The survey was conducted at 96 locations: 84 locations inside the HCP/NCCP area and 12 immediately outside the northern and southern boundaries of the HCP/NCCP area where breeding owls were known to occur, i.e., Alviso environs and northern San Benito County. This survey resulted in an estimate of 19–20 pairs in the HCP/NCCP area, 20 to 21 pairs in the City of San Jose (includes pairs in Alviso outside the plan area), and 21 to 23 breeding pairs when including pairs observed just outside the north and south HCP/NCCP Plan area boundaries. All except two breeding pairs in the Plan area were located on either San Jose International Airport or north San Jose/Alviso. These data strongly support the observation that the South Bay burrowing owl population has declined catastrophically, since just 1997 and that the remaining owls are limited to fewer and fewer locations. In developing a Population Viability Analysis to provide the basis for a HCP/NCCP conservation strategy for the species, only three sites in the South Bay area; Moffett Airfield, San Jose International Airport, and Shoreline Park had enough owls to be used in the analysis.

The current circumstances are such that the remaining burrowing owl breeding and foraging areas are found on the open spaces along the Highway 237 corridor from roughly Shoreline/Moffett to the west to Interstate 880 to the east. This area includes the parcels where the Centennial Gateway development is proposed. These areas are critical to the sustainability of the local burrowing owl population and any loss of useable open space in this area should be considered a significant impact in any CEQA evaluation.

The California Natural Diversity Data Base lists numerous burrowing owl occurrences on and around the Centennial Gateway site (see attached). In addition to the pair of owls which bred near Levi's Stadium the past two years, local burrowing owl biologists have observed owls foraging on the golf course, nesting on the slope of Tasman Drive in front of the golf course parking lot, under the sidewalk along Centennial, and on the berm inside the Pacific Gas and Electric Company substation at the end of Centennial. These records and the proximity of other nesting occurrences establish the site as active burrowing owl habitat and this should be used as the CEQA baseline in the draft EIR.

As noted above, a regionally-specific burrowing owl recovery plan was developed as part of the Santa Clara HCP/NCCP to establish a recovery strategy for the species within the Plan area. Since almost all the remaining owls in the South Bay are located in or near the HCP/NCCP area, this recovery strategy, by extension, serves as the most specific, detailed and local strategy to compensate for the loss of burrowing owl habitat (foraging, movement and breeding) in the South Bay and on the Peninsula. Accordingly, the strategy (Appendix M of the HCP/NCCP, available at http://scv-habitatagency.org/DocumentCenter/Home/View/120), is the best available mitigation and should be discussed and utilized in the draft EIR to mitigate for the loss of burrowing owl habitat resulting from the eventual construction of Centennial Gateway.

Given the state of the local population, out of the area mitigation should not be considered for this project as it will provide no benefit locally and little for the species as a whole.

Nitrogen Deposition

Atmospheric nitrogen deposition is a complex process by which reactive chemical species of nitrogen (N)—nitrogen oxides (NO_X), ammonia (NH_3), and their reaction products—are deposited onto surfaces and enter ecosystems as N fertilizer. N-deposition estimates (from varied studies) for the Santa Clara Valley range from 8–20 kilograms of nitrogen per hectare per year (kg-N/ha/y).

In Santa Clara County, N-deposition threatens serpentine grasslands that support numerous rare and endangered species, including the threatened Bay checkerspot butterfly (*Euphydryas editha bayensis*). The added N allows nutrient-poor serpentine soils to be invaded by non-native annual grasses that displace the native forbs that provide caterpillar food and adult nectar for the butterfly. N-deposition is the largest indirect impact of urban development on the serpentine grassland ecosystem. Although indirect, the impacts from new development on local serpentine communities are considerable and is advised to be considered a significant impact in the draft EIR.

As with burrowing owls, a specific N-deposition analysis was done for the HCP/NCCP (Appendix E, available at http://scv-habitatagency.org/DocumentCenter/Home/View/113). The City and its consultant team should work closely with the HCP/NCCP Implementing Entity and the U.S. Fish and Wildlife Service to analyze the specific impact from Centennial Gateway and to establish appropriate mitigation based on the local, specific strategy developed for this impact.

Thank you for the opportunity to comment at this early stage of the review process. If you have any questions, please contact Mr. Dave Johnston, Environmental Scientist, at (831) 464-6870 or david.johnston@wildlife.ca.gov; or Ms. Annee Ferranti, Senior Environmental Scientist (Supervisory), at (707) 944-5554 or annee.ferranti@wildlife.ca.gov.

Sincerely,

Scott Wilson

Scott Wilson
Regional Manager
Bay Delta Region

ec:
Joseph Terry, U.S. Fish and Wildlife Service – joseph_terry@fws.gov
Edmund Sullivan, Santa Clara Valley Habitat Agency – edmund.sullivan@scv-habitatagency.org
Terah Donovan, ICFI International – Terah.Donovan@icfi.com

Reference:

Albion Environmental, Inc. 2000. City of San Jose, burrowing owl habitat conservation strategy and implementation plan. Draft Final Report. April 2000.

Albion Environmental, Inc. 2008. Burrowing owl survey in the Santa Clara Valley HCP/NCCP. Unpublished report.

DeSante, D.F., E.D. Ruhlen, S.L. Adamany, K.M. Burton and S. Amin. 1997. A census of burrowing owls in central California in 1991. Pages 38–48 in Lincer, J.L. and K. Steenhof. (Eds.). 1997. *The Burrowing Owl, its Biology and Management: Including the Proceedings of the First International Symposium*. Raptor Research Report Number 9.

DeSante, D.F., E.D. Ruhlen, and R. Scalf. 2007. The distribution and relative abundance of burrowing owls in California during 1991–1993: Evidence for a declining population and thoughts on its conservation. Pages 1–41 in Barclay, J.H., K.W. Hunting, J.L. Lincer, J. Linthicum, and T.A. Roberts (Eds.). 2007. *Proceedings of the California Burrowing Owl Symposium, November 2003*. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc. Point Reyes Station, CA, vii + 197 pp.

NORMAN Y. MINETA
SAN JOSE
INTERNATIONAL
AIRPORT

SILICON VALLEY'S AIRPORT

RECEIVED
JUL 21 2014
PLANNING DIVISION

July 18, 2014

Yen Chen
City of Santa Clara Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

Subject: NOP for Centennial Gateway Mixed-Use Project (File #CEQ2014-01178)

Dear Mr. Chen:

Thank you for sending the subject EIR Notice of Preparation to the City of San Jose Airport Department. The Airport concurs with the NOP mention that the environmental analysis will include discussion of the proposed development's compatibility with the operations of the San Jose International Airport and applicable Federal Aviation Regulations (particularly Part 77 if the project includes high-rise development).

City or consultant staff are welcome to contact me at cgreene@sjc.org or 408-392-3623 for any questions regarding that analysis. The Airport will also appreciate the opportunity to review the Draft EIR when available.

Sincerely,

Cary Greene

Cary Greene
Airport Planner

Letter of Transmittal

Santa Clara Unified School District

1889 Lawrence Road, Santa Clara, CA 95050 Bond Programs

To:
City of Santa Clara
Planning Division
Yen Chen, Associate Planner
1500 Warburton Avenue
Santa Clara, CA 95050
408.615.2450

From:
Santa Clara Unified School District
Bond Programs
Michal Healy
1889 Lawrence Road
P.O. Box 397
Santa Clara, CA 95050
408.423.2085

August 12, 2014

Yen Chen,
Attached is the Santa Clara Unified School District's Comment letter for the Centennial Gateway Mixed Use Project (CEQ2014-01178) Notice Of Preparation for the CEQA Environmental Impact Report.

Please feel free to call me if you have any questions.

Thank you,
Michal Healy

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SANTA
CLARA
UNIFIED
SCHOOL
DISTRICT

1889 Lawrence Rd.
Santa Clara, CA
95051
(408) 423-2000
STANLEY ROSE III, Ed.D.
SUPERINTENDENT

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AUG 12 2014
PLANNING DIVISION

August 11, 2014

Yen Chen
Associate Planner
City of Santa Clara
1500 Washburn Avenue
Santa Clara, CA 95050

RE: NOP for EIR; Centennial Gateway Mixed Use Project (CEQ2014-01178)

Dear Yen Chen,

The Santa Clara Unified School District appreciates the opportunity to provide input for the CEQA Environmental Impact Report (EIR) for proposed development. The location of the development is very close to Kathryn Hughes Elementary School and the health and safety of the attending students is paramount. The project has several impacts to schools the EIR should consider.

Students are extremely sensitive receptors to pollution and the air quality around the school can have a significant effect on students' health. The increased traffic congestion, construction equipment, and ongoing airborne contaminants due to the project should be studied relative to the proximity of the school. An Air Health Risk Assessment is suggested for emissions to ensure levels are not significant for students, parents and faculty. The increase in vehicle trips may also affect the transportation and safety of students to and from the elementary school.

The new development will attract new employees to the area and every 1,664 square feet of commercial or industrial development creates the need for one additional housing unit in the Santa Clara area for new employees of the businesses. The District's schools do not have the capacity to accommodate the students from these homes until new schools are built.

Based on the current estimated cost of building new elementary, middle, and high schools, for construction, we request the above developments mitigate their impact on the District by paying the full mitigation amount per square foot of residential and commercial/industrial construction.

The Santa Clara Unified School District is requesting a Health Risk Study, an analysis of the Safe Routes to and from School and the developers work with the District to mitigate these impacts related to additional classrooms and/or schools. Please contact Michal Healy, mhealy@scusd.net with any questions.

Sincerely,

Mark Allgire, CPA, Assistant Superintendent, Business Services
MA:mh

BOARD
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INA K. BENDIS
JIM CANOVA
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CHRISTOPHER STAMPOLIS

"The mission of Santa Clara Unified School District is to prepare students of all ages and abilities to succeed in an ever-changing world."

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PLANNING DIVISION

August 11, 2014

Yen Chen, Associate Planner
City of Santa Clara
Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

Re: Comments to Notice of Preparation of a Draft Environmental Impact Report for Centennial Gateway Mixed-use Project

Dear Yen:

Thank you for the opportunity to review the Notice of Preparation (NOP) for the proposed mixed-use project at 5120 Stars and Stripes Drive in Santa Clara. This letter includes all City of Sunnyvale comments to the project NOP.

The following comments cover issues the City of Sunnyvale would like to be discussed in the DEIR:

A. General Questions and Comments:

1. Please provide a discussion of how the proposed project works with the 49er stadium parking and traffic circulation plan, especially during construction of the proposed project.

2. We also request that the City of Santa Clara provide outreach to Sunnyvale residents, and that the notice area be expanded if the traffic impacts show serious impacts to the nearby Sunnyvale neighborhoods.

B. Traffic and Transportation Input for the Notice of Preparation:

1. The City of Sunnyvale uses criteria found within the VTA Transportation Impact Analysis (TIA) Guidelines as a basis for determining study intersections. It is likely that project trips would travel to and from the west through intersections located within the City of Sunnyvale. Accordingly, municipal and CMP intersections with ten or more project trips per lane added to any intersection movement should be analyzed.

2. The project site is located near the City of Sunnyvale's eastern border. Relevant approved projects within Sunnyvale and other neighboring jurisdictions need to be included in the study estimates of the Background traffic volumes. This is consistent with the VTA TIA Guidelines. Please

contact the City of Sunnyvale to get a list of approved projects to include in the study.

3. Similarly, pending projects within Sunnyvale and other neighboring municipalities and/or the application of an annual growth rate need to be incorporated in the Cumulative traffic volume estimates in order to reflect the growth in both the local and regional traffic. Please contact the City of Sunnyvale to get a list of pending projects to include in the study.

4. Since this project is just north of the 49er Stadium, a game day scenario should be included in the analysis.

The City of Sunnyvale appreciates your consideration of the requested study scope elements described above. Please contact me at 408 730-7707 (aminer@sunnyvale.ca.gov) if you have any questions or concerns about items discussed in this letter.

Sincerely,

Andrew Miner
Principal Planner, Community Development Department

cc: Hanson Hom, CDD Director
Kent Steffens, Director of Public Works
Trudi Ryan, Planning Officer
Carol Shariat, Principal Transportation Engineer
Kevin Riley, Santa Clara Director of Planning and Development
Steve Lynch, Santa Clara City Planner

SANTA CLARA
Valley Transportation Authority

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AUG 08 2014
PLANNING DIVISION

August 8, 2014

City of Santa Clara Planning Division
1500 Warburton Avenue
Santa Clara, CA 95050

Attention: Yen Chen, Associate Planner

Subject: Notice of Preparation for Centennial Gateway Mixed-Use Project

Dear Mr. Chen:

The Santa Clara Valley Transportation Authority (VTA) has reviewed the Notice of Preparation (NOP) for the Centennial Gateway Mixed-Use Project. We have a number of comments on the document, which are included in the attached memorandum. However, I would like to highlight here the key themes from our review.

- First, VTA strongly believes that the analysis of transportation impacts and mitigation measures for the Centennial Gateway Project should be coordinated with the analysis of the adjacent City Place Santa Clara Project (NOP dated July 30, 2014). The proximity and timing of the projects and location across the street from the newly-opened Levi's Stadium offers an extraordinary opportunity for the City to leverage this combined investment to offer world-class transportation options to Santa Clara's "new downtown." VTA recommends coordinated mitigation strategies to address transportation impacts, described in detail in the attached memorandum.
- Second, given the size of the project and limited roadway access to and from the project area, the project should include a robust Transportation Demand Management (TDM) Program to reduce auto trips, vehicle miles traveled and greenhouse gas emissions. Such measures will be critical in order to facilitate efficient transportation access to and from the site and reduce transportation impacts. The single most important measure is to design the project to facilitate the maximum percentage of trips taken by pedestrian, bicycle and transit modes. Additional recommended TDM measures are included in the attached memorandum.
- Lastly, based on the level of transit demand to be generated by the Centennial Gateway Project in combination with the nearby City Place Santa Clara Project and Levis's Stadium, transit improvements will likely be necessary to effectively move people within and through the area. VTA would like to engage in dialogue with the City about how to make transit, biking and walking successful in the area, as an effective measure to reduce automobile travel. VTA recommends that the City consider developer contributions to transit improvements in the project area, such as construction of a new bus transfer center; fencing the light rail tracks along Tasman Drive, consistent with City commitments, to enhance safety and increase speeds; and station/access improvements and double-tracking of the Santa Clara Great America ACE/Capitol Corridor train station.

VTA would like to work collaboratively with the City as this project and other projects in the area continue to evolve. Please do not hesitate to contact me at (408) 321-7093 or Robert Cunningham at (408) 321-5792 if you have any questions or would like to arrange a meeting.

Sincerely,

Chris Augenstein, AICP
Deputy Director, Planning

cc: Ying Smith, Robert Swierk, Robert Cunningham, Roy Molseed, VTA
Kevin Riley, Gloria Sciara, Debby Fernandez, Rajeev Batra, Dennis Ng, City of Santa Clara

RECEIVED
AUG 08 2014
PLANNING DIVISION

MEMORANDUM

TO: Yen Chen, Associate Planner
City of Santa Clara Planning Division

FROM: Robert Cunningham
VTA Planning and Program Development Division

DATE: August 8, 2014

SUBJECT: Notice of Preparation for Centennial Gateway Mixed-Use Project

The Santa Clara Valley Transportation Authority (VTA) has reviewed the Notice of Preparation (NOP) for the Centennial Gateway Mixed-Use Project. In addition to the key themes raised in our letter from Chris Augenstein dated August 8, 2014, we have the following specific comments based on our review.

Land Use

VTA supports the proposed land use intensification at this important site, strategically located on the regional transportation network adjacent to the Santa Clara Great America train station served by Altamont Corridor Express (ACE) and Capitol Corridor services, and within walking distance of the Great America and Lick Mill Light Rail Transit (LRT) Stations. In addition, the project is within walking distance of Levi's Stadium and the proposed City Place Santa Clara Project, offering additional opportunities for residents and employees to reduce vehicle trips and greenhouse gas emissions. Tasman Drive is identified as a Corridor in VTA's Community Design & Transportation (CDT) Program Cores, Corridors and Station Areas framework, which shows VTA and local jurisdiction priorities for supporting concentrated development in the County. The CDT Program was developed through an extensive community outreach strategy in partnership with VTA Member Agencies, and was endorsed by all 15 Santa Clara County cities and the county.

TIA Report

VTA's Congestion Management Program (CMP) requires a Transportation Impact Analysis (TIA) for any project that is expected to generate 100 or more net new peak-hour trips. Based on the information provided on the size of this project, a TIA may be required. The current March 2009 version of the *TIA Guidelines* may be downloaded from http://www.vta.org/cmp/technical-guidelines. For more information on the *TIA Guidelines*, please call Shanthi Chatradhi of the VTA Planning and Program Development Division at 408-952-4224.

Coordination with the City Place Santa Clara Project

The Centennial Gateway site is directly adjacent to the proposed City Place Santa Clara Project of up to 8.34 million square feet of office, retail, entertainment, residential and hotel uses (NOP dated July 30, 2014). The proximity and timing of the projects and location across the street from the newly-opened Levi's Stadium offers an extraordinary opportunity for the City to leverage this combined investment to offer world-class transportation options to Santa Clara's "new downtown." VTA recommends coordinated mitigation strategies such as the formation of a Transportation Management Association (TMA), transit access improvements potentially

including a new bus transfer center, contributions to additional public or private transit service in the area, and roadway mitigation measures and operational improvements. VTA also recommends that the City consider area-wide strategies to analyze and mitigate impacts in the area such as a Specific Plan, Traffic Impact Fee (TIF) Program, and/or an area-wide Multimodal Improvement Plan.

Transportation Demand Management/Trip Reduction

Given the size of the project and limited roadway access to and from the project area, the project should include a robust Transportation Demand Management (TDM) Program to reduce auto trips, vehicle miles traveled and greenhouse gas emissions. Such measures will be critical in order to facilitate efficient transportation access to and from the site and reduce transportation impacts. VTA recommends that the City consider the following TDM/Trip Reduction strategies:

- Project design to encourage walking, bicycling, and convenient transit access;
- Parking cash out/parking pricing;
- Formation of a Transportation Management Association (TMA) in partnership with City Place and other developments in the area;
- Adoption of an aggressive trip reduction target with a Lead Agency monitoring and enforcement program;
- Transit fare incentives such as such as free or discounted transit passes on a continuing basis;
- Public-private partnerships or employer contributions to provide improved transit or shuttle service in the project area.

Potential Transit Improvements

Based on the size of Centennial Gateway, City Place and other projects in the area, VTA recommends that the DEIR and TIA analyze anticipated transit demand and capacity in the project vicinity. This analysis should refer to the guidance in Chapter 12 – Special Project Types in the *VTA TIA Guidelines.*

Improvements to transit service may be necessary to accommodate the increased transit demand in the area. VTA is open to engaging in dialogue with the City about how to make transit successful in the area, as an effective measure to reduce automobile travel.. VTA recommends that the City consider project contributions to transit improvements in the project area, such as:

- Construction of a new bus transfer center within the project vicinity in coordination with VTA;
- Fencing the light rail tracks along Tasman Drive, consistent with City commitments, to enhance safety and increase speeds;
- Access improvements and double-tracking of the Santa Clara Great America ACE/Capitol Corridor train station, in coordination with Union Pacific Railroad.

VTA's *Transit Sustainability Policy & Service Design Guidelines* (TSP/SDG), adopted by the VTA Board in February 2007, contain information about ridership performance standards and land use density targets for considering potential service changes. VTA notes that any future

decision to potentially increase transit service in the area would rest with the VTA Board and would be evaluated based on sufficient transit demand among other factors.

Access to Santa Clara Great America Train Station

A site plan on the City's website shows the project's parking garage placed directly adjacent to the Santa Clara Great America train station, with minimal pedestrian features in this location (http://santaclaraca.gov/index.aspx?page=2495&recordid=62, accessed 8/6/2014). In order to foster an attractive and welcoming environment for passengers arriving to the area via the train station, including Levi's Stadium event attendees, VTA recommends that the City work with the applicant to consider modifications to this portion of the site plan.

Pedestrian and Bicycle Accommodations

VTA requests that the DEIR and TIA address Pedestrian and Bicycle Accommodations in its analysis of the transportation impacts of the project. Given the location of the project in close proximity to destinations such as Levi's Stadium and the future City Place Santa Clara Project, VTA recommends that this analysis consider the high volumes of pedestrian and bicycle trips both within and traversing the site. This analysis should refer to the guidance in Chapter 12 – Special Project Types in the *VTA TIA Guidelines*. If the analysis shows that the demand for pedestrian and bicycle travel through the area will exceed capacity, VTA recommends that the City consider measures to improve pedestrian and bicycle facilities to increase capacity and improve safety, such as providing a grade-separated bicycle/pedestrian crossing of Tasman Drive as a project feature or mitigation measure.

VTA recommends that the City work with the applicant to include exceptional pedestrian and bicycle accommodations to accommodate the expected travel demand to and from the area and reduce the automobile trips and greenhouse gas emissions associated with the project. VTA recommends, at a minimum, the inclusion of bike lanes, wide sidewalks and a buffer strip between pedestrians and automobiles with consistent street trees. Resources on quality of service, such as the Highway Capacity Manual 2010 Pedestrian and Bicycle Level of Service methodologies, indicate that such accommodations improve perceptions of comfort and safety on a roadway.

VTA supports bicycling as an important transportation mode and thus recommends inclusion of conveniently located bicycle parking for the project. Bicycle parking facilities can include bicycle lockers or secure indoor parking for all-day storage and bicycle racks for short-term parking. VTA's Bicycle Technical Guidelines provide guidance for estimating supply, siting and design for bicycle parking facilities. This document may be downloaded from http://www.vta.org/projects-and-programs/planning/bikes-bicycle-technical-guidelines-btg.

Vehicle Miles Traveled (VMT) Analysis

VTA recommends the inclusion of a vehicle miles traveled (VMT) analysis in the transportation section of the DEIR and TIA, in light of recent state legislation.

CMP Facilities

Based on the size and location of the project, there may be impacts to one or more Congestion Management Program (CMP) facilities, including freeway segments and CMP intersections. If the transportation analysis in the DEIR indicates that there will be significant impacts according to CMP standards, VTA suggests early coordination with the appropriate agencies to identify potential mitigation measures and voluntary contribution opportunities based on the transportation projects included in *Plan Bay Area* in the project vicinity.