



ALBANY - STREET LIGHTING EVALUATION

FINAL STREET LIGHTING RECOMMENDATIONS

2/29/2024

CLANTON & ASSOCIATES



LIGHTING DESIGN AND ENGINEERING

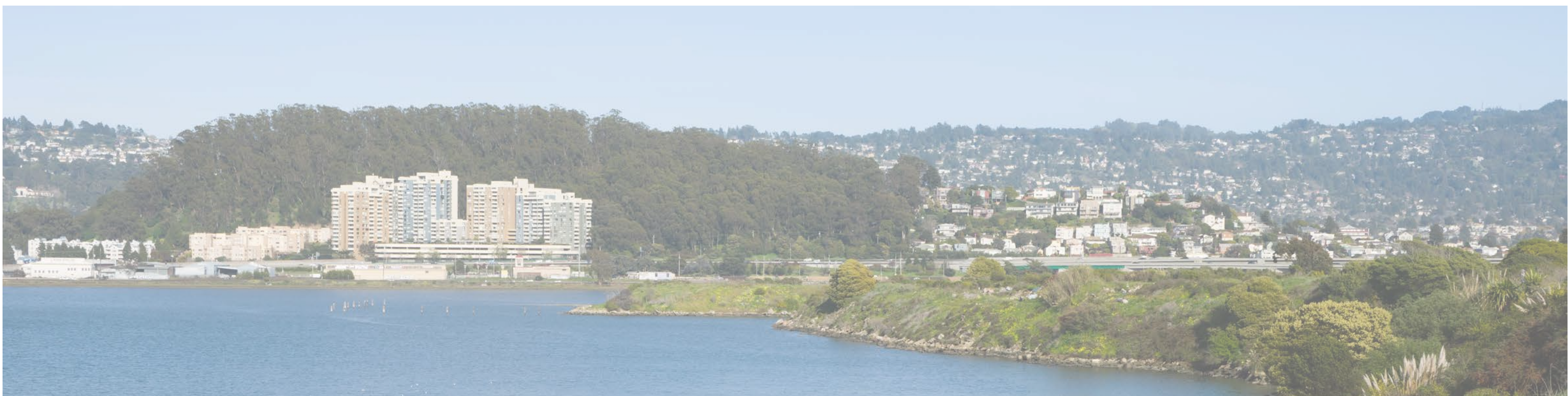
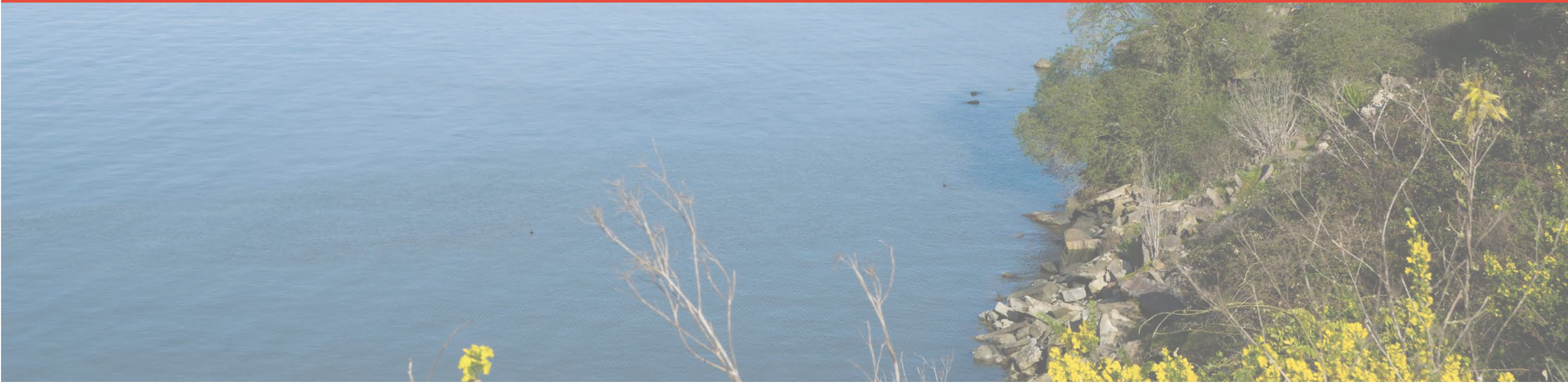


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PROJECT STRUCTURE



STREET LIGHTING IN ALBANY

The City of Albany requested an inventory and evaluation of their existing street lighting to assist them in addressing resident concerns and prioritizing lighting improvements. Every streetlight in the City has now been inventoried by EvariGIS and the data compared to Clanton & Associates evaluation of the existing lighting. A public demonstration of new street lighting options and their functions has taken place, as well as other public outreach in the form of an online survey. Reports over these events and over street lighting technologies and options suitable for Albany have been completed.

SCOPE OF THE STREET LIGHTING EVALUATION

The scope of this evaluation focused on street lighting, or other lighting meant for streets, their accompanying sidewalks, and major bikeways. It excluded exterior lighting present from private yards, building facades, or other sources. This evaluation includes the following items:

- A citywide inventory of the existing streetlights
- A photo and GIS database of the inventory for the City
- Evaluation of up to ten representative sites through measurements and photographs
- Recommendations for luminaire characteristics, light levels, and appropriate CCT's
- A lighting demonstration for public engagement
- Public feedback collected for the City in the form of surveys collected and analyzed
- Reports summarizing the results of the evaluation and any recommendations

RESULTS OF THE STREET LIGHTING EVALUATION

This report provides detailed recommendations for lighting improvements and strategies suitable for the City of Albany based upon the inventory, site observations, public feedback, and national lighting criteria published by the Illuminating Engineering Society (IES). The intention of this report is to identify the needed improvements and prioritize locations for these street lighting improvements that will have the greatest immediate positive impacts for the community, while coordinating with the City's existing budget structures.

These recommendations are intended to address the following needs:

- Safety:
 - Provide lighting to improve visibility of pedestrians & cyclists
 - Replace existing street lighting that is at its end-of-life
- Reassurance:
 - Provide sufficient light for pedestrians to see obstacles and other people
- Encourage walking & biking:
 - Support priority walkway usage with improved pedestrian scale lighting
 - Support bikeway usage with improved street & pedestrian scale lighting
- Protect human & environmental health:
 - Protect residents from light trespass into their homes
 - Use Dark Sky International's best practices for more appropriate outdoor lighting
- Enhance the Character of Albany:
 - Street and Pedestrian Lighting provides an opportunity for the City to better define the design characters and identities of their urban streetscape environments



CLANTON & ASSOCIATES TEAM IN ALBANY



CITY OF ALBANY



ALAMEDA CTC

EVARI GIS INVENTORY

The street lighting inventory was performed by teams from Evari GIS over several weeks in the summer of 2023. They collected data and photographs for every street and pedestrian light within the City of Albany, a total of 918 lights.

The following information was collected for the location of each light:

- | | | |
|----------------------|-----------------|-----------------------------|
| ■ Object ID | ■ Pole Material | ■ Link to Google Streetview |
| ■ Badge ID | ■ Pole Height | ■ Roadway Classification |
| ■ Fixture Height | ■ GPS Auditor | ■ Road Width |
| ■ Fixture Lamp Type | ■ GPS Date | ■ Pavement Type |
| ■ Fixture Wattage | ■ Notes | ■ Number of Total Lanes |
| ■ Latitude | ■ Full Photo | ■ Sidewalk |
| ■ Longitude | ■ Up Photo | ■ Bike Lane |
| ■ Mast Arm Length | ■ Badge Photo | ■ Fixture Location |
| ■ Mast Arm Direction | ■ Base Photo | |

This information was then verified and incorporated into a GIS database format that the City can utilize for deciding future changes and tracking their lighting inventory as the existing streetlights are replaced and new lights added.

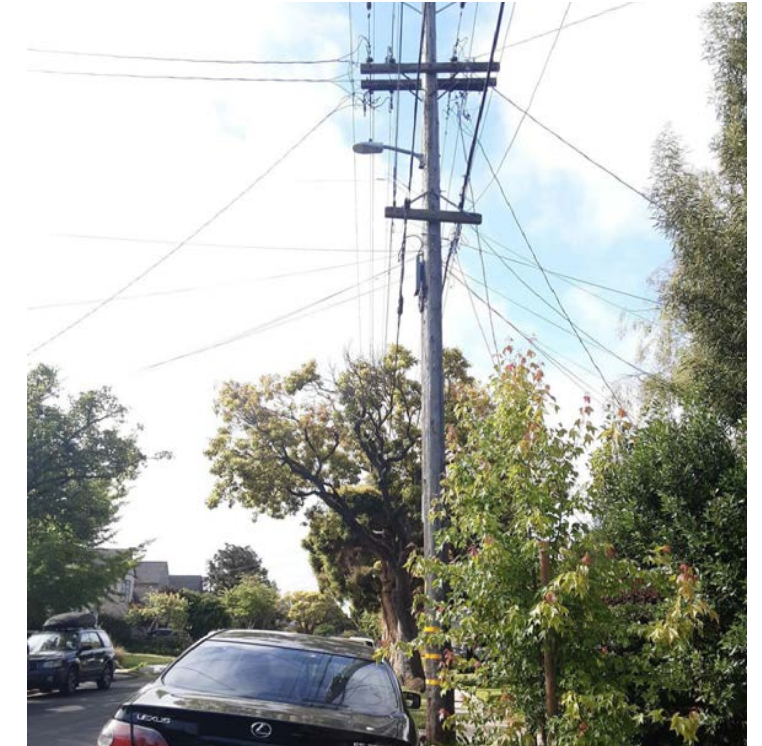
DATA MAPPING

Not only will this inventory allow the City to more easily keep track of their lighting and its maintenance needs, the data collected allowed Evari GIS and Clanton & Associates to collaborate in the development of several maps based on multiple datasets. By comparing the new streetlighting inventory to other available data like UC Berkeley’s Transportation Injury Mapping System (TIMS) database or the luminaire spacing criteria Clanton & Associate’s refined for use in Albany from standards set by the Illuminating Engineering Society (IES), valuable insights into Albany’s streetlighting were able to be communicated in more accessible formats.

These maps will continue to be a valuable resource for the City of Albany alongside the new inventory. Several are incorporated into this report.



INVENTORY PHOTO



INVENTORY PHOTO



INVENTORY TEAMS

FIGURE COUNT BY LUMINAIRE TYPE & WATTAGE MAP

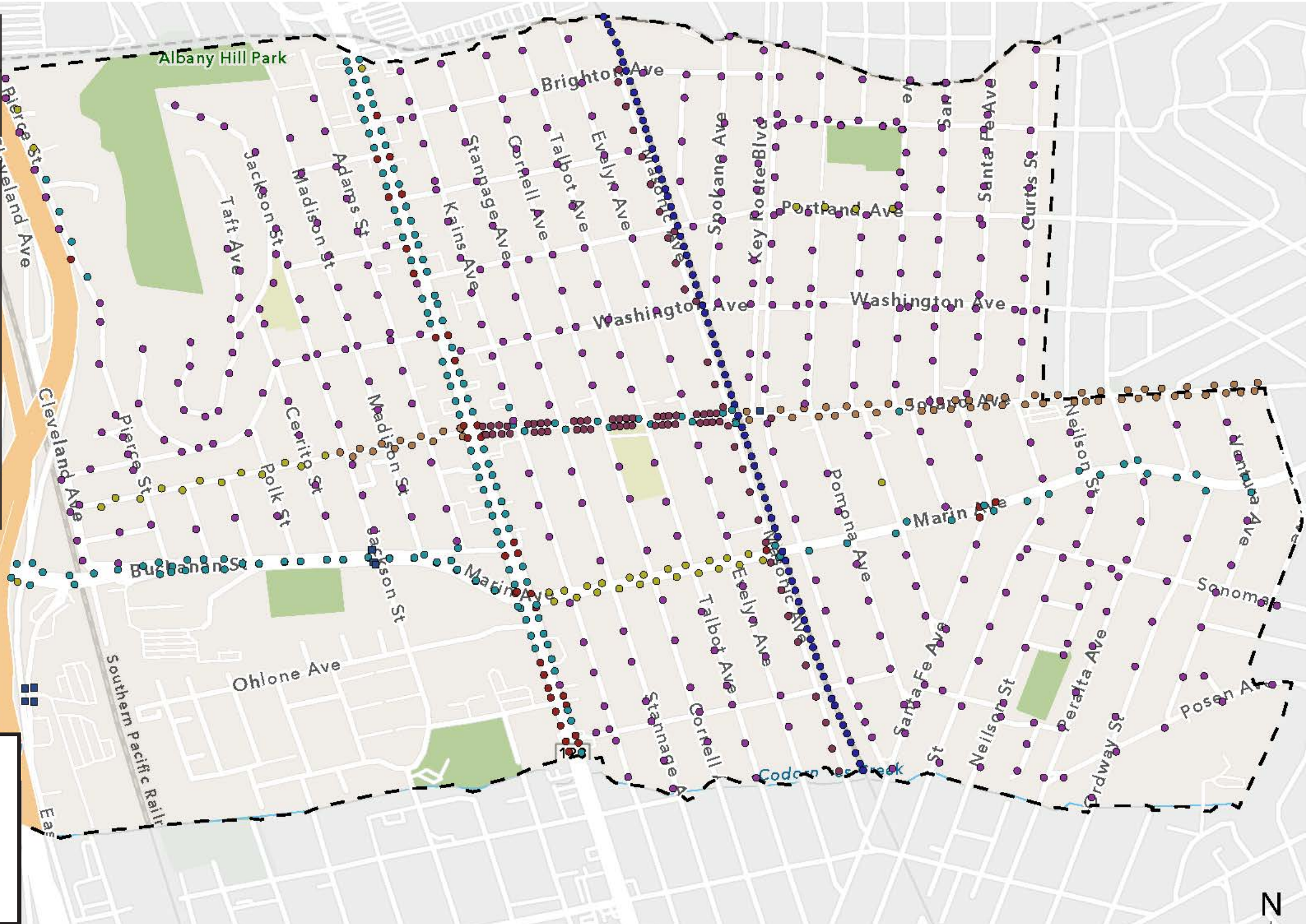


This map identifies the location, luminaire type, and wattage of every streetlight surveyed by Evari in the City of Albany. Luminaires that could not be identified by their light sources are instead listed by their forms.

The vast majority of luminaires in use in Albany are LED cobraheads. There are still some legacy light sources like HPS in a few locations and some older luminaires like the globe lights along Solano Avenue where the light sources used vary.

A total of 918 luminaires were surveyed.

- LED Cobrahead 24w - 59w (434)
- LED Cobrahead 60w - 90w (46)
- LED Cobrahead 91w - 139w (170)
- LED Cobrahead 140w - 189w (40)
- HPS Cobra Head 190w - 310w (8)
- LED Post Top 24 - 59 Watts (77)
- LED Globe 24 - 59 Watts (66)
- Canopy,LED,24 - 59 Watts (78)



IMPROVEMENT PRIORITIES

This chart shows in general the priority level and complexity of implementation of the different lighting improvement tasks recommended for the City of Albany. They are intended to help the City to identify which improvements could make the greatest impact for improved safety at night and with what resources.

The colors reflect the categories used for the recommendations on pg. 17. Priority is shown as a range from lower to higher. Complexity levels take into account the funding needed for an improvement, the amount of planning and staff time required, and the amount of lighting or streetscape design needed. These levels are:

Minimal Improvements:

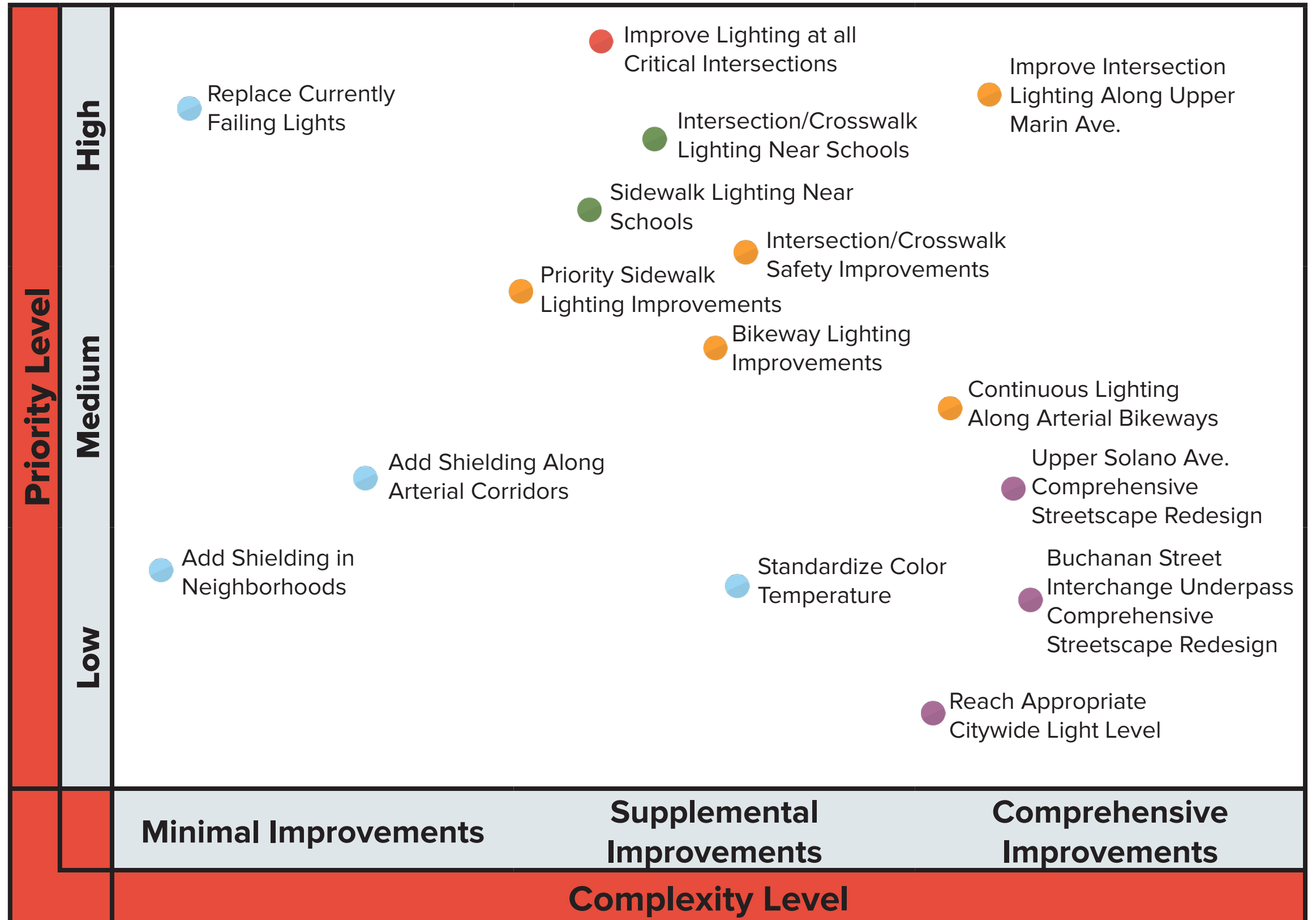
These improvements include the intersections marked as in critical need of safety updates as seen on page 17 as well as several types of modification improvements. They can mostly utilize existing funding sources with the City.

Supplemental Improvements:

These improvements include intersection and crosswalks throughout the City, as well as additional lighting around schools to create a more continuously lit environment for students and families. The funding structures for these improvements are not defined, but would generally utilize the CIP process.

Comprehensive Improvements:

These improvements include lighting redesigns to accompany larger streetscape improvement projects that are planned in Albany, adding more continuous lighting along key bike lanes and sidewalks, and the ultimate goal of reaching the appropriate light levels citywide. The funding structures for these improvements are not defined, but would generally require the funding structures for a large streetscape project and RFP's.



GLOSSARY OF LIGHTING TERMS

- **Avg:** Average Illuminance (fc) or average Luminance (cd/m²) should be within a reasonable range of the criteria being used. This is generally 10% above or below the criteria. This allows for site-driven restrictions on luminaire placement to be accommodated within the design and for a reasonable amount of non-uniformity.
- **Avg/Min:** This use the average illuminance divided by the maximum measured illuminance in an area to measure the uniformity of the lighting. It should be somewhat less than or equal to the stated criteria for any site and usage. It is not desirable for this number to exceed the criteria as excessive uniformity begins to lower contrast, making visibility worse instead of better.
- **Candela:** The SI unit for measuring luminous intensity (lumens per steradian). Typically used to measure light distribution of luminaires.
- **Color Rendering Index (CRI):** This is a metric developed using a scale of 0 to 100 to describe the ability of a light source to render an object's colors as if it were being exposed to natural daylight. A score close to 100 indicates an artificial light source is a very close match for natural light.
- **Contrast:** In lighting this is used to discuss the differences in visibility between objects and their surroundings due to the level of luminance.
 - **Positive Contrast:** The object has a higher luminance than its surroundings.
 - **Negative Contrast:** The object has a lower luminance and is seen in silhouette against its surroundings.
- **Correlated Color Temperature (CCT):** Measured in Kelvin (K). This is the color appearance of the light emitted by a lamp. The CCT rating for a lamp is a measure of the "warmth" or "coolness" of its appearance. Lower CCT (2200K) appears very warm or amber. Medium CCT (2700K – 3000K) appears "warm white". High CCT (4000K +) appears "cool white" or "blue".
- **Distribution:** The pattern of light cast upon the ground plane by a luminaire. Five distribution types are defined by the IES. Some distributions are more appropriate for use in streetlighting than others.
- **Glare:** The visual sensation created by a luminance (or brightness) that is significantly higher than the surrounding luminance level that the eyes are adapted to. This can cause annoyance and discomfort (discomfort glare), or even a decrease in someone's visual performance and visibility (disability glare).
- **Fixture Height:** Height of the light fixture shall be measured as the vertical distance from finished grade or from the nearest walking surface below the fixture up to the centerline of the luminaire.
- **Footcandles:** A unit of illuminance equal to one (1) lumen per square foot.
- **Illuminance:** Measured in Footcandles (Fc) or lux. This is the density of light that is falling onto a surface. Commonly measured in the horizontal and vertical planes.
- **Illuminating Engineering Society (IES):** The IES strives to improve the lit environment by publishing recommended practices to guide decisions made by lighting designers, architects, engineers, sales professionals, and researchers. The IES' The Lighting Handbook and Recommended Practices are the currently recognized authoritative references on the science and applications of lighting.
- **Legacy Light Source:** All non-LED light sources including incandescent, halogen, high pressure sodium, low pressure sodium, induction, and fluorescent source types.
- **Light Level:** The amount of light falling on a surface. Also defined as illuminance.
- **Light Output:** The amount of visible light coming from a luminaire. Measured in lumens.

- **Light Trespass:** This is light spilling past property lines so it falls onto adjacent properties unintentionally. This can be a neighborhood nuisance, be detrimental to privacy, and is a contributor to light pollution. Light trespass is determined by measuring illuminance in the vertical or horizontal plane. This measurement should be somewhat less than or equal to the maximum criteria.
- **Lumen:** The unit of measurement for visible light (luminous flux) emitted from a light source.
- **Luminaire:** The complete electrical light unit including the light source, housing, optics, and driver.
- **Luminance:** Measured in Candela per meter squared (cd/m²). The light source or surface brightness as it is perceived by the human eye.
- **Multiple of Criteria:** The multiple of criteria is determined by the measured average light level for an area divided by the specified lighting criteria. Since meeting the criteria exactly would result in a value of 1, an acceptable Multiple of Criteria is generally 0.8 to 1.5. Numbers falling below this range may be underlit while numbers above this range may be overlit.
- **One-for-One Replacement:** This is when existing streetlights are upgraded to newer luminaires without making any other changes to the existing lighting layout.
- **Point Light Source:** The exact place from which illumination is produced (e.g. a light bulb filament or LED package) even when behind a clear lens.
- **Watt (W):** A measurement of energy transfer over a unit of time.
- **Wayfinding:** Illuminating key locations such as entrances, architectural features, and pathways improves navigation at night for anyone unfamiliar with the area.



OHLONE GREENWAY

ALBANY LAND USE MAP

LEGEND

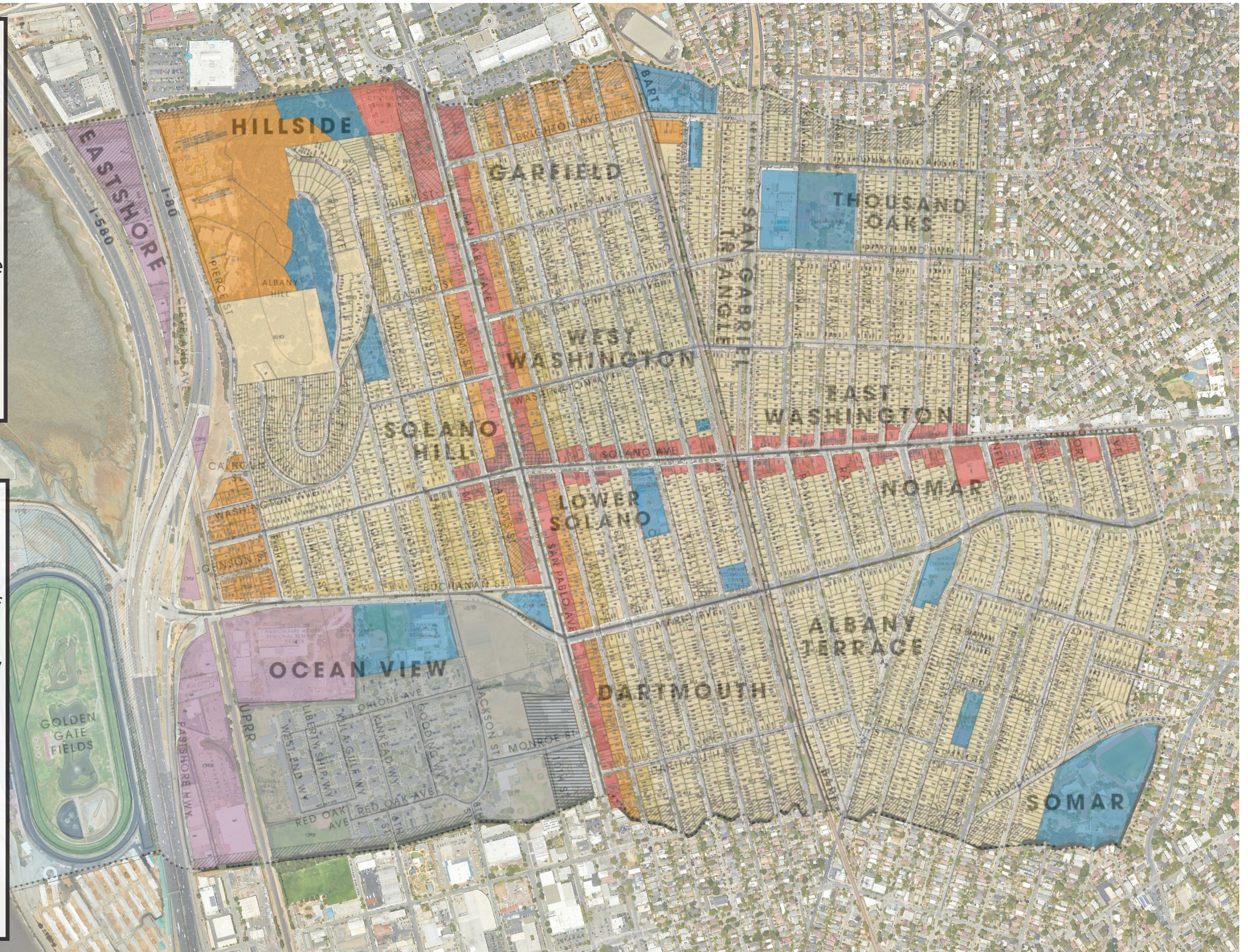
- Low Density Residential (R1 & RHD)
- Medium Density Residential (R2)
- Higher Density Residential (R3 & R4)
- Solano & San Pablo Commercial/Mixed Use
- Public Facilities & Parks
- Commercial/Mixed Use/Industrial

ROLE IN RECOMMENDATIONS

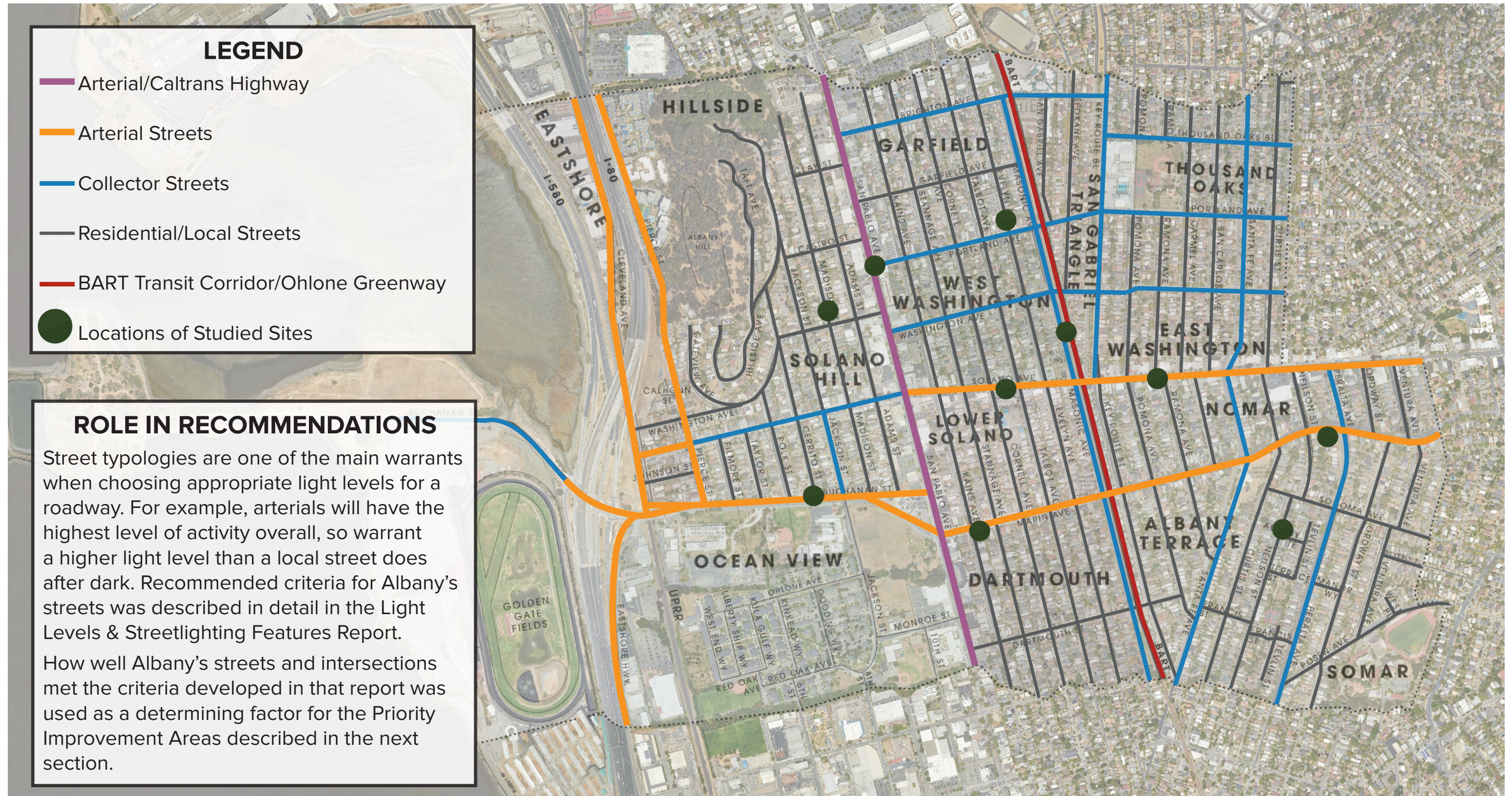
Albany's typical zoning utilizes 10 standard zones and 7 overlay zones. For land use planning it is common to have multiple types of residential zones and is sensible to group park land and public facilities since both are publicly owned.

For lighting design decisions the nighttime usage of the space takes precedence in decision making. Multiple residential zones in Albany need the same light level and parks require a different level from public facilities.

This is discussed in more detail in the Light Levels & Streetlighting Features Report.



STREET TYPOLOGY MAP



LEGEND

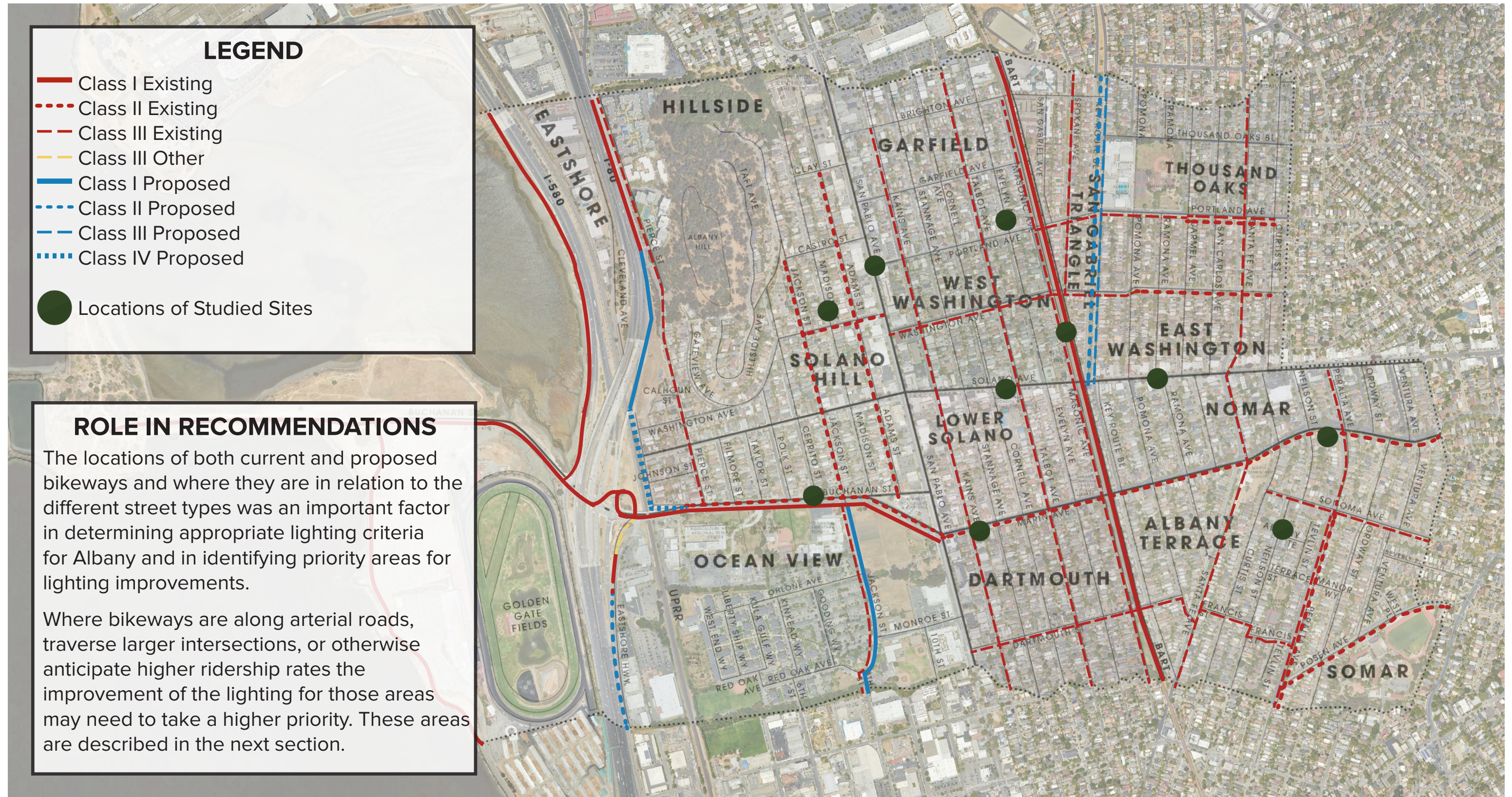
- Arterial/Caltrans Highway
- Arterial Streets
- Collector Streets
- Residential/Local Streets
- BART Transit Corridor/Ohlone Greenway
- Locations of Studied Sites

ROLE IN RECOMMENDATIONS

Street typologies are one of the main warrants when choosing appropriate light levels for a roadway. For example, arterials will have the highest level of activity overall, so warrant a higher light level than a local street does after dark. Recommended criteria for Albany's streets was described in detail in the Light Levels & Streetlighting Features Report.

How well Albany's streets and intersections met the criteria developed in that report was used as a determining factor for the Priority Improvement Areas described in the next section.

BIKEWAY TYPOLOGY MAP



LEGEND

- Class I Existing
- - - Class II Existing
- - - Class III Existing
- Class III Other
- Class I Proposed
- - - Class II Proposed
- - - Class III Proposed
- · · · · Class IV Proposed
- Locations of Studied Sites




ROLE IN RECOMMENDATIONS

The locations of both current and proposed bikeways and where they are in relation to the different street types was an important factor in determining appropriate lighting criteria for Albany and in identifying priority areas for lighting improvements.

Where bikeways are along arterial roads, traverse larger intersections, or otherwise anticipate higher ridership rates the improvement of the lighting for those areas may need to take a higher priority. These areas are described in the next section.

SIDEWALK PRIORITY MAP

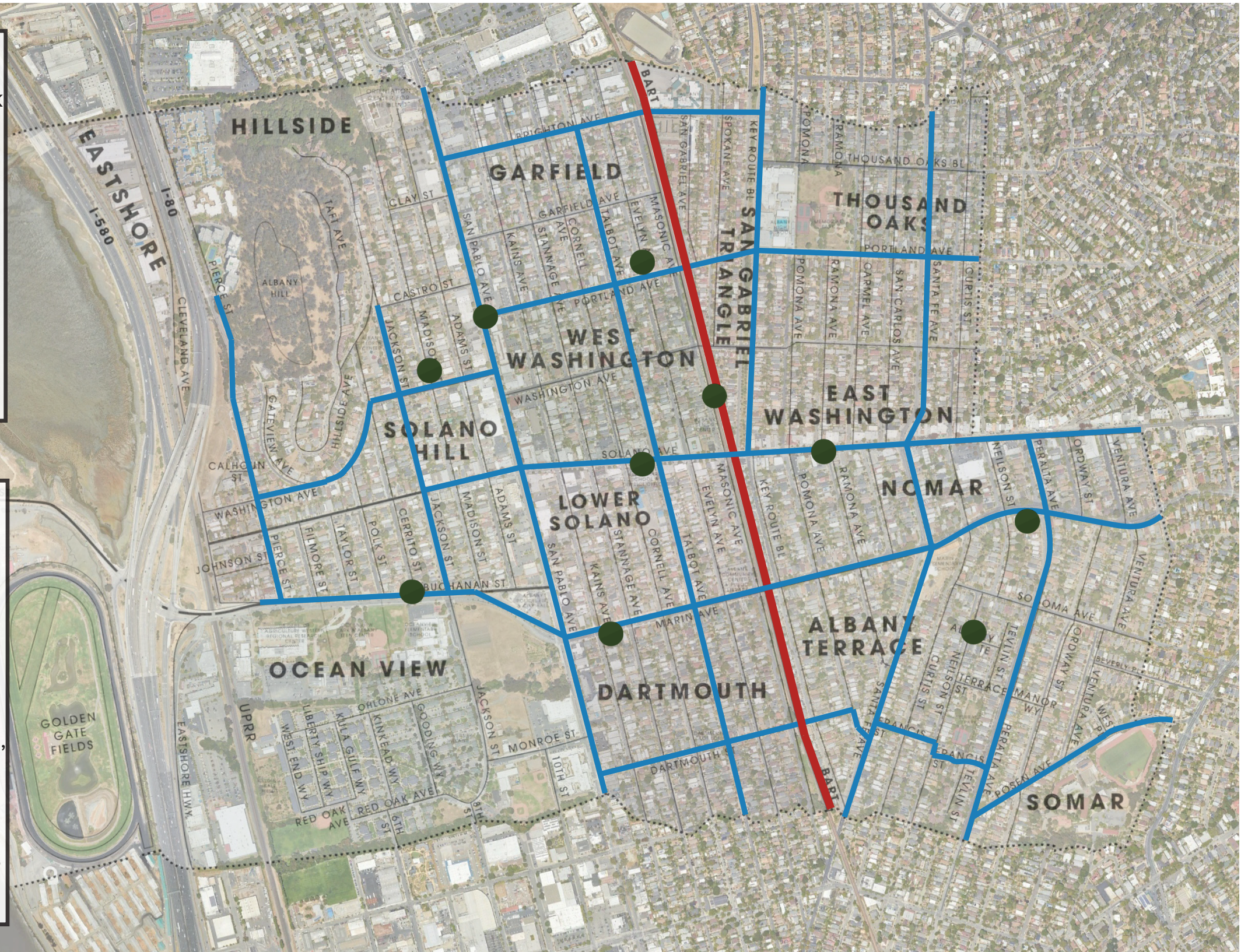
LEGEND

-  Active Transportation Plan Priority Sidewalk Network
-  BART Transit Corridor/Ohlone Greenway
-  Locations of Studied Sites


ROLE IN RECOMMENDATIONS

Albany's Priority Sidewalk Network is intended to create a network of streets safe for the majority of pedestrians to utilize to get around the City. Improving this network has also been used to help determine the priority of different areas for lighting improvements.

Where these sidewalks are along arterial roads, traverse larger intersections, or anticipate higher usage by pedestrians at night the improvement of the lighting for those areas may need to take a higher priority. These areas are described in the next section.




NON-DAYTIME 5-YEAR COLLISION HISTORY MAP (2017 - 2021)



This map utilized UC Berkeley's Transportation Injury Mapping System (TIMS) database to identify crashes that took place in Albany during the last five years. The color matrix shown below identifies what time of night the accident took place and how severe the injuries were simultaneously per location. Wherever the collisions were predominantly at night, the location has been outlined in red.

These red outlined locations occur on every street type, though the majority are along arterials. They have been analyzed by Clanton & Associates for how far they differ from recommended IES lighting criteria and the pole spacing recommendations developed for Albany. Which of these intersections are considered critical safety issues that may be improved by immediate changes to the lighting are shown on pg. 18.

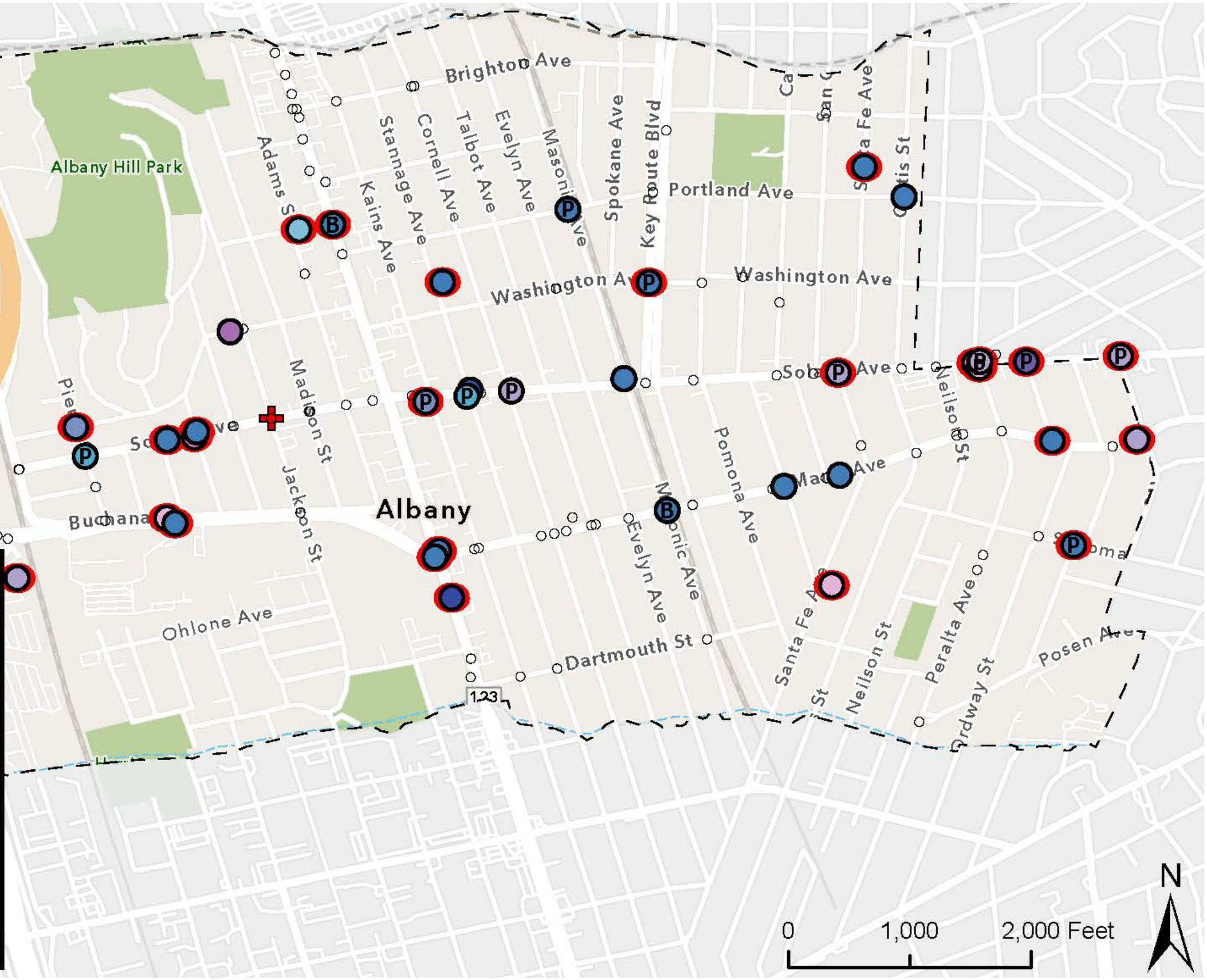


Injury Severity
Ambient Lighting

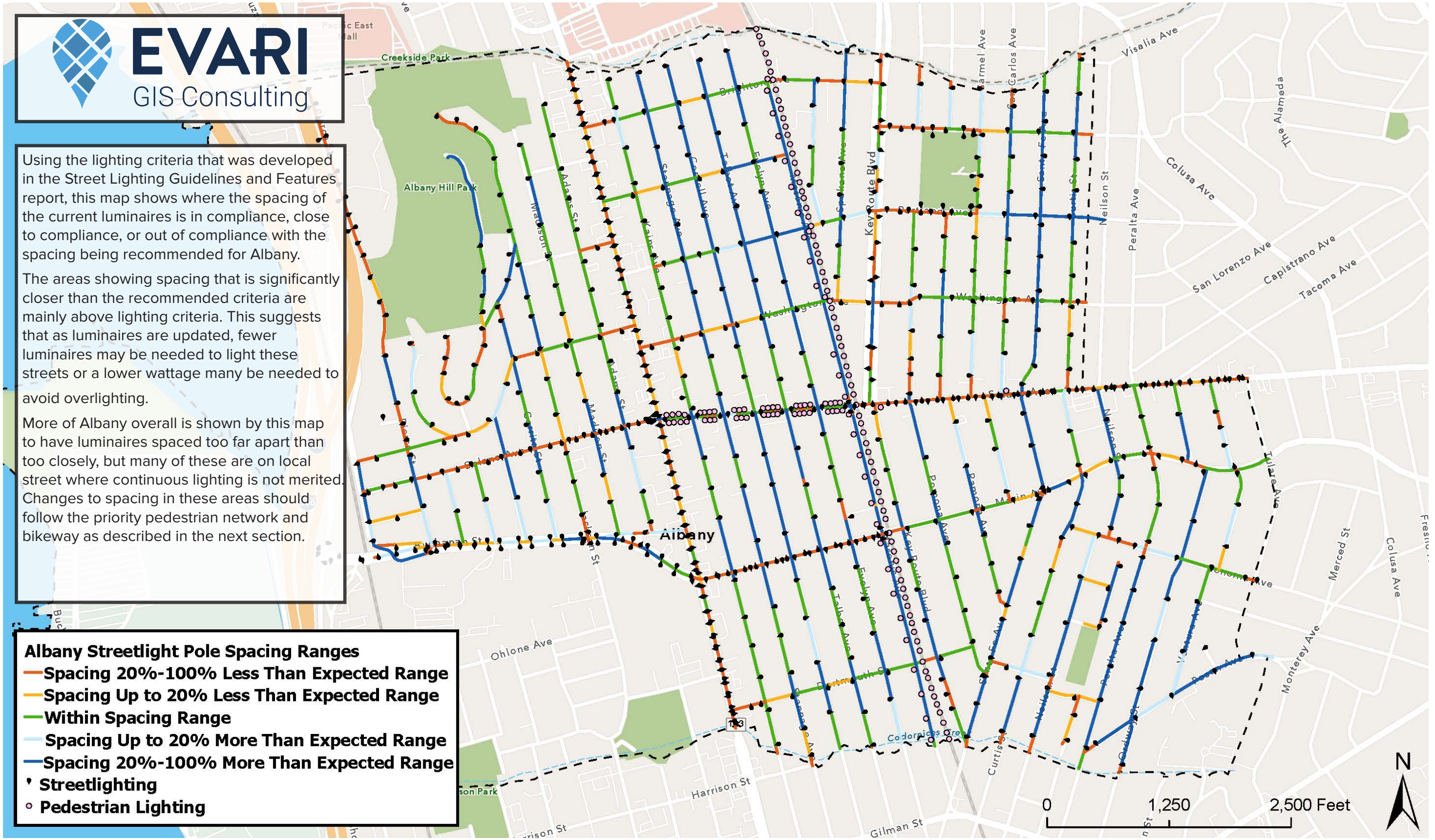
Low Fatal
 Twilight Night

P - Pedestrian-Involved
 B - Bicycle-Involved
 Other - Vehicle/Vehicle

○ Daytime Injury Collisions
 + Fatal Collisions (1 Daytime Fatal Collision)
 ○ Primarily NonDay Collision Location



LUMINAIRE SPACING COMPLIANCE MAP



Using the lighting criteria that was developed in the Street Lighting Guidelines and Features report, this map shows where the spacing of the current luminaires is in compliance, close to compliance, or out of compliance with the spacing being recommended for Albany.

The areas showing spacing that is significantly closer than the recommended criteria are mainly above lighting criteria. This suggests that as luminaires are updated, fewer luminaires may be needed to light these streets or a lower wattage may be needed to avoid overlighting.

More of Albany overall is shown by this map to have luminaires spaced too far apart than too closely, but many of these are on local street where continuous lighting is not merited. Changes to spacing in these areas should follow the priority pedestrian network and bikeway as described in the next section.

Albany Streetlight Pole Spacing Ranges

- Spacing 20%-100% Less Than Expected Range
- Spacing Up to 20% Less Than Expected Range
- Within Spacing Range
- Spacing Up to 20% More Than Expected Range
- Spacing 20%-100% More Than Expected Range
- Streetlighting
- Pedestrian Lighting





PRIORITY IMPROVEMENT AREAS

IMPROVEMENT CATEGORIES

After evaluating existing street lighting conditions in the City of Albany, and engaging residents during the Street Lighting Workshop & Demonstration, the following Street Lighting Improvements have been identified to meet the City of Albany's street lighting goals.

Replace Failing LED & Remaining HPS Street Lighting:

- The existing LED street lighting is beyond the expected end of life and is experiencing significant failures across the City of Albany. All LED and remaining HPS street lights should be replaced to improve safety and reduce energy use.
- Priority Level: High Complexity Level: Minimal Improvements
- General maintenance replacements using existing funding should be focused on critical intersections and intersections along Bikeways & Priority Sidewalks.
- Failing mid-block lighting on residential streets should be replaced following intersection improvements
- Anticipated costs are in the range of \$1,159,640 - \$1,391,568

Improve Lighting at Critical Intersections:

- Reviewing the 5-year Collision Data Map alongside the Luminaire Spacing Compliance Map helped identify the intersections where lighting is most likely to immediately improve safety.
- Priority Level: High Complexity Level: Supplemental Improvements
- Anticipated costs are in the range of \$214,000 - \$256,800

Additional Lighting Near Schools:

- With a more frequent higher level of activity after dark, schools must have adequate lighting. Adding new street or pedestrian lighting will help ensure safety around the schools.
- Priority Level: High Complexity Level: Supplemental Improvements
- Projects that require new electrical infrastructure are longer-term and will require more funding sources.
- Anticipated total costs are in the range of \$259,000 - \$310,800

Additional Lighting Along Bikeways & Priority Sidewalks:

- Installing additional street lighting along bikeways and priority sidewalks and at intersections will improve visibility and help residents feel more comfortable utilizing these areas at night.
- Priority Level: Medium Complexity Level: Supplemental Improvements
- Anticipated intersection lighting costs are in the range of \$899,000 - \$1,078,800
- Anticipated mid-block lighting costs are in the range of \$735,000 - \$882,000

Provide Shielding to Prevent Light Trespass:

- All lighting in residential and mixed-use areas should have shielding added and appropriate light distributions used to eliminate or at least limit light trespass onto private property.
- Priority Level: Medium Complexity Level: Minimal Improvements
- Anticipated costs are in the range of \$10,000 - \$12,000

Comprehensive Streetscape Design:

- Street and pedestrian lighting is the most visually prominent type of public infrastructure and is a great opportunity to add visual distinction to a City. For example, the lighting along the Solano Retail Corridor is a great opportunity to define the area and enhance its character as a regional destination.
- Priority Level: Low Complexity Level: Comprehensive Improvements
- Anticipated costs for Solano Ave (Masonic to Tulare) are in the range of \$1,822,100 - \$2,271,500
- Anticipated costs for Buchanan Street are in the range of \$282,762 - \$336,000



BUCHANAN STREET - LIGHT TRESPASS ON NORTH SIDE



LOWER MARIN AVENUE - LIGHT TRESPASS ON NORTH SIDE

PROPOSED STREET LIGHTING IMPROVEMENTS MAP



RECOMMENDATIONS FOR MODIFICATIONS - 1-FOR-1 REPLACEMENT

The existing LED street lighting is mostly at its end-of-life and is experiencing wide-spread failure of LED luminaires, both through color shifting and inoperable diodes. Replacing the existing street light luminaires on their existing poles is the most cost effective way to improve the street lighting throughout Albany. With existing poles and electrical infrastructure, costs and installation time are significantly less than adding new street light locations.

The City of Albany must replace all of the legacy LED street lights using the luminaire standards developed throughout this evaluation.

Arterial & Collector Street Priorities

- Refer to the luminaire schedule on page 29 to determine luminaire types
- Refer to the Street Lighting Guidelines and Features report for additional details
- Shielding to be added when these streets are located in low-density residential areas

Local Residential Streets

- Refer to the luminaire schedule on page 29 to determine luminaire types
- Refer to the Street Lighting Guidelines and Features report for additional details
- Provide 80° Shield and House-Side Shield in low-density residential areas.
- Evaluate light trespass patterns in high-density residential areas to determine if shielding is beneficial.



PRIORITIZED MODIFICATION LOCATIONS

Modifications of Existing Luminaires - 1-for-1 Replacement					
Luminaire Type	Luminaire Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
S4	325	\$292,500	-	\$8,775	\$301,275
S3	38	\$34,200	-	\$1,026	\$35,226
S2	18	\$16,200	-	\$486	\$16,686
S3	38	\$34,200	-	\$1,026	\$35,226
S2	18	\$16,200	-	\$486	\$16,686
S1	140	\$157,500	-	\$4,725	\$162,225
S1	20	\$22,500	-	\$675	\$23,175
S1	20	\$22,500	-	\$675	\$23,175

This table shows an excerpt of the estimated total cost for this upgrade in the mapped locations. This total cost is a summation of the luminaire costs and the lighting design costs for the labor needed to install all of the new luminaires in these priority areas. Please refer to page 35 in the Appendix for the full table for this category.

PROJECTED TOTAL 1-FOR-1 COSTS: **\$1,159,640 - \$1,391,568**



LEOTEK COMFORT VIEW (HSS)



SIGNIFY PURE FORM

CRITICAL SAFETY RECOMMENDATIONS

The critical safety issue locations were selected from those intersections identified in the Non-Daytime 5-Year Collision History map. These locations were identified as critical for street lighting improvements based on their increased level of vehicle-to-pedestrian and vehicle-to-bike collisions at night, and by their lack of existing lighting that meets the recommended intersection lighting criteria and luminaire layouts from this evaluation.

The characteristics of these critical locations are:

Solano Ave & Kains Ave:

- Arterial / Local - SC Solano Commercial
- ACTC Near Term Projects coordination

Solano Ave & Santa Fe Ave:

- Arterial / Collector - SC Solano Commercial
- Existing Electrical System

Solano Ave & Peralta Ave:

- Arterial / Collector - SC Solano Commercial
- Some New Underground Electrical Required

Solano Ave & Ordway St:

- Arterial / Local - SC Solano Commercial
- Some New Underground Electrical Required

Solano Ave & Tulare Ave:

- Arterial / Local - SC Solano Commercial
- Some New Underground Electrical Required

Sonoma Ave & Ventura Ave:

- Local / Local - R1 Residential Low
- High Priority Residential Intersection

Washington Ave & Key Route Blvd:

- Collector / Collector - R1 Residential Low
- High Priority Residential Intersection

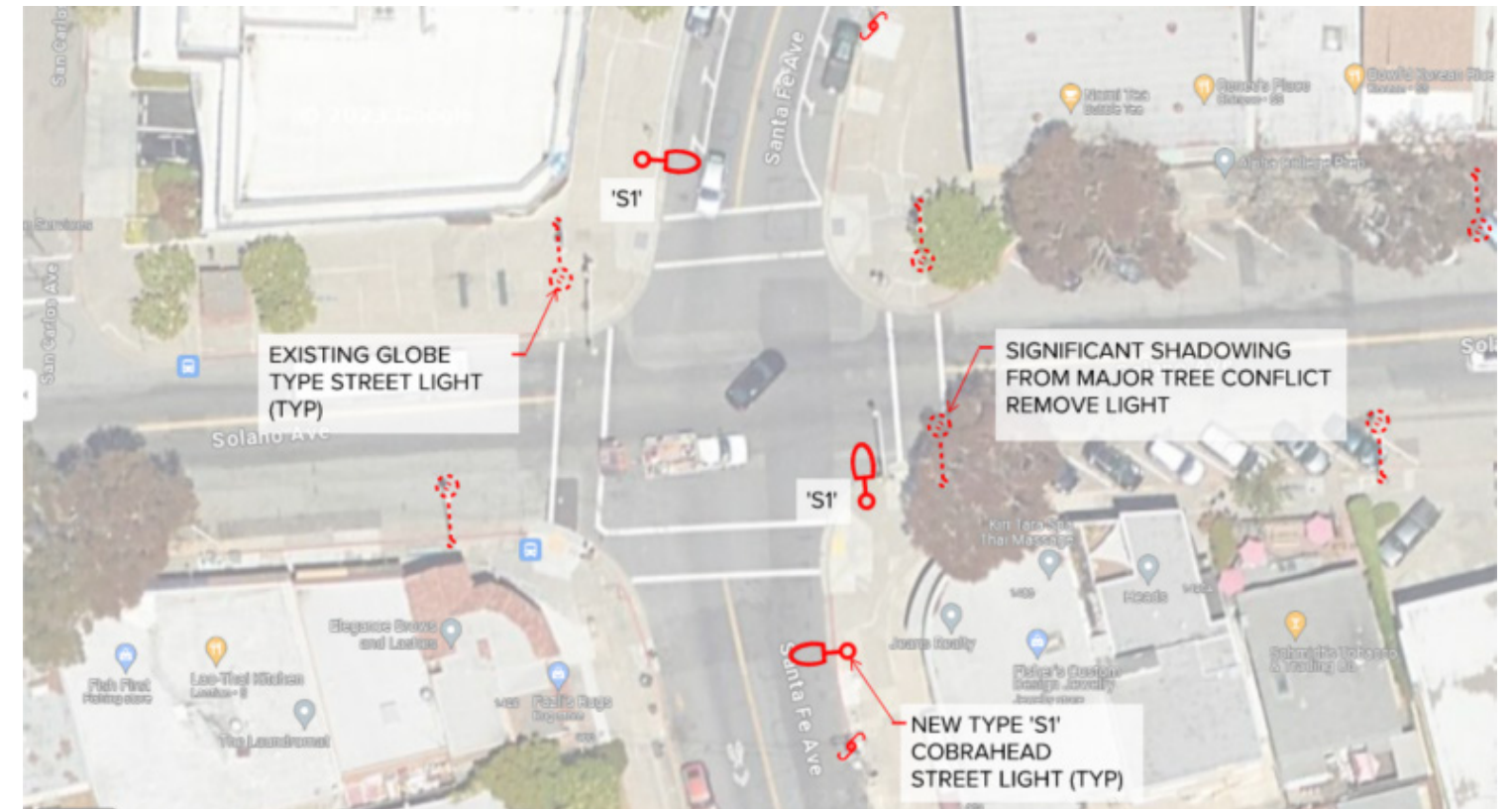


CRITICAL SAFETY LOCATIONS

Critical Safety Locations						
Location	Luminaire Quantity	Pole Quantity	Luminaire & Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Solano Ave & Kains Ave	3	3	\$34,125	\$16,537	\$5,066	\$55,728
Solano Ave & Santa Fe Ave	2	0	\$1,750	\$2,794	\$454	\$4,999
Solano Ave & Peralta Ave	2	2	\$22,750	\$7,146	\$2,990	\$32,886
Solano Ave & Ordway St	2	2	\$22,750	\$3,170	\$2,592	\$28,512
Solano Ave & Tulare Ave	1	1	\$11,375	\$1,492	\$1,287	\$14,154
Sonoma Ave & Ventura Ave	2	1	\$12,250	\$3,262	\$1,551	\$17,063
Washington Ave & Key Route Blvd	4	3	\$35,000	\$19,810	\$5,481	\$60,291

This table shows the estimated total lighting & electrical cost to upgrade the mapped locations. This total cost is a summation of the costs for luminaire and pole, electrical, and lighting design. It excludes costs for civil design, hardscape, and landscaping impacted by the work. The luminaire and pole costs were determined analyzing the roadways adjacent to these areas to identify the needed improvements. The electrical costs include copper wiring as well as trenched and bored conduit where wiring is underground. Please refer to page 30 in the Appendix for additional information.

PROJECTED TOTAL CATEGORY COSTS: **\$214,000 - \$256,800**



SOLANO AVE & SANTA FE AVE: CONCEPTUAL IMPROVEMENTS

RECOMMENDATIONS FOR LOCATIONS NEAR SCHOOLS

The areas around neighborhood schools often have higher levels of pedestrian traffic in the mornings, evenings, and whenever there are nighttime school events. In order to support this activity level and to support the efforts of the Safe Routes to School program, additional lighting is being recommended as the standard for these areas compared to other residential areas. Several locations that will need improvements to meet this standard are shown in the map to the right.

Among these recommendations, the two intersections selected for additional lighting are the higher safety priority in order to provide excellent visibility for crosswalks being used by students. Additional lighting along streets near schools is also important to improve the visibility for sidewalks providing access to schools for class days or nighttime events.

Since residential properties are typically adjacent to schools, additional considerations should be given to controlling light trespass, dimming or turning lights off when no night events are occurring, and utilizing pedestrian scale lights where appropriate in these areas in order to avoid any nuisance to residents from this street lighting.

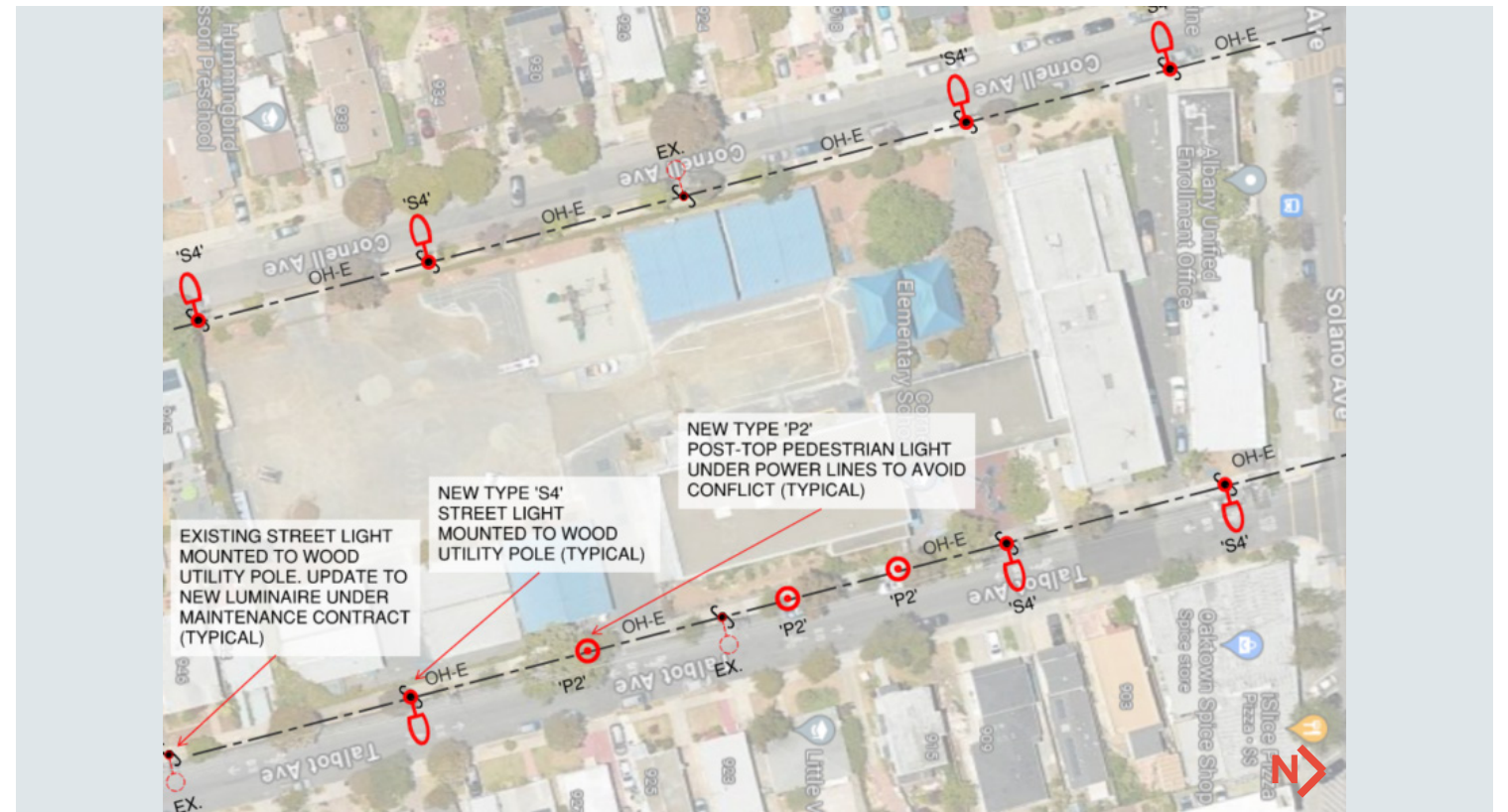


AREAS NEAR SCHOOLS

Lighting Improvements Near Schools						
Location	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
San Gabriel Ave: Near Middle School Annex	5	5	\$40,250	\$40,000	\$8,025	\$88,275
Santa Fe Ave: Marin Ave to Ramona Ave	3	0	\$2,100	\$27,944	\$3,004	\$33,048
Jackson St: Hillside Ave to Gateway Ave	2	0	\$1,400	\$39,620	\$4,102	\$45,122
Cornell Ave: Solano Ave to Marin Ave	4	0	\$2,800	\$10,000	\$1,280	\$14,080

This table shows an excerpt of the estimated total cost to upgrade the mapped locations. This total cost is a summation of the costs for luminaire and pole, electrical, and lighting design. It excludes costs for civil design, hardscape, and landscaping impacted by the work. The luminaire and pole costs were determined analyzing the roadways adjacent to these areas to identify the needed improvements. The electrical costs include copper wiring as well as trenched and bored conduit where wiring is underground. Please refer to page 33 in the Appendix for the full table.

PROJECTED TOTAL CATEGORY COSTS: **\$259,000 - \$310,800**



CORNELL ELEMENTARY SCHOOL: CONCEPTUAL IMPROVEMENTS

RECOMMENDATIONS FOR BIKEWAYS & SIDEWALKS

Quality lighting along on-street bikeways and priority walkways helps encourage recreation and commuting by bicycle and on foot year round. It also improves the visibility of pedestrians and cyclists to drivers, which helps reduce collisions and improve everyone’s comfort. The locations recommended for lighting improvements in this evaluation focus on the City of Albany’s Bikeways and Priority Sidewalk Network.

Some areas of this network like Upper Marin have large trees that create shadowing from taller street lights. Pedestrian scale lights (12-ft to 14-ft tall poles) would provide better quality lighting to cyclists and pedestrians with fewer shadowing issues as the light would remain under the tree canopy.

Other areas that are bikeway improvement priorities are:

- Upper Marin Ave
- Masonic Ave
- Talbot Ave
- Kains Ave
- Pierce St
- Adams St
- Jackson St
- Portland Ave
- Washington Ave
- Dartmouth St
- Santa Fe Ave
- Peralta Ave
- Sonoma Ave
- Francis
- Posen Ave

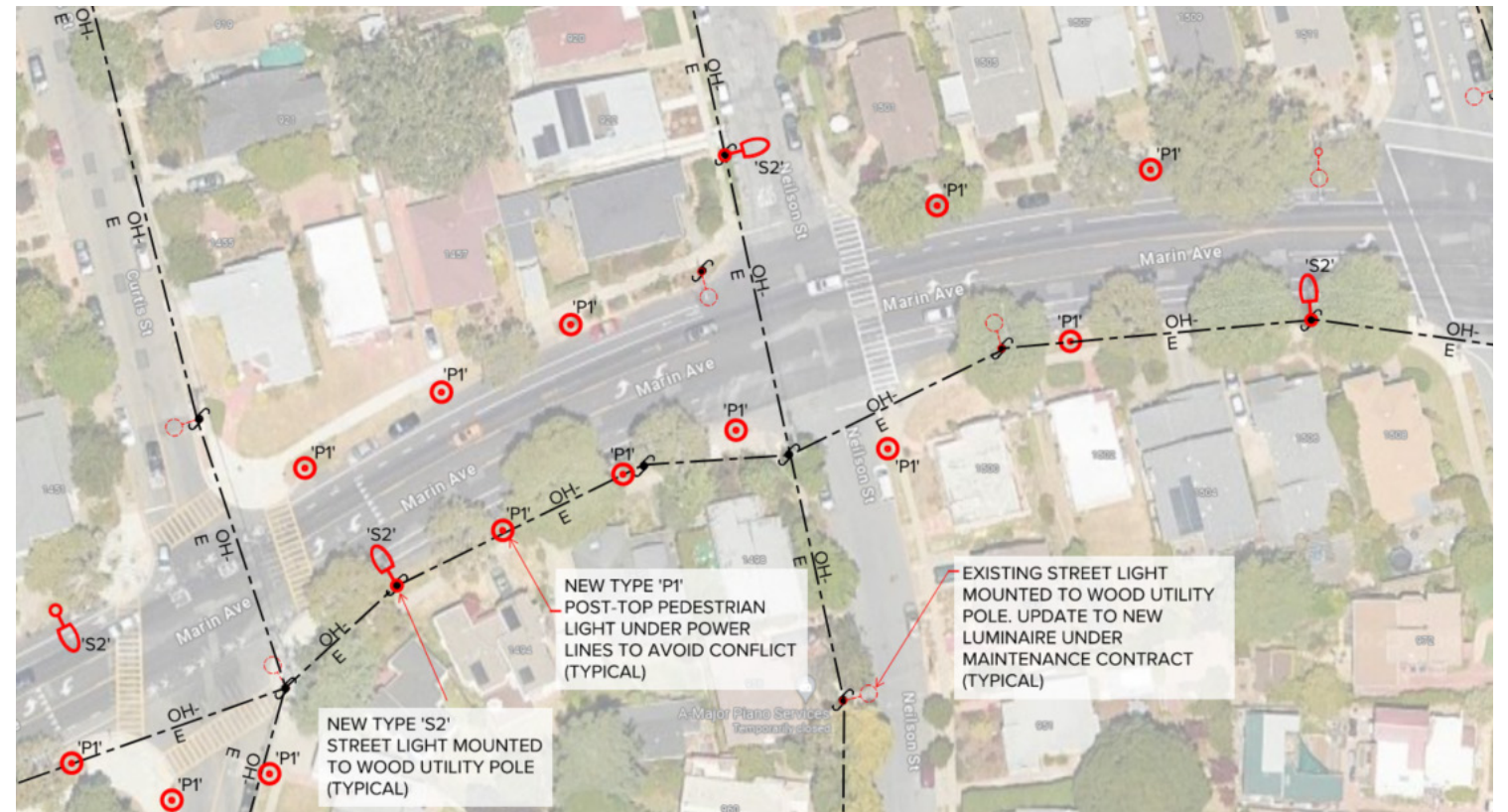


LOCATIONS ALONG BIKEWAYS & SIDEWALKS

Bikeway/Priority Walkway Intersection Lighting						
Location	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Pierce St & Washington Ave	1	0	\$700	\$4,547	\$525	\$5,771
Adams St & Clay St	1	1	\$11,200	\$4,910	\$1,611	\$17,721
Adams St & Castro St	1	0	\$700	\$3,092	\$379	\$4,171
Adams St & Washington Ave	1	1	\$11,200	\$5,970	\$1,717	\$18,887
Kains Ave & Brighton Ave	1	1	\$11,200	\$3,731	\$1,493	\$16,424
Kains Ave & Garfield Ave	1	1	\$11,200	\$3,031	\$1,423	\$15,654

This table shows an excerpt of the estimated total cost to upgrade the mapped locations. This total cost is a summation of the costs for luminaire and pole, electrical, and lighting design. It excludes costs for civil design, hardscape, and landscaping impacted by the work. The luminaire and pole costs were determined analyzing the roadways adjacent to these areas to identify the needed improvements. The electrical costs include copper wiring as well as trenched and bored conduit where wiring is underground. Please refer to page 31 in the Appendix for the full table.

PROJECTED TOTAL INTERSECTIONS COSTS: **\$899,000 - \$1,078,800**
 PROJECTED TOTAL MID-BLOCK COSTS: **\$735,000 - \$ 882,000**



UPPER MARIN AVE: CONCEPTUAL IMPROVEMENTS

RECOMMENDATIONS FOR MODIFICATIONS - ADDITIONAL SHIELDING

There are many opportunities for Albany to add shielding to existing luminaires to improve their performance for the community by reducing light trespass. While shielding for legacy luminaires was often bulky and noticeable, new LED shields are inconspicuous and easy to install. Two of these shielding types are shown below and both were used during the public lighting demonstration in September 2023.

Light trespass from street lighting into homes must be mitigated to reduce residents' exposure to artificial light at night. This reduces annoyance and sleep disruption that can result in long term health implications. Using the appropriate light distribution for a site and aiming light only where needed addresses much of this, but adding shielding can compensate whenever there is still a trespass issue. Albany's narrow streets makes light trespass from street lighting into homes a noticeable issue in many areas. The improvements for two corridors where this was a major concern are described below.

Buchanan Street:

The homes on the North side of Buchanan Street are currently exposed to excessive levels of light trespass. These street lights are older and ready to be replaced according to the Street Lighting Guidelines & Features report. The following recommendations apply:

- Replace LED street lights on Buchanan according to the Street Lighting Guidelines & Features.
- Add 80° Shield & Front-Side Shield to the street lights on the North side only to reduce light trespass onto residential properties.
- Do not add shielding on the South side, where the spill light is illuminating the Class I Bikeway.

Lower Marin Avenue:

The street lighting measurements here (from San Pablo Ave to Masonic Ave) show that the light trespass at the front property line is higher than recommended levels for single and multi-family housing. However, some of the spill light is currently illuminating some stairs and shared private walkways for multi-family housing and may be contributing to residents safely navigating the area. Single-family residents and multi-family residents may have different opinions and needs for shielding in this area. The following recommendations apply:

- Perform a mock-up of the 80° Shields to determine if the reduced glare is effective, without reducing light levels in areas where the light is beneficial.
- Discrete use of House-Side, or Front-Side Shields should be applied as needed, where light trespass is offensive to the adjacent properties.

Modification of Existing Luminaires - Add Shielding			
Location	Luminaire Quantity	Pole Quantity	Total Cost
Buchanan St: San Pablo Ave to Cleveland Ave	18	-	\$4,500
Marin Ave: San Pablo Ave to Masonic	22	-	\$5,500

This table shows the estimated total cost for this upgrade in the mapped locations. This total cost is a summation of the material costs and the design costs for the labor needed to install all of the new shields in these priority areas. Please refer to page 34 in the Appendix for the full table for this category.

PROJECTED COSTS RANGE:

\$10,000 - \$12,000



PRIORITIZED MODIFICATION LOCATIONS

House Side Shield (HSSCV)



LED HOUSE-SIDE SHIELD

80 Degree Cutoff Shield (VHCS)



LED 80° SHIELD

RECOMMENDATIONS FOR COMPREHENSIVE STREETScape REDESIGN

Two potential comprehensive lighting improvement projects have been identified as ideal to be included with potential future comprehensive streetscape redesign projects in the City. These locations have significant potential for a multifaceted lighting design including street lighting, pedestrian scale lighting, and other lighting features to enhance and add value to their use by the community and the region.

These projects would require the input of a full design and engineering team to determine their actual design and budgetary needs at the time of the project, but an initial concept of the lighting and electrical component for this type of project have been included below.

Solano Ave - Masonic Ave to Tulare Ave

Solano Avenue is a regional destination street for the City of Albany’s residents and visitors to access mixed-use retail shopping, cafes, restaurants, commercial services, and contains some high-density residential. As the historic downtown for Albany, this street often hosts public events including events for the holidays. The street and pedestrian lighting along Solano Ave is an opportunity to highlight the character of the City and better support public events and holiday decorations by providing additional access to power that can be integrated into the light poles.

The lighting should be fully integrated with landscape and hardscape features, while still providing for safe and comfortable visibility throughout the corridor, especially at intersections and crosswalks. It could also consider the integration of other technology such as speakers, security cameras, motion detection, 5G small cell, wifi, static and animated digital signage, and EV charging.

Approximate Quantity:

- (3,250) Linear Feet of Streetscape w/ new below-grade electric service
- (2) Signalized Intersections at Masonic Ave & Santa Fe Ave
- (10) Non-Signalized Intersections
- (28) Type ‘SG1’ Intersection Light Poles @ \$12,000 - \$15,000 per pole, including electrical & installation
- (130) Type ‘P1’ Pedestrian Light Poles @ \$10,000 - \$12,000 per pole, including electrical & installation
- (130) Power Receptacles for Holiday Lighting & Events, 6 sockets per block, (58,500-ft) #6 CU wire = \$75,000
- Civil engineering, landscape, and hardscape design costs are not included. Additional technology and EV charging is also not included.

Buchanan St - Eastshore Highway & Under I-80/I-580

There is currently little to no lighting along the bikeway and multi-use trail adjacent to Buchanan Street, mainly under I-80 & I-580. This is a major crossing for the community and visitors to reach the Albany Bulb and its various activities. New pedestrian scale lighting is recommended along this segment of Class I Bikeway to provide for improved visibility and safety in this area and enhance its character.

Approximate Quantity:

- (1,000) Linear Feet of Trail w/ new below-grade electric service
- (20) Type ‘P1’ Pedestrian Light Poles @ \$10,000 - \$12,000 per pole, including electrical & installation
- Civil engineering, landscape, and hardscape design costs are not included.



STREETScape REDESIGN LOCATIONS

Comprehensive Streetscape Design					
Location	Luminaire Types	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Cost
Buchanan St & Trail: Pierce St through I-80/580 Interchange	S2	\$2,800	\$254,257	\$25,706	\$282,762
Solano Ave: Masonic Ave to Tulare Ave	S2, S1	\$990,000	\$1,075,000	\$206,500	\$2,271,500

This table shows the estimated total cost to upgrade the mapped locations. This total cost is a summation of the costs for luminaire and pole, electrical, and lighting design. It excludes costs for civil design, hardscape, and landscaping impacted by the work. The luminaire and pole costs were determined analyzing the roadways adjacent to these areas to identify the needed improvements. The electrical costs include copper wiring as well as trenched and bored conduit where wiring is underground. Please refer to page 35 in the Appendix for the additional information for this category.

PROJECTED SOLANO AVE COSTS RANGE: **\$1,822,100 - \$2,271,500**

PROJECTED BUCHANAN ST COSTS RANGE: **\$282,762 - \$336,000**



ADDITIONAL RECOMMENDATIONS



RESPONSIBLE LIGHTING AT NIGHT

The Bay Area is a regional hotspot for light pollution in California. Light pollution typically comes from light being emitted or reflected upward excessively. This could be due to poorly shielded luminaires, poorly aimed luminaires, or the use of excessive lumen outputs. Outdoor light sources with higher CCT's exacerbate the issue as they generally contain greater amounts of blue spectrum light, which scatters further in the atmosphere.

Another form of light pollution is light trespass. Light trespass is commonly discussed as a neighborhood nuisance and is defined as stray light crossing a property boundary where it then often enters windows. Annoying light from a neighboring property is a familiar complaint in cities. However overlighting and light trespass from outdoor lighting which enters indoor spaces at night can have measurable impacts on the stress levels and sleep quality of a community. While people can control the lights in their indoor environment, it's important that the potential glare and light trespass from outdoor luminaires that residents cannot control be minimized through design standards for everyone's health.

Lighting responsibly includes using the appropriate CCT, light distribution, shielding for luminaires when needed, using no more light than is needed for the type of street, and keeping that light on the streets, bikeways, and sidewalks. The information needed to light Albany responsibly is contained in this document and in the Light Levels & Streetlighting Features Report.



BUCHANAN STREET - LIGHT TRESPASS ON NORTH SIDE



SKYGLOW IN ALBANY



LOWER MARIN AVENUE - LIGHT TRESPASS ONTO RESIDENCES

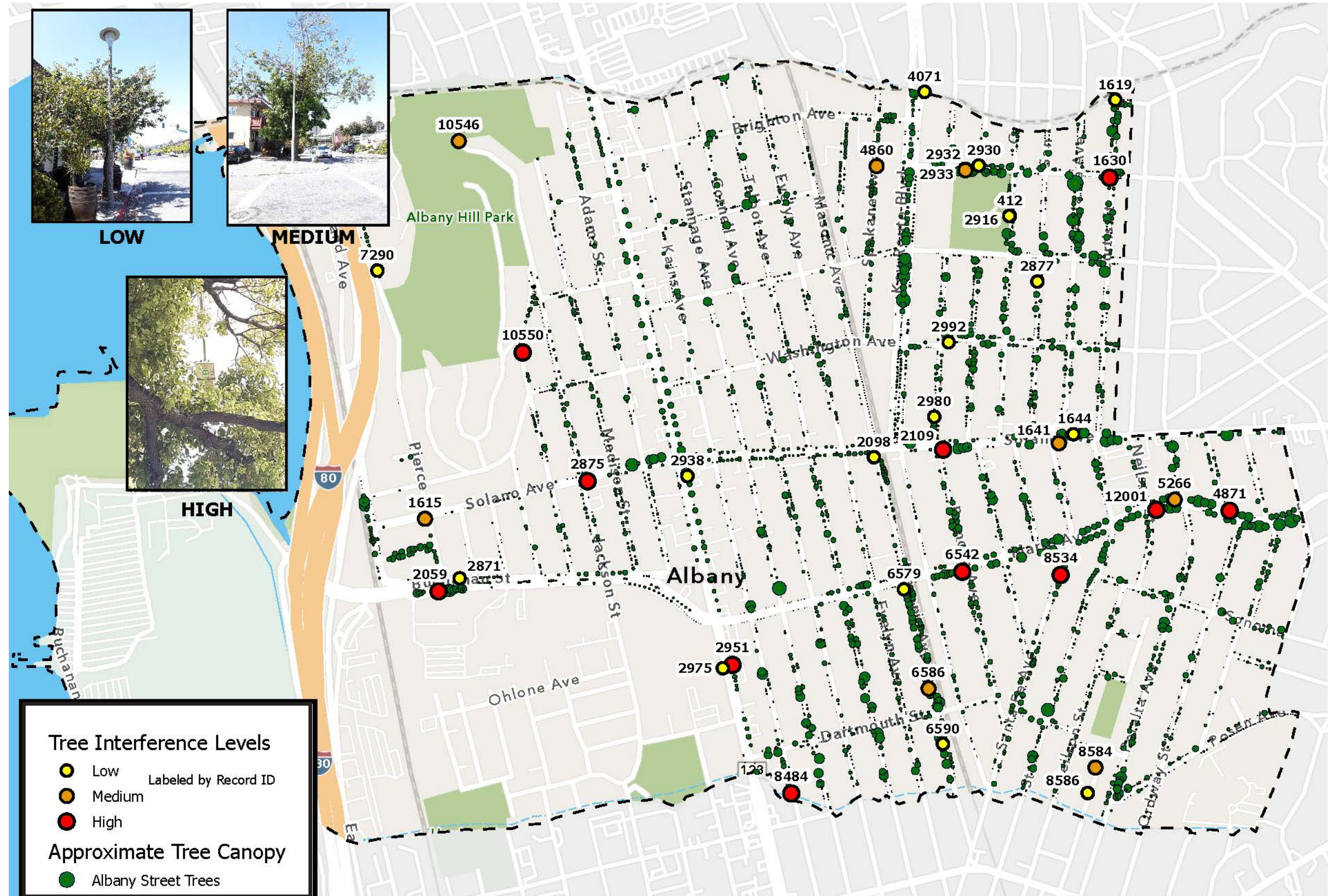
TREE INTERFERENCE



A point of concern in Albany is the limited amount of ROW available to accommodate street trees, sidewalks, and streetlighting. Albany's existing tree canopy is shown in green. Some of these trees are nearing the end of their natural life span. Albany's narrow ROW spaces make it difficult to accommodate trees that are large when fully grown, however tree canopy is a crucial component of managing urban heat islands.

This map indicates which of the luminaires surveyed by EvariGIS were having their light output interfered with by existing street trees. A total of 35 luminaires were identified as having some level of tree interference. This is a small number of the City's total luminaires, but of these 35 luminaires 11 have very high interference from nearby trees. Low or medium levels of interference can likely be addressed through pruning by an arborist. For high levels of interference it may be preferable to relocate the luminaire. Pruning in these cases is likely to be damaging to the look and health of the tree.

Tree and luminaire conflict can be avoided by ensuring landscape architects and lighting designers are able to coordinate when plans are developed, by choosing tree species that remain below the mounted level of the streetlights at full maturity and are spaced properly, or by using pedestrian lighting to keep light below the canopy of large trees. Tree shadowing should be evaluated as part of any lighting improvement.



CORRELATED COLOR TEMPERATURES

The Correlated Color Temperature (CCT) rating system is a metric used in the lighting industry to describe how “warm” or “cool” a light source appears to be to the human eye. In reality, the “warmer” colors of light have lower temperatures than “cooler” ones as measured in degrees Kelvin. Standardizing the CCT used in a City by street type or land use can help the outdoor lighting look more consistent, be less distracting, and ensure the light is appropriate for the needs of the location. These CCT’s are:

- 2200K - This CCT is often encouraged near ecologically sensitive areas such as natural parks, waterways, or coastlines.
- 2700K - This CCT is being pursued as the standard outdoor lighting CCT by California. It is now a standard offering by many manufacturers.
- 3000K - This CCT has become a standard maximum temperature for most outdoor lighting. It’s often referred to as warm white.
- 3500K - This CCT is less standard for outdoor use but is available. Sometimes individuals struggle to distinguish it from a 3000K light temperature.
- 4000K - This CCT was standard when LED technology was new but is no longer recommended as a default outdoor CCT.

Some areas of Albany are currently using light sources with a CCT of 5000K outdoors, which is not appropriate for outdoor use, especially when near residential areas. Some areas still have legacy light sources like HPS in use, which has a CCT closer to 1600K. Some poles currently have different CCT’s in use on the same block. Another issue is many luminaires in the City that have passed their end-of-life have color-shifted and are putting out light that is visibly greenish and off-putting to residents.

During the Street Lighting Demonstration that took place September 19th, the community generally preferred a “warmer” CCT to a “cooler” light source. Between this feedback and California’s efforts to standardize at 2700K, it’s recommended Albany replaces their degraded and higher-CCT light sources with 2700K.



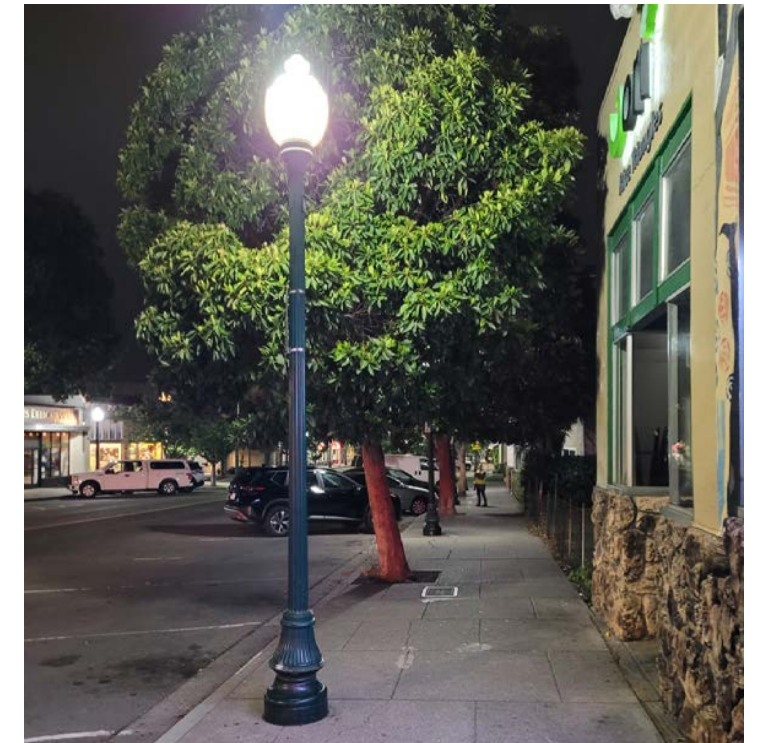
DIFFERENT CCT’S ON ONE POLE



CCT EXAMPLES



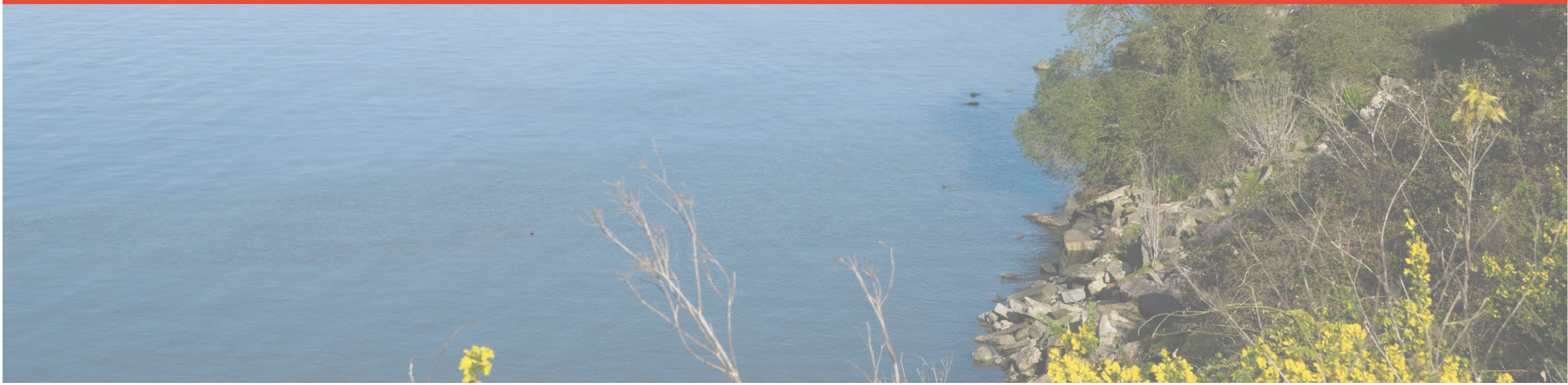
1600K LEGACY LIGHT SOURCE



5000K LIGHT SOURCE



APPENDICES



LUMINAIRE SCHEDULE

The following table details the recommended specifications for each type of luminaire that could be used for street lighting in Albany. These luminaire specifications describe the minimum quality requirements for lighting equipment in order for Albany’s street lighting to minimize contribution to light trespass or light pollution. All recommended luminaire types are using a CCT of 2700K or lower. Some of the types shown here as distinct could also potentially be satisfied by the same luminaire in order to reduce variety in the lighting inventory and improve maintenance response times.

Also included are the anticipated quantities of each luminaire type that would be needed to accomplish some of the recommendations described in this report, mainly the necessary one - for - one replacements that would address failed luminaires and otherwise unsuitable luminaires currently in the City.

Streetlight Typologies											
Luminaire Type Name	Luminaire Type	Adjacent Land Use	Street Classification	Maximum CCT	Maximum Luminaire Lumen Output	Spacing Range* (ft)	Maximum BUG Rating	Distribution	Shielding Accessories	Mounting Height	Anticipated Quantity for 1-to-1 Replacements
S1	Streetlight	SC, SPC, PF, R-2, R-3, R-4, RHD	Arterial	2700K	12,000-16,000	150-200	B2-U0-G2	Type 2 or 3	House side shield near residential	25-30ft.	140
S2	Streetlight	SC, SPC, PF, R-1, R-2, R-3, R-4, RHD, CMX	Arterial or Collector	2700K	8,000-12,000	150-230	B2-U0-G2	Type 2	House side shield near residential	25-30ft.	36
S3	Streetlight	PF, R-2, R-3, R-4, RHD, CMX	Collector or Local	2700K	6,000-10,000	150-240	B1-U0-G1	Type 2	House side shield near residential	25-30ft.	76
S4	Streetlight	PF, R-1, R-2, R-3, R-4, RHD, CMX	Collector or Local	2700K	4,000-8,000	170-240	B1-U0-G1	Type 2	80° shield, House side shield	25ft.	325
P1	Pedestrian Light	R-1, R-2, CMX	Arterial or Collector	2700K	2,500-3,500	60-90	B1-U0-G1	Type 2	80° shield, House side shield	12-15ft.	77
P2	Pedestrian Light	R-1, R-2, CMX	Local	2700K	1,500-2,500	60-90	B1-U0-G1	Type 2	80° shield, House side shield	12-15ft.	0
SG1	Intersection Light	SC, SPC, PF, R-2, R-3, R-4, RHD	Arterial	2700K	14,000-16,000	3-4 at Intersection	B2-U0-G2	Type 3 or 4	House side shield near residential	25-30ft.	40
SG2	Intersection Light	SC, SPC, PF, R-1, R-2, R-3, R-4, RHD, CMX	Arterial or Collector	2700K	10,000-14,000	3-4 at Intersection	B2-U0-G2	Type 3	House side shield near residential	25-30ft.	36
SG3	Intersection Light	PF, R-1, R-2, R-3, R-4, RHD, CMX	Collector or Local	2700K	6,000-10,000	1-3 at Intersection	B1-U0-G1	Type 2	80° shield, House side shield	25ft.	42

* Spacing Range is based on a range to achieve continuous lighting. For non-continuous lighting increase spacing by 1.5 to 2 times.

COST ANALYSIS CHARTS & APPROACH

The following cost analysis for the City of Albany’s Street Lighting Evaluation provides a detailed approach for each category of proposed lighting improvements and align with the proposed street lighting improvement map on page 17. The type and quantity of new luminaires, new light poles, and approximate cost of electrical installation that would be needed has been applied to each proposed improvement site in each category.

Each street lighting improvement category was developed around the existing and proposed additional lighting and electrical infrastructure that would be required to bring each area into compliance with national criteria and the standards developed by Clanton & Associates during this evaluation that were detailed previously in the Light Levels & Streetlighting Features report.

The electrical cost was determined by locating the nearest power source to the specified intersection and then determining the conduit and wire necessary to reach each luminaire. The specific unit costs for luminaires, light poles, foundations, conduit, and wiring were all developed using the material and installation labor costs from recently installed project data published by the Colorado Department of Transportation in their Project Cost Data Book. The design cost was estimated based on the total labor required to install the luminaires, poles, and electrical equipment. To adjust for geographic location between Clanton & Associates firm location and the City of Albany, a multiplier of 1.75 was used to adjust for California’s typical material and labor rates as of 2023.

Cost Summary Table	
Proposed Lighting Improvement Category	Anticipated Cost of Category
Critical Safety Lighting	\$214,000 - \$256,800
Bikeway/Priority Walkway Lighting	\$735,000 - \$882,000
Bikeway/Priority Walkway Intersection Lighting	\$899,000 - \$1,078,800
Lighting Near Schools	\$216,000 - \$259,200
Intersection Lighting Near Schools	\$43,000 - \$51,600
1-for-1 Replacement: Cobrahead	\$685,980 - \$823,176
1-for-1 Replacement: Post Top	\$473,660 - \$568,392
Modification of Existing: Add Shielding	\$10,000 - \$12,000
Modification: Replace Luminaire or Luminaire/pole	\$159,000 - \$190,800
Comprehensive Design: Streetscape	\$2,164,862 - \$2,554,262

Critical Safety Lighting Improvements										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Solano Ave & Kains Ave	Arterial / Local	SC - Solano Commercial	1	S1	3	3	\$34,125	\$16,537	\$5,066	\$55,728
Solano Ave & Santa Fe Ave	Arterial / Collector	SC - Solano Commercial	1	S1	2	0	\$1,750	\$2,794	\$454	\$4,999
Solano Ave & Peralta Ave	Arterial / Collector	SC - Solano Commercial	1	S1	2	2	\$22,750	\$7,146	\$2,990	\$32,886
Solano Ave & Ordway St	Arterial / Local	SC - Solano Commercial	1	S1	2	2	\$22,750	\$3,170	\$2,592	\$28,512
Solano Ave & Tulare Ave	Arterial / Local	SC - Solano Commercial	1	S1	1	1	\$11,375	\$1,492	\$1,287	\$14,154
Sonoma Ave & Ventura Ave	Local / Local	R1 - Residential Low	1	S1	2	1	\$12,250	\$3,262	\$1,551	\$17,063
Washington Ave & Key Route Blvd	Collector / Collector	R1 - Residential Low	1	S1	4	3	\$35,000	\$19,810	\$5,481	\$60,291

COST ANALYSIS CHARTS

Bikeway/Priority Walkway Lighting										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Masonic Ave: Brighton Ave to Solano Ave	Collector	R1 - Residential Low	1	P1	4	4	\$32,200	\$14,316	\$4,652	\$51,167
Masonic Ave: Solano Ave to Codornices Creek	Collector	R1 - Residential Low	1	P1	2	2	\$16,100	\$3,308	\$1,941	\$21,349
Marin Ave: Masonic Ave to Tulare Ave	Arterial	R1 - Residential Low	2	P1	10	10	\$80,500	\$45,000	\$12,550	\$138,050
Santa Fe Ave:Ward Ave to Solano Ave	Collector	R1 - Residential Low	2	P1	4	4	\$32,200	\$20,000	\$5,220	\$57,420
Santa Fe Ave: Solano Ave to Marin Ave	Collector	R1 - Residential Low	2	P1	3	3	\$24,150	\$39,695	\$6,385	\$70,230
Thousand Oaks Blvd: Ramona Ave to Santa Fe Ave	Collector	R1 - Residential Low	2	P1	4	4	\$32,200	\$14,316	\$4,652	\$51,167
Francis St: Curtis St to Neilson St	Local	R1 - Residential Low	2	P1	2	2	\$16,100	\$12,555	\$2,865	\$31,520
Talbot Ave: Creekside Park to Washington	Local	R1 - Residential Low	2	S4	8	0	\$5,600	\$10,000	\$1,560	\$17,160
Talbot Ave: Solano Ave to Marin Ave	Local	R1 - Residential Low	2	S4	6	3	\$35,700	\$10,000	\$4,570	\$50,270
Talbot Ave: Dartmouth St to Codornices Creek	Local	R1 - Residential Low	2	S4	9	0	\$6,300	\$50,000	\$5,630	\$61,930
Portland Ave: Talbot Ave to Masonic Ave	Collector	R1 - Residential Low	2	S2	2	0	\$1,400	\$9,786	\$1,119	\$12,305
Portland Ave: Carmel Ave to Neilson St	Collector	R1 - Residential Low	2	S2	3	0	\$2,100	\$10,000	\$1,210	\$13,310
Kains Ave: Solano Ave to Marin Ave	Local	R3 - Residential High	2	S4	3	0	\$2,100	\$10,000	\$1,210	\$13,310
Pierce St: Albany Hill Park to Buchanan St	Arterial	R3 - Residential High	2	S1	3	0	\$2,625	\$10,000	\$1,263	\$13,888
Spokane Ave: Creekside Park to Portland Ave	Local	R1 - Residential Low	2	P1	6	6	\$48,300	\$45,000	\$9,330	\$102,630
Peralta Ave: Sonoma Ave to Solano	Collector	R1 - Residential Low	2	S1	4	0	\$3,500	\$10,000	\$1,350	\$14,850
Posen Ave: Peralta to Monterey Ave	Local	PF - Public Facilities	2	S4	4	0	\$2,800	\$10,000	\$1,280	\$14,080

Bikeway/Priority Walkway Intersection Lighting										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Pierce St & Washington Ave	Arterial / Local	R1 - Residential Low	2	S2	1	0	\$700	\$4,547	\$525	\$5,771
Adams St & Clay St	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$4,910	\$1,611	\$17,721
Adams St & Castro St	Local / Local	R1 - Residential Low	2	S4	1	0	\$700	\$3,092	\$379	\$4,171
Adams St & Washington Ave	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$5,970	\$1,717	\$18,887
Kains Ave & Brighton Ave	Collector / Local	R3 - Residential High	2	S2	1	1	\$11,200	\$3,731	\$1,493	\$16,424
Kains Ave & Garfield Ave	Local / Local	R3 - Residential High	2	S4	1	1	\$11,200	\$3,031	\$1,423	\$15,654
Kains Ave & Dartmouth Ave	Local / Local	R3 - Residential High	2	S4	1	1	\$11,200	\$12,124	\$2,332	\$25,656
Talbot Ave & Brighton Ave	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$6,062	\$1,726	\$18,988
Marin Ave & Key Route Blvd	Arterial / Collector	R1 - Residential Low	1	S1	4	4	\$45,500	\$21,402	\$6,690	\$73,592
Marin Ave & Pomona Ave	Arterial / Local	R1 - Residential Low	1	S1	2	0	\$1,750	\$999	\$275	\$3,024

COST ANALYSIS CHARTS

Bikeway/Priority Walkway Intersection Lighting (Continued)

Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Marin Ave & Ramona Ave	Arterial / Local	R1 - Residential Low	1	S1	2	1	\$12,250	\$6,755	\$1,901	\$20,906
Marin Ave & Carmel Ave	Arterial / Local	R1 - Residential Low	1	S2	1	1	\$11,200	\$5,597	\$1,680	\$18,476
Marin Ave & Curtis St	Arterial / Local	R1 - Residential Low	1	S1	1	1	\$11,375	\$2,425	\$1,380	\$15,180
Marin Ave & Neilson St	Arterial / Local	R1 - Residential Low	1	S1	1	1	\$11,375	\$8,487	\$1,986	\$21,848
Marin Ave & Ordway St (#1)	Arterial / Local	R1 - Residential Low	1	S1	1	1	\$11,375	\$7,274	\$1,865	\$20,514
Marin Ave & Ordway St (#2)	Arterial / Local	R1 - Residential Low	1	S1	1	0	\$875	\$1,212	\$209	\$2,296
Marin Ave & Ventura Ave	Arterial / Local	R1 - Residential Low	1	S1	2	1	\$12,250	\$3,262	\$1,551	\$17,063
Marin Ave & Tulare Ave	Arterial / Local	R1 - Residential Low	1	S2	1	1	\$11,200	\$4,547	\$1,575	\$17,321
Portland Ave & Kains Ave	Collector / Local	R3 - Residential High	2	S2	1	0	\$700	\$3,698	\$440	\$4,838
Portland Ave & Stannage Ave	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$7,462	\$1,866	\$20,528
Portland Ave & Cornell Ave	Collector / Local	R1 - Residential Low	2	S2	1	0	\$700	\$5,153	\$585	\$6,438
Portland Ave & Talbot Ave	Collector / Local	R1 - Residential Low	2	S2	1	0	\$700	\$7,462	\$816	\$8,978
Portland Ave & Evelyn Ave	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$10,912	\$2,211	\$24,323
Portland Ave & Masonic Ave	Collector / Collector	R1 - Residential Low	2	S2	1	0	\$700	\$606	\$131	\$1,437
Portland Ave & Spokane Ave	Collector / Collector	R1 - Residential Low	2	S2	1	0	\$700	\$4,547	\$525	\$5,771
Portland Ave & San Carlos Ave	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$9,275	\$2,047	\$22,522
Portland Ave & Santa Fe Ave	Collector / Collector	R1 - Residential Low	2	S2	1	1	\$11,200	\$7,462	\$1,866	\$20,528
Portland Ave & Curtis St	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$9,093	\$2,029	\$22,322
Washington Ave & Kains Ave	Collector / Local	R3 - Residential High	2	S2	1	0	\$700	\$3,031	\$373	\$4,104
Washington Ave & Stannage Ave	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$4,477	\$1,568	\$17,245
Washington Ave & Cornell Ave	Collector / Local	R1 - Residential Low	2	S2	1	0	\$700	\$2,425	\$312	\$3,437
Washington Ave & Talbot Ave	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$9,093	\$2,029	\$22,322
Washington Ave & Evelyn Ave	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$4,547	\$1,575	\$17,321
Washington Ave & Masonic Ave	Collector / Collector	R1 - Residential Low	2	P1	1	1	\$8,050	\$8,806	\$1,686	\$18,542
Washington Ave & Ramona Ave	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$3,637	\$1,484	\$16,321
Washington Ave & Carmel Ave	Collector / Local	R1 - Residential Low	2	S2	1	1	\$11,200	\$12,124	\$2,332	\$25,656
Washington Ave & San Carlos Ave	Collector / Local	R1 - Residential Low	2	S1	1	1	\$11,375	\$12,124	\$2,350	\$25,849
Washington Ave & Santa Fe Ave	Collector / Collector	R1 - Residential Low	2	S2	1	1	\$11,200	\$3,731	\$1,493	\$16,424
Solano Ave & Key Route Blvd	Arterial / Local	R1 - Residential Low	1	S1	2	1	\$12,250	\$6,871	\$1,912	\$21,033
Solano Ave & Pomona Ave	Arterial / Local	R1 - Residential Low	1	S1	1	1	\$11,375	\$7,462	\$1,884	\$20,721
Solano Ave & Ramona Ave	Arterial / Local	R1 - Residential Low	1	S1	1	0	\$875	\$606	\$148	\$1,629

COST ANALYSIS CHARTS

Bikeway/Priority Walkway Intersection Lighting (Continued)

Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Solano Ave & Carmel Ave	Arterial / Local	R1 - Residential Low	1	S1	1	0	\$875	\$6,062	\$694	\$7,631
Solano Ave & Neilson St	Arterial / Local	R1 - Residential Low	1	S1	1	1	\$11,375	\$3,637	\$1,501	\$16,513
Solano Ave & Ventura Ave	Arterial / Local	R1 - Residential Low	1	S1	1	0	\$875	\$606	\$148	\$1,629
Sonoma Ave & Neilson St	Local / Local	R1 - Residential Low	2	S2	1	0	\$700	\$606	\$131	\$1,437
Sonoma Ave & Peralta Ave	Collector / Collector	R1 - Residential Low	2	S2	1	0	\$700	\$606	\$131	\$1,437
Sonoma Ave & Ordway St	Local / Local	R1 - Residential Low	2	S4	1	0	\$700	\$7,462	\$816	\$8,978
Dartmouth St & Kains Ave	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$12,124	\$2,332	\$25,656
Dartmouth St & Stannage Ave	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$3,731	\$1,493	\$16,424
Dartmouth St & Cornell Ave	Local / Local	R1 - Residential Low	2	S4	1	0	\$700	\$606	\$131	\$1,437
Dartmouth St & Talbot Ave	Local / Local	R1 - Residential Low	2	P1	1	1	\$8,050	\$5,939	\$1,399	\$15,387
Dartmouth St & Evelyn Ave	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$4,547	\$1,575	\$17,321
Dartmouth St & Masonic Ave	Collector / Collector	R1 - Residential Low	2	P1	1	1	\$8,050	\$6,532	\$1,458	\$16,041
Dartmouth St & Key Route Blvd	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$4,547	\$1,575	\$17,321
Dartmouth St & Pomona Ave	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$4,547	\$1,575	\$17,321
Francis St & Curtis St	Local / Local	R1 - Residential Low	2	S4	1	1	\$11,200	\$606	\$1,181	\$12,987
Posen Ave & Peralta Ave	Collector / Collector	R1 - Residential Low	2	S1	1	0	\$875	\$18,186	\$1,906	\$20,967
Posen Ave & Ordway St	Local / Local	R1 - Residential Low	2	S4	1	0	\$700	\$6,062	\$676	\$7,438
Posen Ave & Ventura Ave	Local / Local	R1 - Residential Low	2	S4	1	0	\$700	\$9,093	\$979	\$10,772

Lighting Improvements Near Schools

Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
San Gabriel Ave: Near Middle School Annex	Local	PF - Public Facilities	1	P1	5	5	\$40,250	\$40,000	\$8,025	\$88,275
Santa Fe Ave: Marin Ave to Ramona Ave	Collector	PF - Public Facilities	1	S2	3	0	\$2,100	\$27,944	\$3,004	\$33,048
Jackson St: Hillside Ave to Gateway Ave	Local	R1 - Residential Low	1	S4	2	0	\$1,400	\$39,620	\$4,102	\$45,122
Cornell Ave: Solano Ave to Marin Ave	Local	PF - Public Facilities	1	S4	4	0	\$2,800	\$10,000	\$1,280	\$14,080
Key Route Blvd: Thousand Oaks Blvd to Portland Ave	Local	PF - Public Facilities	1	S4	6	0	\$4,200	\$28,000	\$3,220	\$35,420

COST ANALYSIS CHARTS

Intersection Lighting Near Schools										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Masonic Ave & Curtis St	Arterial / Local	PF - Public Facilities	1	S2	1	1	\$11,200	\$3,031	\$1,423	\$15,654
Sonoma Ave & Curtis St	Local / Local	PF - Public Facilities	1	S2	1	1	\$11,200	\$15,761		\$26,961

Modification of Existing Luminaires - General Replacements										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Solano Ave: Cleveland Ave to San Pablo Ave	Collector	R1 - Residential Low / R3 Residential High / SC Solano Commercial	3	S1	25	13	\$158,375	NO ELECTRICAL COST	\$15,838	\$158,375

Modification of Existing Luminaires - Add Shielding										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Buchanan St: San Pablo Ave to Cleveland Ave	Arterial	R1 - Residential Low / CMX - Commercial Mixed Use	3	NA	18	-	-	-	-	\$4,500.00
Marin Ave: San Pablo Ave to Masonic	Arterial	R1 - Residential Low / R3 Residential High	3	NA	22	-	-	-	-	\$5,500.00

Modifications of Existing Luminaires - 1 - for - 1 Replacement - Post-Top										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Solano Ave: San Pablo Ave to Masonic Ave	Arterial	SC - Solano Commercial	3	10 S2, 24 P1	34	-	\$234,600	-	\$23,460	\$258,060
1-for-1 Replacement: Masonic Ave	Collector	R1 - Residential Low	1	P1	77	-	\$215,600	-	\$21,560	\$215,600

COST ANALYSIS CHARTS

Modifications of Existing Luminaires - 1 - for - 1 Replacement - Cobraheads										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Cost
1-for-1 Replacement	Local	R1 - Residential Low	1	S4	325		\$292,500	-	\$8,775	\$301,275
1-for-1 Replacement	Collector	R1 - Residential Low	1	S3	38		\$34,200	-	\$1,026	\$35,226
1-for-1 Replacement	Arterial	R1 - Residential Low	1	S2	18		\$16,200	-	\$486	\$16,686
1-for-1 Replacement	Local	R3 - Residential High	1	S3	38		\$34,200	-	\$1,026	\$35,226
1-for-1 Replacement	Collector	R3 - Residential High	1	S2	18		\$16,200	-	\$486	\$16,686
1-for-1 Replacement	Arterial	R3 - Residential High	1	S1	140		\$157,500	-	\$4,725	\$162,225
1-for-1 Replacement	Arterial / Arterial		1	S1	20		\$22,500	-	\$675	\$23,175
1-for-1 Replacement	Arterial / Collector		1	S1	20		\$22,500	-	\$675	\$23,175
1-for-1 Replacement	Arterial / Local		1	S2	36		\$32,400	-	\$972	\$33,372
1-for-1 Replacement	Collector / Collector		1	S3	14		\$12,600	-	\$378	\$12,978
1-for-1 Replacement	Collector / Local		1	S3	14		\$12,600	-	\$378	\$12,978
1-for-1 Replacement	Local / Local		1	S3	14		\$12,600	-	\$378	\$12,978

Comprehensive Streetscape Design										
Location	Street or Intersection Class	Adjacent Land Use	Priority	Luminaire Type	Luminaire Quantity	Pole Quantity	Luminaire and Pole Cost	Electrical Cost	Design Cost	Total Estimated Cost
Buchanan St & Trail: Pierce St through I-80/580 Interchange	Arterial	Industrial	3	S2	4	-	\$2,800	\$254,257	\$25,706	\$282,762
Solano Ave: Masonic Ave to Tulare Ave	Arterial	SC - Solano Commercial	3	34 S2, 3 S1	37	-	\$990,000	\$1,075,000	\$206,500	\$2,217,500

OPERATIONS & MAINTENANCE COSTS

The typical cost of operating and maintaining a LED street lighting system are monthly energy costs, routine maintenance costs for lighting equipment failures, and non-routine maintenance costs for unexpected pole knock-downs and vandalism. These can vary significantly by city and region. An estimate of Albany’s new O&M costs has been detailed below.

Monthly Energy Costs

The City of Albany pays a non-metered, monthly flat rate directly to PG&E for their street lighting’s electrical power. The monthly flat rate cost for each light depends on the wattage of the light and assumes an average dusk-to-dawn operation. Based on three monthly bills provided by Albany’s Public Works Department, there have been significant rate increases of 33% over the last 6 months from June 2023 (\$4,062) to January 2024 (\$5,455). At this current rate, with no additional lighting, the annual street lighting energy cost is \$65,460.

Installing additional street lights according to the recommendations of this evaluation will increase the energy cost by approximately \$1,300 per month. However, replacing the remaining HPS luminaires with LED light sources will reduce the energy cost by approximately \$1,300 per month, resulting in a \$0 net increase in monthly energy costs. Projecting reliable future rate increases is difficult at this time with the very recent significant increases. Albany Public Works should track the rate increases by PG&E over the next few years to develop a longer term rate increase projection.

Routine Maintenance Costs

When new LED street lights are installed in Albany they should include a 10-year warranty period. Therefore, all lighting equipment replacement that occurs within this time frame should have no equipment cost to the City, but may still incur labor costs. New LED street lights typically have a 2% - 4% failure rate, so Alameda County maintenance crew may need to address some scattered LED street light failures within the 10-year warranty period. Alameda County charges per maintenance call (total hrs/mo + traffic signals). The current monthly maintenance bills in Albany provide the labor & materials costs, but do not differentiate between routine vs non-routine maintenance. According to six months of invoices provided by Albany’s Public Works Department, the average monthly maintenance cost (including both routine and non-routine maintenance) for the period of June 2023 - December 2023 was \$5,766 per month. It should be noted that this average cost also included the costs of the additional set-up required for the outdoor lighting demonstration performed for this evaluation.

Non-Routine Maintenance Costs

Other maintenance costs are more unpredictable, but still impact the overall budget for street lighting maintenance. These non-routine maintenance costs can include pole knock-downs, graffiti or other types of vandalism, and other unexpected damage from human activity or weather. These costs are in addition to the energy and routine maintenance costs listed. Since many of Albany’s street lights are on overhead utility lines instead of free-standing poles, they are not as susceptible to knock-downs, but any free-standing metal poles in the City could be vulnerable.

Future System Costs

While not a maintenance cost in and of itself, after 15 - 20 years of operation the LED luminaires

installed following this evaluation will reach their end of service life. The City should establish a reserve fund for these future replacements ahead of time. This reserve fund for replacing street lights in 20 years

Anticipated O&M Costs				
	Monthly Energy Costs	Routine Maintenance Costs	Non-Routine Maintenance Costs	Total Monthly O&M Costs
Current	\$5,500	\$2,900 ²	\$2,900 ²	\$11,300
Projected	\$5,500 ¹	\$6,250 ^{1,3}	\$725 ²	\$12,475

¹ Not including increasing future costs of energy rates, materials, and labor.

² With no differentiation between Routine and Non-Routine Maintenance provided in Alameda County invoices, these numbers assume a 50%/50% split between these two categories for current costs. Once LED replacements are complete, the projected cost of routine maintenance is anticipated to reduce by 75% or more.

³ While newly installed LEDs will significantly reduce routine maintenance costs, the City should establish a reserve fund to prepare for the future replacement costs in 15-20 years when these new LED lights reach their end-of-service-life.



2700K LIGHT AT DEMO SITE 2