LANDSCAPE PERFORMANCE SERIES
presented by the Landscape Architecture Foundation

Mission Creek Stormwater Park
Methods

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This investigation was conducted as part of the Landscape Architecture Foundation's 2024 *Case Study Investigation* (CSI) program. CSI matches faculty-student research teams with design practitioners to document the benefits of exemplary high-performing landscape projects. Teams develop methods to quantify environmental, social, and economic benefits and produce Case Study Briefs for LAF's *Landscape Performance Series*.

The full case study can be found at: https://landscapeperformance.org/case-study-briefs/mission-creek

To cite:
Mohr Ferron, Victoria and Mary Devlin. "Mission Creek Stormwater Park Methods." *Landscape Performance Series*. Landscape Architecture Foundation, 2024. https://doi.org/10.31353/cs2071

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Acknowledgements

We acknowledge that Mission Creek Stormwater Park is located on the ancestral homeland of the Ramaytush Ohlone who are the original inhabitants of the San Francisco Peninsula.

We extend our sincere gratitude to all individuals and organizations who supported and contributed to this research project on the Mission Creek Stormwater Park:

- Willett Moss, Andrew Prindle, and Lauren Bergenholz from CMG
- Jeffrey Tarantino from Freyer & Laureta
- Luke Stewart from Mission Bay Development Group
- Ken Kortkamp and Willis Logsdon from SFPUC (San Francisco Water)
- Jack Avery from San Francisco Parks and Recreation Department
- Members of the South Beach | Rincon | Mission Bay Neighborhood Association
- Matthew Duran, Operations Manager at One Mission Bay
- Residents and visitors willing to answer our survey

We want to give a special thanks to Professor *Danielle Zoe Rivera* for the support in this process and *Megan Barnes* from LAF for the encouragement, guidance, and feedback.

Research Strategy

Our research strategy for the Mission Creek Stormwater Park investigation followed the guidelines provided by the Landscape Architecture Foundation. Still, we adapted the deliverable requirements to the specifics of our site, focusing on four stages: (1) site selection, (2) site study, (3) data collection and analysis, and (4) narrative production (Figure 01). This workflow ensured a thorough understanding of the park's impact on the surrounding urban environment and its potential as a model for water infrastructure.

Figure 01: Research Strategy

Site Selection

In September 2023, we approached the CMG without a specific case study in mind but interested in their water resiliency projects in the Bay Area. We met to discuss which of their built projects would be the most interesting for a case study investigation. Together we chose the Mission Creek Stormwater Park as it is a novel model of water infrastructure in the city - enhancing habitat creation, social, and economic benefits in a centralized stormwater system.

Site Study and Preparation

During the initial months of the Case Study Investigation (CSI) program, we dedicated our efforts to studying the site and defining research goals. We conducted multiple site visits, engaged with CMG's design team, and consulted with other stakeholders. Preparing for the survey to measure social benefits was a significant part of this phase.

Winter site visits, especially during major rain events, were critical for understanding the park's functionality, particularly water retention and flow. Observing these aspects provided valuable qualitative insights, even though we did not collect quantitative data at this time (Figure 02).

Understanding the urban policy and design context was essential due to the park's integration within a larger urban development. Meetings with project stakeholders, water engineers, and the San Francisco Water Commission helped us grasp the two-decade-long process from envisioning the redevelopment of the area to designing and constructing the park. This highlighted the importance of policy development, mediation, and adapting to new urban needs.

Prior to launching the survey, we conducted a demographic study to understand the residents' profiles. This informed our survey design, outreach strategies, and language use. After obtaining Institutional Review Board (IRB) approval, we initiated the survey.

Figure 02: Mission Creek Stormwater Park during an Atmospheric River event February 4th, 2024

Data Collection and Analysis

With our research goals defined, we outlined the benefits to study, drafting an overview of the background and data sources. This overview facilitated a structured plan for on- and off-site data collection. We worked on one benefit at a time, starting with off-site data sources. To develop each benefit, we began with data collection then moved on to analysis, writing a background, and formulating a conclusion (the benefit itself).

This focused approach allowed us to develop expertise in each topic we addressed. Through regular check-in meetings with CMG and the LAF team we could ask specific questions and gather information as needed. However, working on each part separately initially resulted in a document that lacked consistency and cohesion.

Narrative and Production

In the final phase, we concentrated on editing and refining the narrative for legibility. This involved enhancing the context background for each benefit, incorporating images and graphics to complement the text, and ensuring the content addressed the multiple scales of influence within the project. This revision process helped establish connections between different benefits and provided a cohesive and comprehensive document.

In conclusion, our research strategy for the Mission Creek Stormwater Park study involved stages that enhanced feedback cycles and effective communication with the Landscape Architecture Foundation as well as with the firm liaison and other stakeholders. Each phase contributed to a deep understanding of the park's role in urban water infrastructure and its broader social, economic, and environmental impacts. This strategy ensured that our findings were well-founded, comprehensive, and effectively communicated.

Environmental Benefits

Captures and treats approximately 694,028 gallons of stormwater annually. Once the park's stormwater pump station is online this will increase to 5.5 million gallons of stormwater treated annually, equivalent to over 11 Olympic-sized swimming pools.

Background:

Figure 03: The area in green is Mission Creek Stormwater Park and is the current drainage area (DM 1). The blue area is the second drainage area (DM 2), stormwater from this area will be treated by the park once construction of the stormwater pump station is completed. Image Source: CMG

As part of the Stormwater Management Plan (SWMP), the City required Mission Bay District developers to manage their stormwater independently of San Francisco's combined stormwater system. The SWMP required Mission Bay's developers to invest in green stormwater management infrastructure. Mission Creek Stormwater Park is a centralized stormwater system that treats runoff before discharging into Mission Creek Channel. Previously, the park was a paved parking lot, and much of the stormwater runoff entered the combined sewer system, with the rest directly entering Mission Creek Channel *(find more information in Lessons Learned)*.

Mission Bay Stormwater Park is designed to treat stormwater runoff from the 52,272 square feet of park area (1.2 acres), as well as stormwater from 364,632 square feet of surrounding streets and adjacent parcels (8.37 acres), amounting to a total area of 416,574 square feet (9.6 acres) (Figure 03) (Table 01).

Currently, the 6,482 square foot bioretention basins only treat stormwater runoff from the 45,460 square foot park area (DM1). The park bioretention basins will treat the runoff from the additional surroundings once a planned pump station connecting the other drainage (DM2) areas is completed *(find more information in Lessons Learned)*.

Before opening, the park bioretention basins underwent observational flow test simulations testing the flow inputs expected once the pump is connected. The basins were able to handle and direct the anticipated stormwater flow successfully (Figure 04). In 2023, heavy rainfall in the basins dealt with the flow as expected (CMG). We visited the site during an atmospheric river event in 2024, and we could see water retention in the basins (Figure 05).

Figure 04: Image of flow water testing conducted in 2022. Source: SFPUC

Figure 05: Park during an Atmospheric River event on February 4th, 2024

Methods:

We calculated the approximate amount of water currently treated by the park annually, as well as the anticipated capture the basins will treat once the stormwater pumps that will connect the second drainage area are online. Our calculation is based on average precipitation in San Francisco, expected rainfall capture, and typical bioretention/ infiltration flow rates.

Calculations:

Surface areas

Drainage Management Area 1 (DM1): *(current treatment: total area of the park)*	45,460 sq. ft (1.05 acres)
Bioretention Basins (not included as in the drainage management)	6,482.00 sq. ft (0.15 acres)
Drainage Management Area 2 (DM2): *(total surrounding area, where stormwater is directed to the park through the pump station)*	364,632 sq. ft (8.37 acres)
Total (DM1 + DM2): *(future treatment: once pump station is connected)*	416,574 sq. ft (9.6 acres)

Table 01: Calculation of current and future drainage management areas.
Source: Stormwater Management Plan, Freyer & Laureta.

Formula

[annual precipitation (inches) * (feature area (sq. ft) + drainage area (sq. ft)] * % of rainfall captured] * 144 sq. inches/sq. ft * 0.00433 gal/cubic inch = **approximate gallons of stormwater runoff treated** (Equation from "The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Social and Environmental Benefits.")

Current treatment

23.66 inches * 52,272 sq. ft * 0.9 * 144 sq. inches/sq. ft * 0.00433 gal/ cubic inch = **694,028 gallons annually**

Future treatment

23.66 inches * 416,574 sq. ft * 0.9 * 144 sq inches/sq. ft * 0.00433 gal/ cubic inch = **5,530,951 gallons annually**

Volume of an Olympic sized swimming pool: **490,000 gallons**
5,530,951 gallons / 490,000 = approximate to 11.3 Olympic-sized swimming pools

Sources:

American Rivers and Center for Neighborhood Technology. *"The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Social and Environmental Benefits."* 2011.

"Mission Creek Stormwater Park." n.d. CMG Landscape Architecture. Accessed July 31, 2024. https://www.cmgsite.com/places/mission-creek-stormwater-park/.

Freyer & Laureta. *"Mission Bay Park P3, Stormwater Pump Station #3, & Drainage Area D: Final Stormwater Control Plan."* San Francisco. 2019.

San Francisco Public Utilities Commission. *"San Francisco Stormwater Management Requirements and Design Guidelines."* San Francisco, 2016.

San Francisco Public Utilities Commission. *"Sewer System Improvement Program (SSIP)."* 2015.

Limitations:

- This calculation is based on the average rainfall for the area. Actual rainfall can vary year to year, and as a result so can the actual gallons of water captured annually.
- As we mentioned, the pump is not connected yet and the calculations are based on the water engineers' models. It is known that the infiltration capacity of the basins will decrease with time due to sediment accumulation and we cannot guarantee that once when the pump is connected the treatment capacity will be the same.

Captures and treats 100% of rainfall for a 90th percentile, 24-hour storm event, which will amount to an estimated 124,625 gallons or more once the stormwater pump station is online.

Background:

Mission Creek Stormwater Park sits over a former marshland which was filled during the Gold Rush (circa 1848) to 'provide space to load and unload ships and barges' gaining importance for military logistics during World War II when it was converted to the Southern Pacific rail yards. After the war concluded most of the industries moved, leaving a toxic and underutilized landscape.

Prior to the Mission Bay Development plan to redevelop the area in 1998, the surroundings of Mission Creek (or China Basin) were an underutilized and polluted post-industrial landscape. The San Francisco Giants constructed a ballpark (known as Oracle Park) on the south side of the creek in the year 2000, prompting further development in the area. The plot where Mission Creek Stormwater Park sits was

primarily used as an overflow parking for the stadium known as '4th St/Channel St Parking Site.' (Figure 06) By then, water runoff was discharged to Mission Creek and the combined sewer system. Concrete pavement covered most of the parking lot, leaving only a riprap strip along the shoreline. Standing over a filled land, this area is prone to flooding during storm events, but especially in high tides due sea level rise.

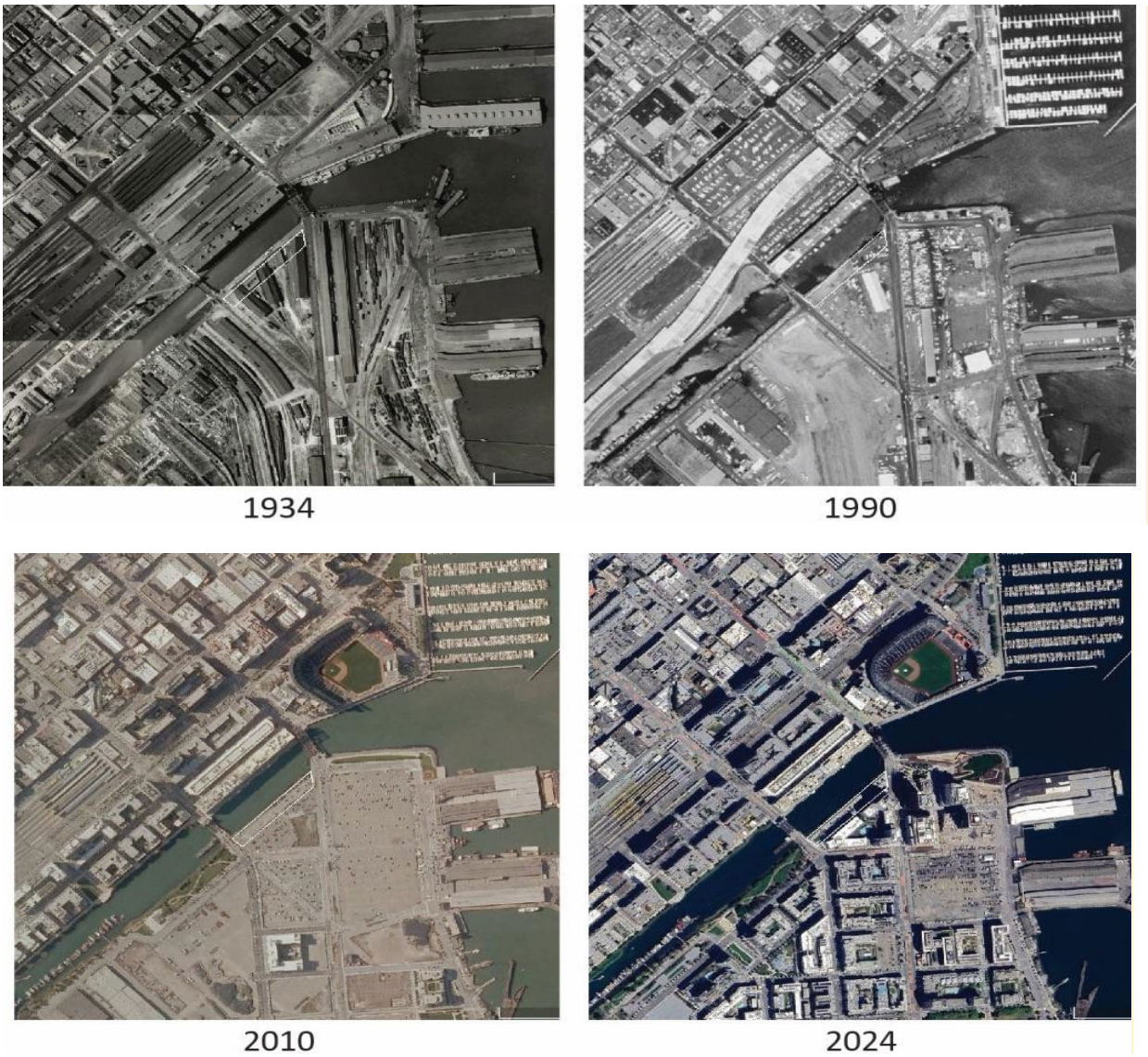


Figure 06: Historical Analysis of the site. Source: Google Earth

Method:

As part of the stormwater management plan, engineers calculated the water quality volume that the park must treat in the event of a 90th percentile, 24- hour storm in line with SFPUC requirements. The park was designed to treat this volume, and calculations specifying how the bioretention basins meet these requirements were outlined in the stormwater management plan. We used this information to compare the designed water quality volume capacity to the required water quality volume for a 90th percentile, 24-hour storm event.

Calculations:

Required Water Quality Volume for a 90th percentile 24-hour storm, with a rain depth of 0.75 inches (100-year storm event) Calculated in accordance with SFPUC district regulations:

WQv= water quality volume (cubic feet)

Water Quality Volume equation: WQv = C X A d/12

C= runoff coefficient (determined for each drainage management area using the November 2011 SFPUC Water Quality Volume and Water Quality Flow Rate Calculator)

A= proposed drainage area (square feet) from submitted Stormwater Control Plan

d= design depth of rainfall (inches) (as required by SF Port Jurisdiction)

Refer to Table 02 to find drainage management area calculations:

Drainage management area I (DM 1)

WQv = 0.773 * 45,460 sq. ft * (0.75in/12)= **2,196 cubic feet (16,427 gallons)**

Drainage management area II (DM 2)

WQv = 0.635 * 364,632 sq. ft * (0.75in/12) = **14,471 cubic feet (108,250 gallons)**

Total Required Water Quality Volume calculation

WQv = 16,660 cubic feet (**124,625 gallons**) **The park's bioretention basins were required to be able to capture 100% of this volume in the event of a 90th percentile, 24-hour storm with a 0.75 inch rainfall depth.**

BMP	Total WQv (cf)	Proposed WQf (cfs)	Swale Treated Volume (cf)	Bioretention Area (sf)	Bioretention Treated Volume (cf)	Total WQv (cf) Treated
Bioretention Basin 1						
SW-1	-	0.16	2,195	813	-	-
BB-1A	-	-	-	622	1,879	-
BB-1B	-	-	-	356	949	-
BB-1C	-	-	-	509	1,357	-
Bioretention Basin 2						
SW-2	-	0.16	2,195	813	-	-
BB-2A	-	-	-	411	1,242	-
BB-2B	-	-	-	379	1,011	-
BB-2C	-	-	-	385	1,027	-
Bioretention Basin 3						
SW-3	-	0.16	2,195	813	-	-
BB-3A	-	-	-	586	1,770	-
BB-3B	-	-	-	281	749	-
BB-3C	-	-	-	385	1,027	-
BB-3D	-	-	-	129	344	-
Total	**16,660**	**0.48**	**6,585**	**6,482**	**11,355**	**17,940**

NOTE: SIZING RATIO (BIORETENTION AREA/ DRAINAGE AREA) = 1.5%

Table 02: Bioretention basin capacity calculations. Source: Freyer & Laureta. SCP engineer

Bioretention vegetated swale capacity : 6,482 cubic feet (48488.73 gallons)

Bioretention basin areas capacity : 11,355 cubic feet (84941.298701 gallons)

Water Quality Volume: 11,355 cubic feet (84941.30 gallons) + 6,482 cubic feet (48488.73 gallons) = 17,837 cubic feet (**133,430.30 gallons**), **or over 100% capacity for a 90th percentile, 24-hour storm with a 0.75 inch rainfall depth.**

Notably, park capabilities exceed requirements by 7%, or 1,280 cubic feet (9575.07 gallons):

17,940 cubic feet (134,275.32 gallons) - 16,660 cubic feet (124,625.45 gallons) = **1,280 cubic feet** (9575.07 gallons).
(17940 / 16660) * 100 = 92.87%
100 - 92.87 = exceeds requirements by **7.1%**

Sources:

Freyer & Laureta. *"Mission Bay Park P3, Stormwater Pump Station #3, & Drainage Area D: Final Stormwater Control Plan."* San Francisco, 2019.

San Francisco Water Power Sewer. "Stormwater Requirements." Accessed June 6, 2024. https://sfpuc.org/construction-contracts/design-guidelines-standards/stormwater-requirement

San Francisco Public Utilities Commission. *"San Francisco Stormwater Management Requirements and Design Guidelines."* San Francisco, 2016.

San Francisco Public Utilities Commission. "Sewer System Improvement Program (SSIP)." 2015.

SPUR. "Mission Creek Sea Level Rise Adaptation Study Waterfront Strategies for Long Term Urban Resiliency." San Francisco. 2016.

"FEMA's National Flood Hazard Layer (NFHL) Viewer." n.d. Accessed May 11, 2024. https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd.

SFPUC. "SFPUC Stormwater Management Requirements and Design Guidelines Supplement: Accepted Hydrologic Calculation Methods." *SFPUC Stormwater Management Requirements and Design Guidelines*. 2016. https://sfpuc.org/sites/default/files/construction-and-contracts/design-guidelines/Hydro-CalculationMethods_20160502.pdf.

Limitations:

- The calculations are based on the documents provided by the water engineers and are based on simulations, as such the quantities might not represent the actual amount of stormwater treated.
- We are comparing the infiltration rate to the site conditions right before the park was built and was covered in concrete as a parking lot. If we were to compare to natural conditions, a marshland, findings would differ.

Creates 23,280 sf of new habitat composed of 74% native plant species. Of these species, 52% have special value for pollinators, 19% are larval hosts, 42% provide food or habitat for birds, 61% provide food or habitat for bees or other beneficial insects, and 58% attract butterflies and moths.

Background:

Prior to the construction of Mission Bay Stormwater Park, the site was primarily paved (Figure 07), with a small unpaved upland area dominated by a monoculture of nonnative fennel (*Foeniculum vulgare*). One goal of this park was to use the planting to increase the amount of functional habitat available, especially along the riparian edge of the park, where CMG reestablished some of the species that would have been present when this area was tidal marsh land (Figure 08). Wind, salt exposure, and full sun exposure all impact this site, and planting was selected in part to adapt to these conditions and mitigate the adversity of these conditions for visitors while also treating stormwater and creating wildlife habitat. The park also serves as a greenspace connector and is a segment of the open space corridor that connects the northern edge of the Mission Creek Channel to the waterfront. This corridor of green spaces establishes habitat opportunities along the channel, and creates vector spaces for wildlife, in particular pollinator species and birds (Figure 10).

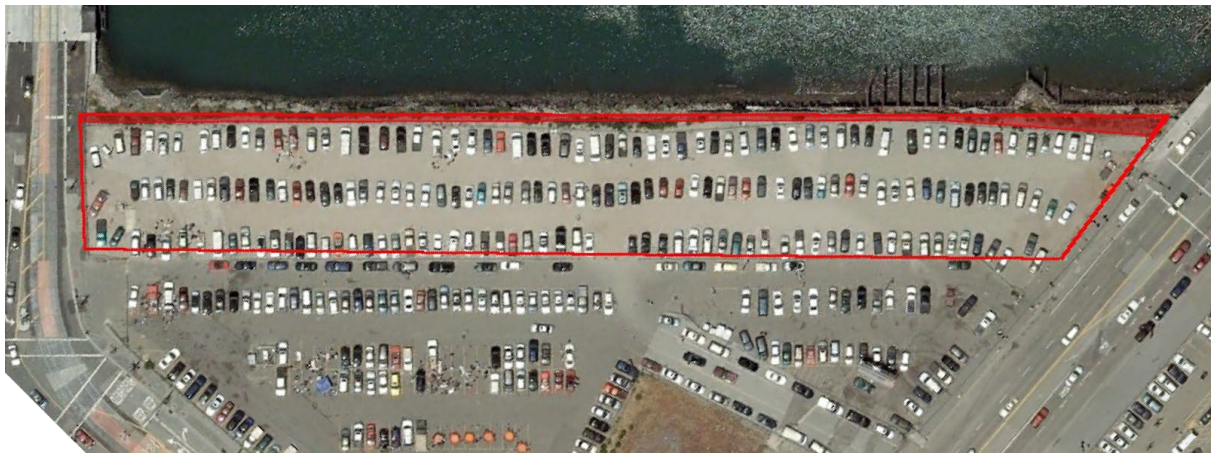


Figure 07: Satellite view of the site in 2021. Source: Google Earth Pro.

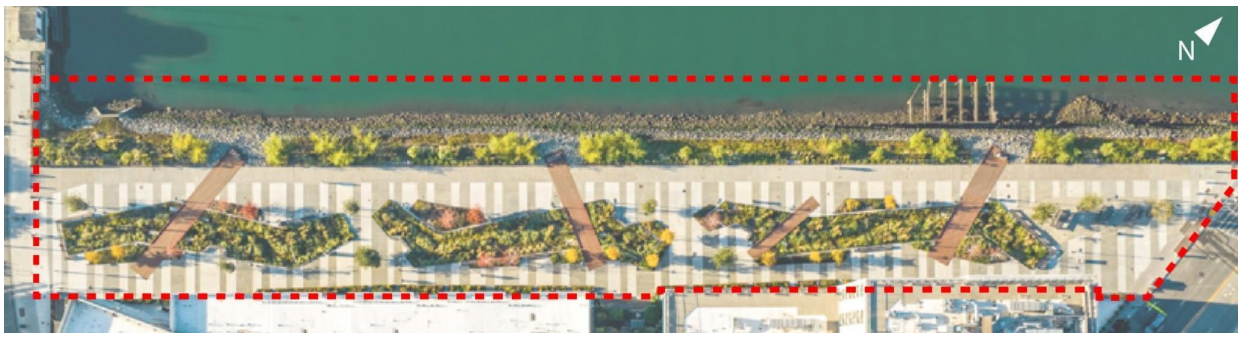


Figure 08: Aerial Photograph from 2023. Source: CMG.

Method:

First we calculated the total area of vegetated surfaces in the park using the construction documents provided by CMG. Then, we conducted an observational survey of the park verifying plant species on site and checked against the intended planting plan. We determined the habitat benefits of each plant species based on data from online plant databases, such as Calscape and CNPS, as well as in person field observation. After researching the habitat benefits of each plant species on site, we calculated the percentage of species that provide different types of habitat support. *(see appendix B for plant chart)*

Calculations:

Surface type	*Area (sq. ft.)*
Shoreline Planting	11,063.03 sq. ft.
Bioretention Basins	6,482.00 sq. ft.
Planters *(next to basins and building)*	5,734.97 sq. ft.
Total Vegetated Surface	**23,280.00 sq. ft.**

Table 03: Calculation of Total Vegetated Areas

% Calculations for plant species:

- *Total # of identified species = **31** (counts multiple varieties of the same species as 1)*
- *Total # of species that are native to California: **23** (23 /31 x 100 = **74 %**)*
- *Total # of species with Special Value to Pollinators = **16** (16 /31 x 100 = **52 %**)*
- *Total # species that are verified Larval Hosts: **6** (6/31 x 100 = **19.4%**)*
- *Total # species attractive to Birds: **13** (13/31 x 100 = **42%**)*
- *Total # of species attractive to Bees: **19** (19/31 x 100 = **61.3%**)*
- *Total # of species attractive to Butterflies/Moths: **18** (18/31 x 100 = **58.1** %)*

Sources:

Calflora. Accessed June 15, 2024. https://www.calflora.org/

CalScape. Accessed June 17, 2024. https://www.calscape.org/.

California Native Plant Society (CNPS). Accessed June 12, 2024. https://www.cnps.org/.

Clark, Josiah. Hee, Michael. CMG Landscape Architecture. *"Ecological Overview, Recommendations and Target Wildlife Species for Mission Creek Park- Park P3"*, San Francisco, 2015.

INaturalist. Accessed June 10, 2024. https://www.inaturalist.org/

Freyer & Laureta. *"Mission Bay Park P3, Stormwater Pump Station #3, & Drainage Area D: Final Stormwater Control Plan."* San Francisco, 2019.

USDA plants database. Accessed June 16, 2024. https://plants.usda.gov/home

CMG Landscape Architecture. *"Mission Bark Park P3, Record Drawings"*, 2022.

Limitations:

- Seasonality: this research was entirely conducted in the summer. As such, field observations are limited to what can be observed during this season.
- Information regarding habitat support benefits is limited. For example, it is likely that more plants are larval hosts or provide habitat to beneficial insects than listed, as this is an area that has not been widely researched for many of the plant species listed. As such, relevant plant databases are often lacking complete information regarding ecological connections, especially regarding insects.
- Surveys were conducted by a research assistant who is trained in native and horticultural plant identification, but who is not a professional botanist. As such, there is a possibility of potential plant misidentification.

Improves species richness by 96% with an increase from 1 to 30 species on-site. Bioretention basins achieve a high biodiversity score of 0.86 out of 1 on the Gini-Simpson diversity scale.

Background:

Before development, Mission Bay was tidal marshland which would have provided a rich ecosystem for seabirds and migratory birds. Mission Bay has since been developed and redeveloped and is permanently and drastically altered from its pre-industrial condition. However, today birds can be seen using Mission Creek Channel and surrounding parks for foraging and shelter. Mission Creek Stormwater Park forms the central segment of a green corridor which stretches from Huffaker Park along Mission Bay Park to China Basin Park (Figure 10). Together, these parks help to support local bird populations. Mission Creek Stormwater Park improves the water quality of stormwater entering the channel, and the park's diverse, primarily native planting scheme supports habitat for a variety of species.

Species richness is often used as a measure of ecological health and robustness of plant communities. Research has shown that plant diversity can improve a plant community's resilience to climate change, and improve resistance to invasive species, decrease the spread of fungal disease, and improve the species richness of insect populations (Tilman et al.). Often, bioretention projects built by the city are limited by modest planting and maintenance budgets, and the diversity of bioretention basins are restricted as a result. Other nearby bioretention projects have less diverse planting plans when compared to the bioretention basins in Mission Creek Stormwater Park. Given that Mission Creek Stormwater Park was intended to function as a park as well as a piece of green infrastructure, and was commissioned by the Mission Bay Development Group, the planting plan was chosen with both ecological diversity and visual appeal in consideration.

Method:

Species richness: A field survey conducted by walking the entirety of the park and noting species seen was conducted to identify existing plants on site as compared to planting plan. The total number of species observed on site was recorded and summed to determine the total species richness of the park (Appendix B).

Simpson's diversity index for bioswale: individual plant counts were recorded for Bioretention basin DMA-1C (Figure 09), one of the three bioretention basins on site. All three basins have very similar planting plans, so we chose the largest, DMA-1C, to study biodiversity in greater detail. Using the total species count and individual plant counts, the Gini Simpson's diversity index was calculated using the Simpson diversity index equation and an online calculator. The Gini-Simpson diversity index score varies between 0 and 1, with scores closest to 1 being the most diverse. As the number of different species increases and the population distribution of species becomes more even, the diversity index increases toward a score of 1.

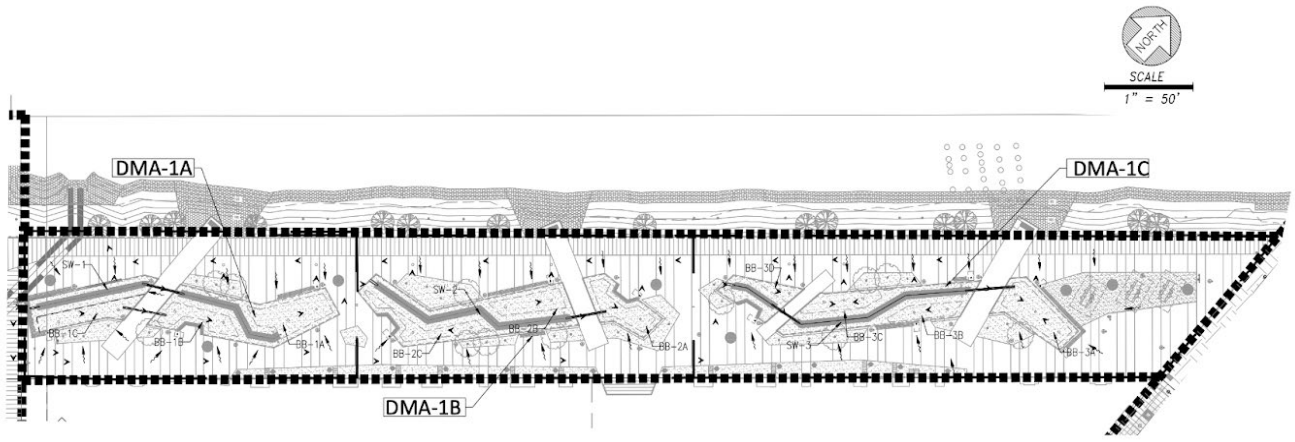


Figure 09: Bioretention Basin DMA-1C used for Gini Simpson Calculation. Source: CD drawings, CMG

Calculations:

BIORETENTION BASIN DMA-1C PLANT LIST		
Common Name	*Botanical Name*	*Quantity*
Purple Top Vervain	*Verbena bonarensis*	17
Yarrow 'Paprika'	*Achillea millefolium 'paprika''*	41
Scarlett Monkeyflower	*Erythranthe cardinalis*	2
Seep Monkeyflower	*Erythranthe guttata*	5
California Sagebrush	*Artemesia californica*	3
Calfiornia Fuschia	*Epilobium canum*	18
Atlas Fescue	*Festuca mairei*	115
Pacific Reedgrass	*Calamagrostis nutkaensis*	90
Common Rush	*Juncus effusa*	36
Dense Sedge	*Carex densa*	36
Berkeley Sedge	*Carex tumulicola*	35
Red Fescue	*Festuca rubra*	25
		423

Table 04: Individual plant count from bioretention basin DMA-1C

$$D = \sum ni(ni-1) \,/\, N(N-1)$$

N = total # of individuals

ni = # of individuals for each species

Simpson's Diversity Index (1-D) for this set is 0.84. This indicates that the bioswale is diverse.

Sources:

Freyman, William A., Linda A. Masters, and Stephen Packard. 2016. "The Universal Floristic Quality Assessment (FQA) Calculator: An Online Tool for Ecological Assessment and Monitoring." *Methods in Ecology and Evolution* 7 (3): 380–83. https://doi.org/10.1111/2041-210X.12491.

Singh, Purnima. 2022. "Simpson's Diversity Index Calculator." Www.omnicalculator.com. April 6, 2022.

Tilman, D., J. Knops, D. Wedin, P. Reich, M. Ritchie, E. Siemann. 1997. The influence of functional diversity and composition on ecosystem processes. Science 277:1300-1302. https://www.omnicalculator.com/statistics/simpsons-diversity-index.

CMG Landscape Architecture. 2022. "Mission Bark Park P3, Record Drawings"

Limitations:

- Plant species richness does not provide a comprehensive measure of the environmental quality of a site. While it can indicate diversity, it does not take into account the exact interactions between plant species and the value each individual plant species provides.
- A Gini-Simpson diversity index was only conducted for one of the bioswales on site as a sample. The Gini-Simpson index gives a more detailed measure of diversity on site than species richness, but it was not conducted across the whole park.

Supports habitat for over 100 bird species and is actively used by at least 10 observed bird species.

Background:

Before development, Mission Bay was tidal marshland which would have provided a rich ecosystem for seabirds and migratory birds. Mission Bay has since been developed and redeveloped and is permanently and drastically altered from its pre-industrial condition. However, today birds can be seen using Mission Creek channel and surrounding parks for foraging and shelter. Mission Creek Stormwater Park forms the central segment of a green corridor which stretches from Huffaker Park along Mission Bay Park to China Basin Park (Figure 10). Together, these parks help to support local bird populations. Mission Creek Stormwater Park improves the water quality of stormwater entering the channel, and the park's diverse, primarily native planting scheme supports habitat for a variety of species.

Figure 10: Green Corridor along the Mission Creek

Methods:

Using data from eBird, a globally recognized birding platform managed by the Cornell Lab of Ornithology, we researched bird sightings along Mission Creek Channel from 2020 to the present. 102 species were observed along Mission Creek Channel between January 2020 and July 19, 2024. Mission Creek Channel includes the area of Mission Creek Stormwater Park, as well as the other parks and walkways bordering the channel *(see appendix C for eBird list of bird species observed in Mission Creek Channel)*. It is likely that not all of the species observed around Mission Creek Channel use Mission Creek Stormwater Park. However, the park does create supporting habitat for many species in the area.

An on-site bird watching survey was conducted at the park from 6:30 am to 8:00 am on June 19th, 2024. We also recorded additional species we happened to notice on site during other visits to the park, though these other site visits did not include dedicated bird watching time.

Birds visually seen on the park premises:

1. Song sparrow *Melospiza melodia*
2. White crowned sparrow *Zonotrichia leucophrys*
3. Rock Pigeon *Columba livia*
4. Bushtit *Psaltriparus minimus*
5. Anna's hummingbird *Calypte anna*
6. Eurasian Collared Dove *Streptopelia decaocto (introduced)*
7. House Finch *Haemorhous mexicanus*
8. American robin *Turdus migratorius*
9. American crow *Corvus brachyrhynchos*
10. Western Gull *Larus occidentalis*

Sources:

CornellLab eBird. "Bar Charts - eBird." Cornell University. Accessed July 28, 2024. https://ebird.org/GuideMe?cmd=changeLocation.

Limitations:

- eBird data is for the entire Mission Bay channel area. Some of the bird species observed may only visit the other parks along mission creek channel, and not Mission Bay Stormwater Park. As such, the eBird estimate may suggest there is a higher number of species that visit the stormwater park than actually use the park in reality.
- Dedicated field observation of bird species on site occurred only once, for 90 minutes. As such, the number of bird species we visually saw in the park during our visits likely does not reflect the total number of avian species visiting the site.

- Site observations were conducted only in the late spring or summer, so we likely missed some migratory bird species. Finally, the survey was conducted by a research experience who has some bird identification training, but who is not an expert in bird identification.

Social Benefits

Survey Overview

Overall Background for Survey:

To measure the social benefits of the Mission Creek Stormwater Park, we based most of our results on a survey conducted in the summer 2024. The survey was directed at residents, commuters, and visitors to the area surrounding the public park, who are aged 18 and above.

The Mission Bay Development area is characterized by a relatively young, highly educated, and affluent population. With a total population of 11,327, the median age is 33.6 years and 75.8% of residents hold bachelor's degrees or higher. The median household income is $180,208, significantly higher than the state's median of $91,551. Employment rates are high, and there is a diverse linguistic profile, with a significant percentage of residents speaking Asian and Pacific Islander languages, while 46.2% of residents speak only English at home. This demographic profile suggests a vibrant and economically thriving community with a strong emphasis on education and professional engagement. (Appendix D)

Overall Method for Survey:

Our survey targeted a diverse population of individuals who frequent the public park. Our focus is on capturing the perspectives and experiences of all park users, regardless of demographic characteristics. Based on the ZIP-CODE (9158) total population (11,327), our minimum sample size is 68 responses *(with 90% Confidence Level and 10% Margin of Error - Qualtrics)*.

We conducted the survey using two outreach strategies: indirect and on-site engagement.

1. **Indirect Outreach:** We contacted local community organizations, neighborhood associations, and relevant stakeholders via email to distribute information about the survey and encourage participation among their members *(see Acknowledgments section to find the associations who participated)*. We provided a link to an online questionnaire to reach a broader audience, including residents and commuters who may not frequent at the times we are conducting the survey.
2. **For the on-site survey**, our research team members were strategically stationed at key locations within the public park, covering different usage hours. We proactively approached individuals who appeared to be park visitors, inviting them to participate in the survey. The participants were given the flexibility to respond either on paper or online using the provided QR code. To ensure compliance with the park's regulations, we obtained a permit from San Francisco Parks and Recreation services, with the condition of avoiding any signage. To overcome this, we printed name tags with the QR code on the back, which proved to be a highly accessible and credible method (appendix E).

Both indirect and on-site outreach started by informing prospective participants about the study objectives, procedures, risks, and benefits. Before starting the survey, participants have to check a box to give consent. Most participants take 3 to 5 minutes to complete the questionnaire. Finally, we utilized

Qualtrics, a survey software that prioritizes confidentiality by not collecting IP addresses or any associated data during the survey administration process.

Overall Calculations for Survey:

Sample Size: 68 responses *(with 90% Confidence Level and 10% Margin of Error - Qualtrics)*
Total surveyed: 71 responses

Distribution Summary

QR Code: 40 responses
(We shared the QR code when approached individuals on-site and through the flier distribution)

Link to survey: 31 responses
(We shared the link in community email lists and we digitized paper copies that we used on-site)

Overview of the Survey Participants

- Most of the people that visit the park are nearby residents.
    - 76% of the survey participants live less than a mile away from the park
    - 21% of the survey participants live less than five miles away from the park
- Find the complete survey questionnaire and responses in appendix F.

Overall Sources for Survey:

"ZCTA5 9158 - Census Bureau Profile." n.d. Accessed May 22, 2024. https://data.census.gov/profile/9158?g=860XX00US94124.

Qualtrics. 2023. "Sample Size Calculator." Qualtrics. March 21, 2023. https://www.qualtrics.com/blog/calculating-sample-size/.

Harvard University, Program on Survey Research, and Chase Harrison. 2007. "Tip Sheet on Questions Wording."

Gehl, Studio. *Public Life Diversity Toolkit*. San Francisco. 2015. https://issuu.com/gehlarchitects/docs/gehl_publiclifediversitytoolkit_pag.

"QUAID Tool." n.d. Accessed May 22, 2024. http://quaid.cohmetrix.com/.

Overall Limitations for Survey:

- A representative number of responses come from on-site outreach, and individuals who are biking or running might be unequally represented in this study.
- Our sample size represents the population around the site, but it has relatively low resolution.
- Some survey participants didn't respond to the full questionnaire, as a result some questions have a smaller sample size.

Attracts about 95 visitors every 30 minutes as observed on typical afternoon, with 58 strolling and 20 dog walking. On a game day, 259 visitors were observed over a 30-minute period. 54% of 69 surveyed visitors reported using the park to stroll and relax, and 17% reported using the park for dog walking.

Background:

When we evaluate the social value of Mission Creek Stormwater Park, it is critical to understand how the park fits into more extensive urban plans that prioritize sustainability and human-scale design. The Mission Bay Development is the new neighborhood in which Mission Creek Stormwater Park is located; however, the park is also adjacent to Mission Rock and Oracle Park (Figure 11).

Figure 11: Development areas surrounding Mission Creek Channel. The Red rectangle indicates the location of Mission Creek Stormwater Park within the Mission Bay Development.

Mission Rock open space, planned by CMG, addresses the waterfront from the Bay and China Basin, incorporating urban design standards that foster a walkable urban fabric. Mission Creek Stormwater Park connects Mission Creek Park and China Basin Park into a half-mile protected and vegetated corridor, creating a peaceful yet active environment for pedestrians, runners, and bikers (Figure 10). China Basin Park was inaugurated while we were conducting our summer site visits. We observed some changes in how people use the space, while China Basin Park promotes active programming, Mission

Creek Stormwater Park now primarily serves as a peaceful yet highly frequented vector space between Mission Creek Park and China Basin Park.

Oracle Park is a baseball stadium that hosts various other sporting and musical events. The Mission Creek Stormwater Park's proximity to Oracle Park enhances its recreational use, allowing visitors to see the screen and listen to events (Figure 12). Visitors around the city use the park during game days, which we observed with more people passing through the park and using the infrastructure for tailgating. On average days, most visitors are residents from the Mission Bay neighborhood, and the use varies depending on the time and weather conditions. The park is typically windy, affecting how people use the space. On sunny days, there's a noticeable change in people's behavior; they tend to stay longer in the park and enjoy the views.

Figure 12: View of the Oracle Park from the Park. Source: Sam Oberter, Photography

Method:

We conducted site fieldwork using a counter to track usage in 30-minute intervals during different days and times of the week, which allowed us to consider all uses through careful observation (Table 05). As intended by the designers, we noticed the back promenade adjacent to the residential building is less frequented by walkers, runners and bikers and it is the preferred path for tranquil strolls. User survey results assess user perceptions and experiences, we specifically asked what brought them to the park the last time they visited (Figure 13).

Calculations:

Field observations

	Time Start	Time End	Walking	Dog Walking	Sitting	Running	Biking Scooter	**Total**
Friday, 05/31/2024 Gameday, windy, 60° F	6:28 PM	7:00 PM	200 (front) 122 (back) 78	20 (front) 12 (back) 8	10	10 (front) 9 (back) 1	19 (front) 16 (back) 3	**259**
Saturday, 06/08/2024 Concert day, sunny, windy, 58° F	1:02 PM	1:36 PM	64 (front) 37 (back) 27	14 (front) 2 (back) 12	0	3 (front) 3 (back) 0	6 (front) 5 (back) 1	**87**
Thursday, 06/13/2024 windy, 58° F	2:30 PM	3:00 PM	43 (front) 28 (back) 15	3 (front) 1 (back) 2	1	1 (front) 1 (back) 0	8 (front) 7 (back) 1	**56**
Saturday, 06/15/2024 sunny, 70° F	6:20 PM	6:50 PM	58 (front) 42 (back) 16	31 (front) 19 (back) 12	14	7 (front) 7 (back) 0	2 (front) 2 (back) 0	**112**
Wednesday, 06/19/2024 sunny, 70° F	8:00 AM	8:30 AM	17 (front) 11 (back) 6	14 (front) 11 (back) 3	1	20 (front) 10 (back) 10	3 (front) 2 (back) 1	**55**
Wednesday, 07/02/2024 sunny, 72° F	7:00 PM	7:30 PM	69	32	8	8	9	**126**

Table 05: People counting in 30 minutes interval

Average visitors in the afternoon: (87 + 56 + 112 + 126) / 4 = 95.25

Average people walking in the afternoon: (64 + 43 + 58 + 69) / 4 = 58.5

Average people dog walking in the afternoon: (14 + 3 + 31 + 32) / 4 = 20

Survey result:

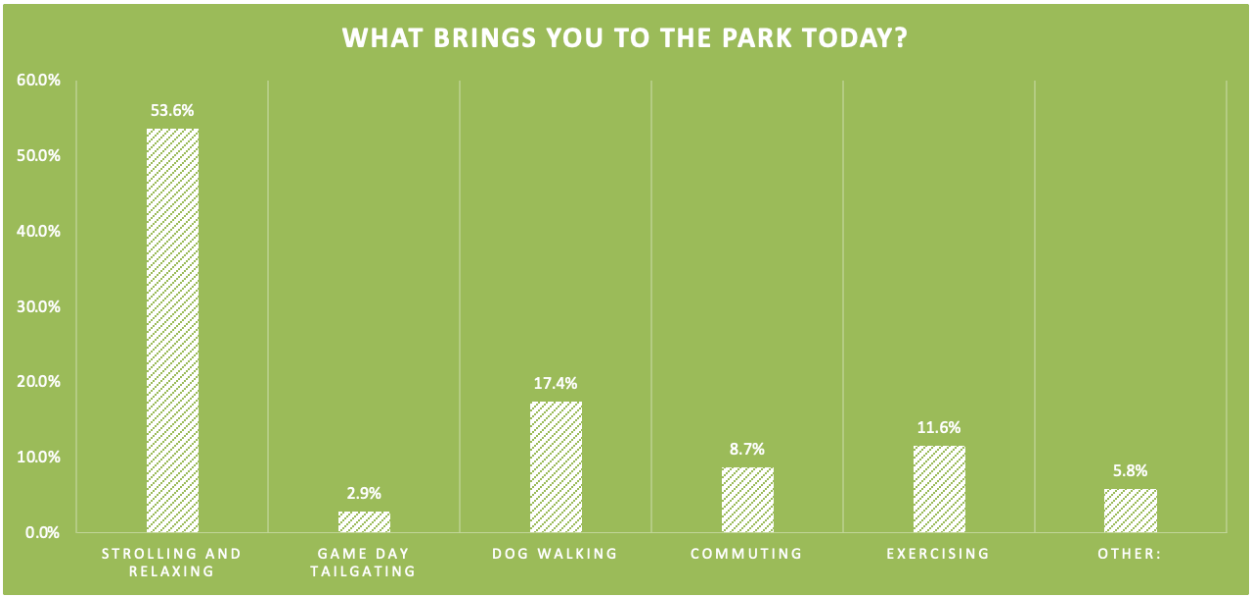


Figure 13: Survey responses to the question: What brings you to the Park today? 69 responses.

Sources:

Gehl, Jan, and Svarre, Birgitte. *How to Study Public Life*. Washington, DC. 2013.

Gehl, Studio San Francisco. *Public Life Diversity Toolkit*. 2015. https://issuu.com/gehlarchitects/docs/gehl_publiclifediversitytoolkit_pag.

SPUR. "Mission Bay." n.d. Design for Walkability. Accessed June 25, 2024. http://www.designforwalkability.com/casesix.

***Limitations** (see more in Survey Overview):*

- The average number of visitors is based on the times when our field visits occurred. Collecting more data could provide a more accurate representation of the average visitors per day.
- The counting is based on our observations, as such are limited to the area that we could observe or eventual distractions.
- As we mentioned in the survey overview, the opinions are representative of a limited number of participants.
- China Basin Park was inaugurated during the first part of our study and noticed changes in the social use of the park, unfortunately our quantitative study does not account for those changes.
- When responding to these questions, participants were able to select more than one option, so the total number of answers is larger than other survey questions.

Enhances social interactions, with 34% of 64 surveyed visitors reporting that they have talked with a stranger in the park and 12% reporting talking with friends of friends.

Background:

Besides being designed for walkability, the Mission Bay Development enhances outdoor life by planning with high density mix-use residential buildings and retail that connects to the sidewalks on the ground floor. With 6,000 market-priced residential units and 1,800 affordable units the neighborhood is diverse enough to keep public life active. Although the building adjacent to the Missions Creek Stormwater Park does not include affordable housing, the quality of public spaces significantly contributes to neighborhood cohesion.

Method:

Based on Gehl's *Public Life Diversity Toolkit*, we surveyed residents of the Mission Bay Development about the social value of the park. We used phrasing from the toolkit, asking participants how often they recognize or talk to neighbors in the park.

Calculations:

Survey result:

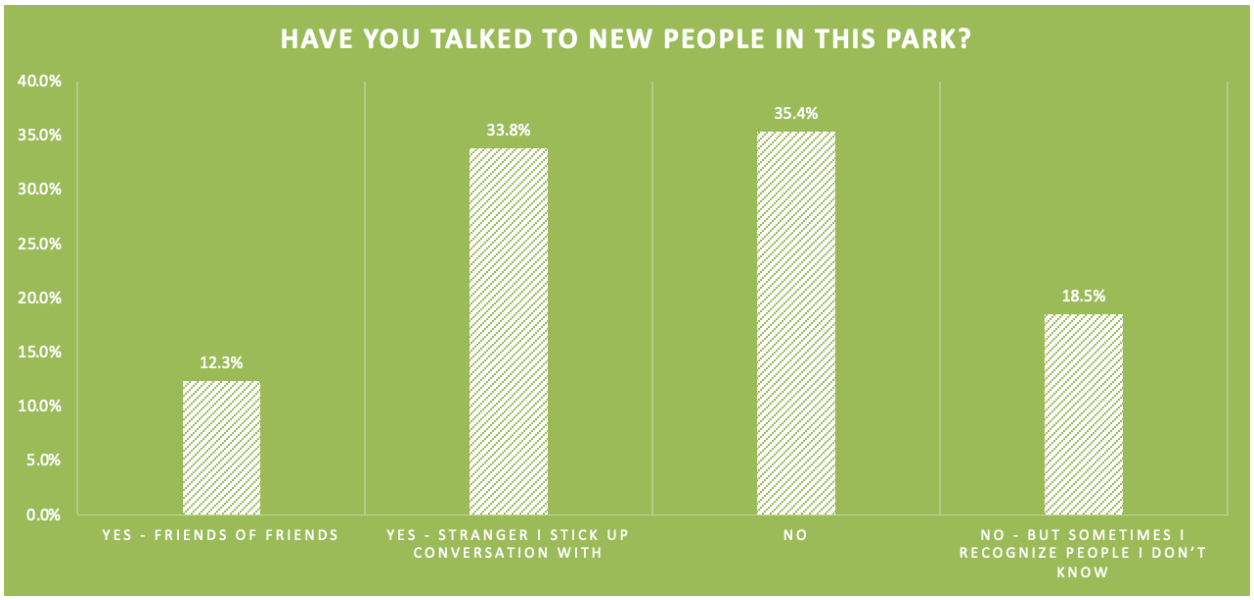


Figure 14: Survey responses to the question: Have you talked to new people in this park?. 64 responses.

Sources:

Gehl, Studio San Francisco. 2015. *Public Life Diversity Toolkit*. https://issuu.com/gehlarchitects/docs/gehl_publiclifediversitytoolkit_pag.

SPUR. “Mission Bay.” n.d. Design for Walkability. Accessed June 25, 2024. http://www.designforwalkability.com/casesix.

Limitations:

- As we mentioned in the survey overview, the opinions are representative of a limited number of participants *(see more in Survey overview)*
- We directed this question only to residents, as such we received fewer responses than in the full survey.

Supports mental health and well-being, with 97% of 64 surveyed visitors reporting that they feel happy after visiting Mission Bay Creek.

Background:

Studies show that access to parks can help improve physical and mental wellness (Cohen et al.). In general, green spaces lead to better health outcomes among residents in comparison to places where residents do not have close access to a park, though accessibility, safety, and context all influence the degree to which users’ mental health is supported by a park (Liu et al.). Mission Creek Stormwater Park operates as a pedestrian corridor and is located near dense commercial and residential spaces as well as local attractions such as the ballpark. Given the park’s accessibility and prime location, we were interested in visitor perceptions of the park, in particular, how visitors felt in the park.

Method:

We used the survey to ask participants how they feel after visiting the park, employing a rating scale with visualized facial expressions to capture their feelings. Based on the survey findings, the study assesses enhancements in mood, satisfaction levels, and overall quality of life among participants.

Calculations:

Survey result:

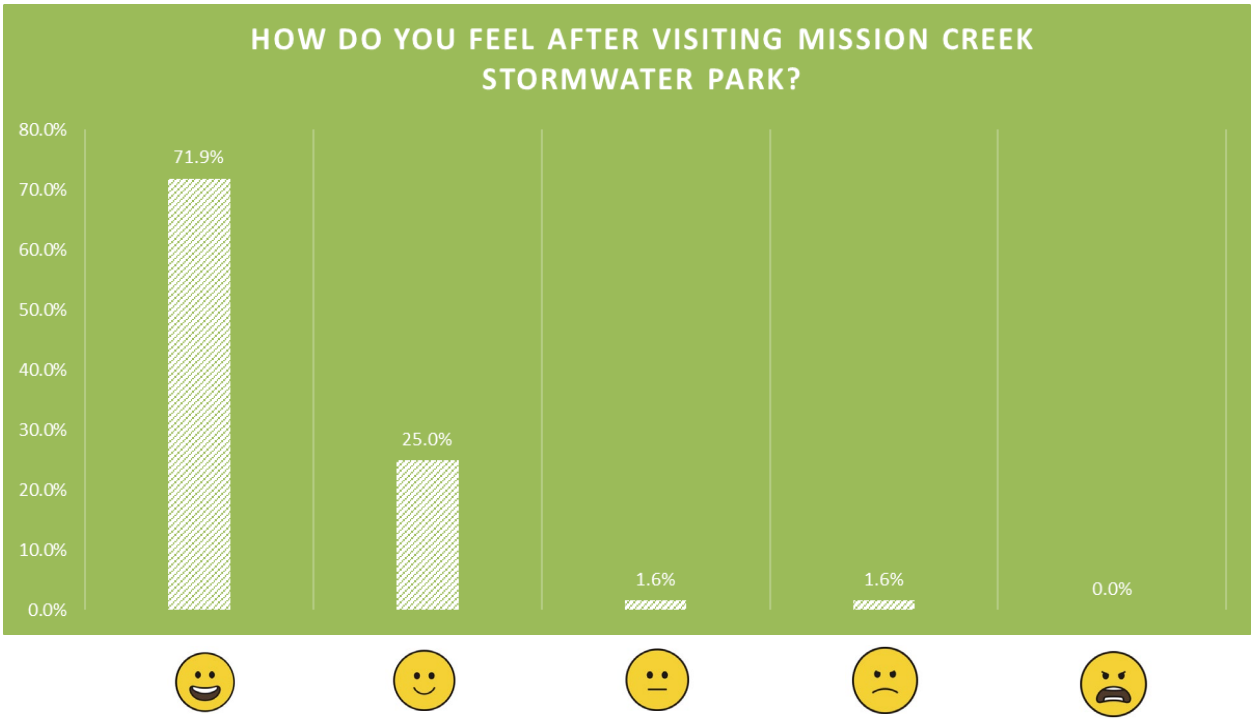


Figure 15: Survey responses to the question: How do you feel after visiting Mission Creek Stormwater Park?. 64 responses.

Sources *(see Survey Overview)*

Cohen, Mychal, Kimberly Burrowes, and Peace Gwam. "The Health Benefits of Parks and Their Economic Impacts." Urban Institute . Urban Institute, February 2022. https://www.urban.org/sites/default/files/2022-03/the-health-benefits-of-parks-and-their-economic-impacts_0.pdf.

Liu, Hongxiao, Feng Li, Juanyong Li, and Yuyang Zhang. "The Relationships between Urban Parks, Residents' Physical Activity, and Mental Health Benefits: A Case Study from Beijing, China." Journal of Environmental Management 190 (April 1, 2017): 223–30. https://doi.org/10.1016/j.jenvman.2016.12.058.

Limitations:

- As mentioned in the survey overview, the opinions are representative of a limited number of participants *(see Survey Overview).*

- There is a possibility that some survey respondents might feel pressured to provide agreeable or positive answers due to our presence during on-site responses.
- Only some survey participants responded to this question and the number of responses is lower than the ideal sample size of the survey.

Encourages outdoor physical activity, with 35% of 69 surveyed visitors reporting that the park has encouraged them to engage in outdoor physical activity. 32% reported visiting the park for the protected corridor to walk, run, or bike.

Background:

The park, which connects Mission Creek Park and China Basin Park into a half mile protected and vegetated corridor, fosters a peaceful and active environment with a 10-foot-wide shared lane for pedestrians, runners, and bikers (Figure 10). Along the creek, the corridor encourages outdoor physical activity with water views of the San Francisco Bay and Mission Creek. The area is characterized by a relatively young population, which contributes to a community that values and utilizes outdoor spaces for exercise and recreation. Some residents mentioned that they visit the park because *"the most important reason is for the safe, protected multi-use lane for walking and biking. But I certainly enjoy the views of the creek and the lush landscape as well,"* and *"it's just so nice walking through! Right on the water!"*

Method:

We used the survey to ask an open question to participants, we asked how they benefit from the park and why they choose to visit this park. Both questions were formatted with alternatives, still we gave the option to express their opinion with the option "Other".

Calculations:

Survey result:

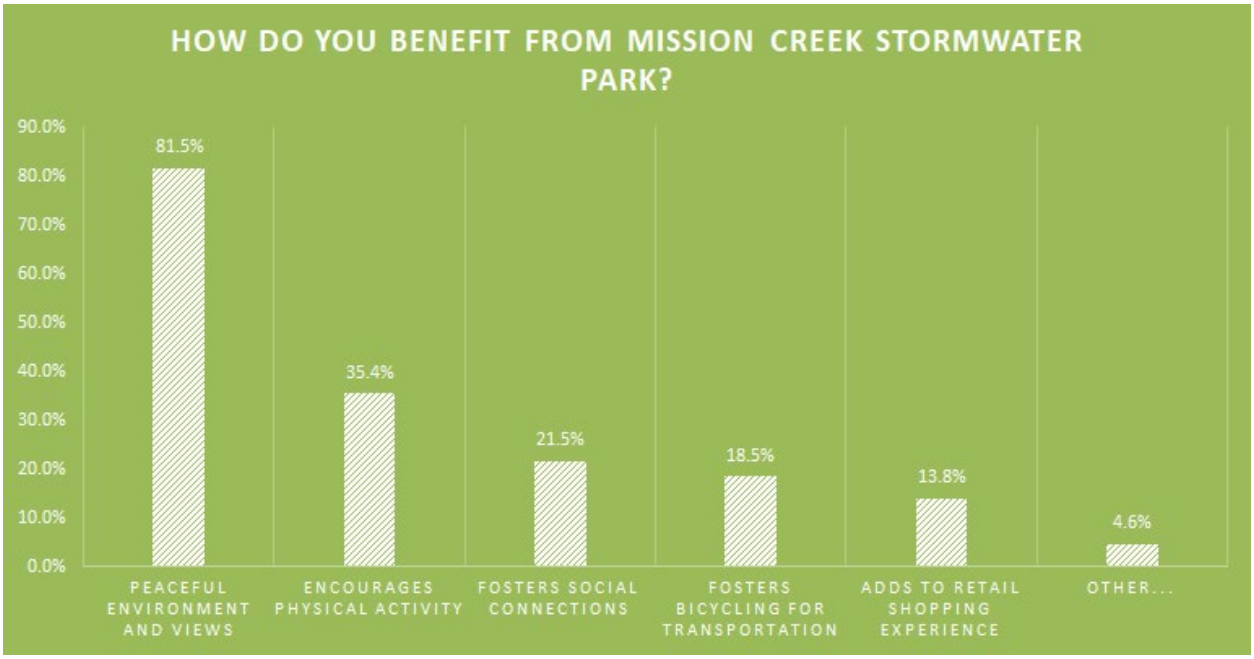


Figure 16: Survey responses to the question: How do you benefit from Mission Creek Stormwater Park?. 69 responses.

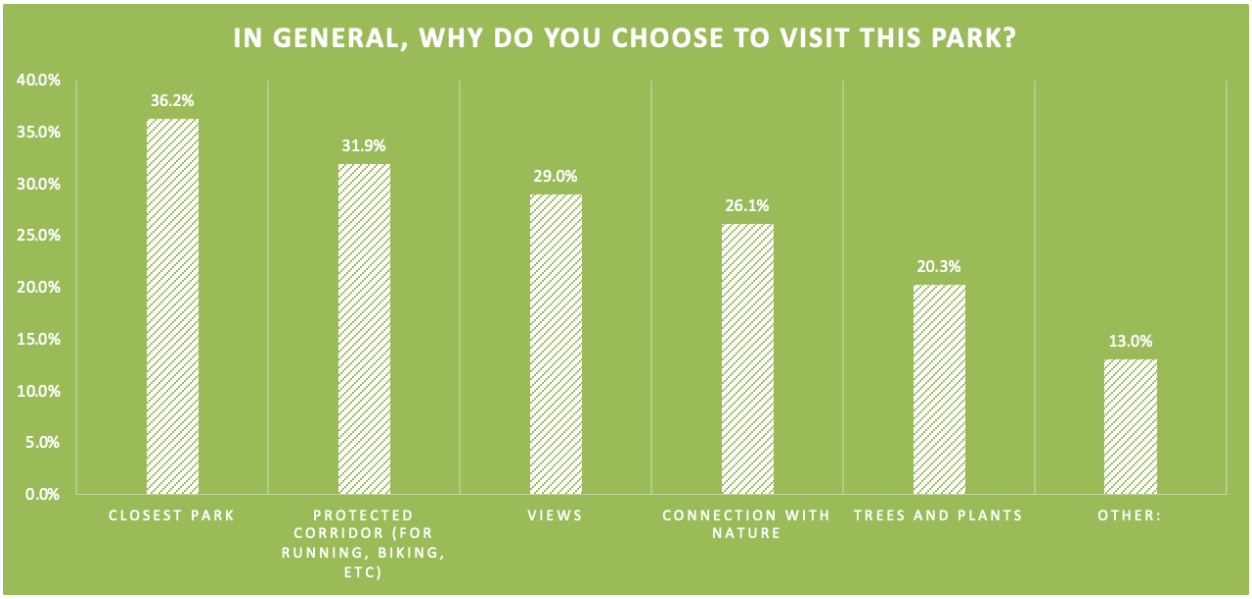


Figure 17: Survey responses to the question: In general, why do you choose to visit this park?. 69 responses.

Sources

(see Survey Overview)

Limitations:

- Visitors exercising in the park were not inclined to stop and answer the survey; as such, it is likely that our findings have underrepresented how many visitors use the park to exercise and believe the presence of the park has encouraged physical activity
- As we mentioned in the survey overview, the opinions are representative of a limited number of participants *(see Survey Overview).*
- When responding to these questions, participants were able to select more than one option, so the total number of answers is larger than other survey questions.

Enhances visual quality of the site, with 82% of 66 surveyed visitors reporting that they benefit from the peaceful environment and views and 93% rating the park's views as good or excellent. 70% of surveyed visitors expressed a positive association with the park's aesthetic.

Background:

Aesthetics play an important role in how people enjoy landscapes and understand their performance. Communities value signs of care in the landscape. In an effort to avoid the messy and to appeal to a traditional sense of aesthetics, this has resulted in manicured choices that decrease the ecological value of landscapes. It becomes the challenge then to modify aesthetic tastes to accommodate some disorder in plantings while creating a visual framework in which it can be appreciated (Nassauer). In Mission Creek Stormwater Park, the bioswale basins have irregular geometric forms with a diverse matrix planting design and create an experience of being embedded in the nature of the bioswales. The park exists as a piece of green infrastructure that also functions as a park.

Method:

We asked survey takers *how they benefit from the park,* and then we asked them to rate the park's views and how the park looks. *(Refer to Appendix F to view survey question format)*

Calculations:

Refer to ***"****Figure 16: Survey responses to the question: How do you benefit from Mission Creek Stormwater Park?"* in the benefit above.

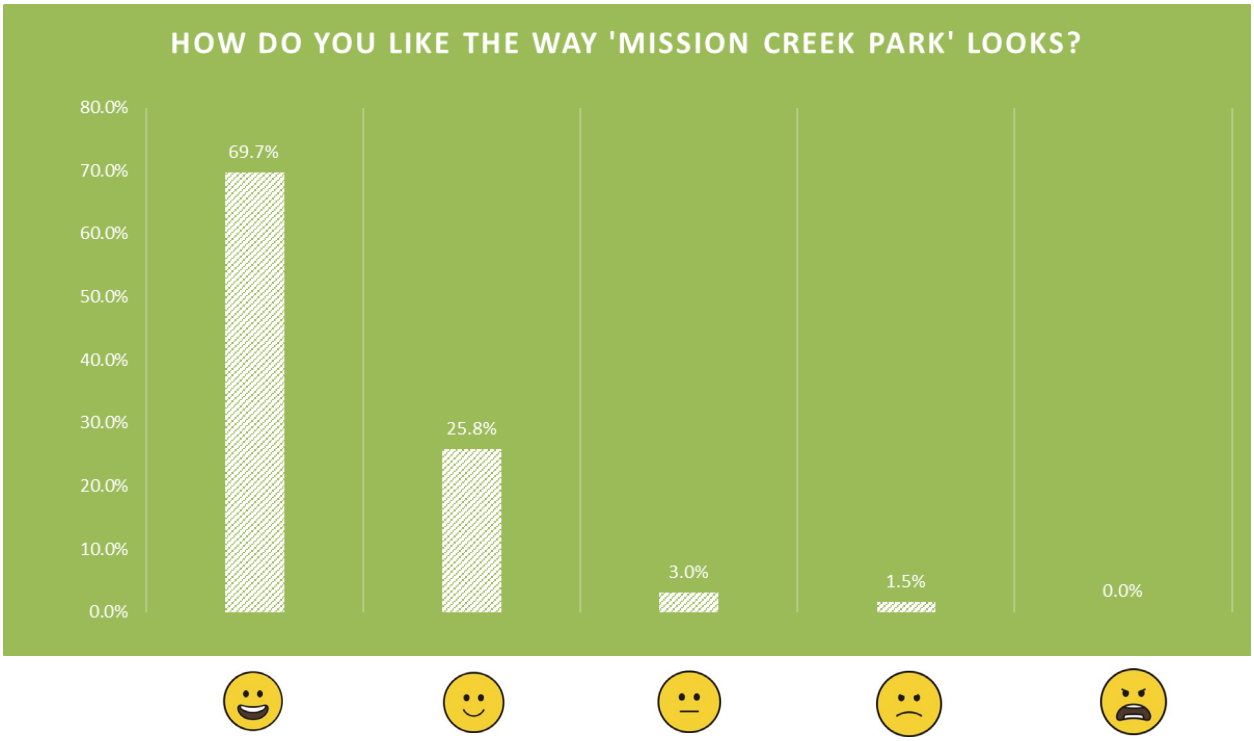


Figure 18: Survey responses to the question: How do you like the way 'Mission Creek Park' looks? 66 responses.

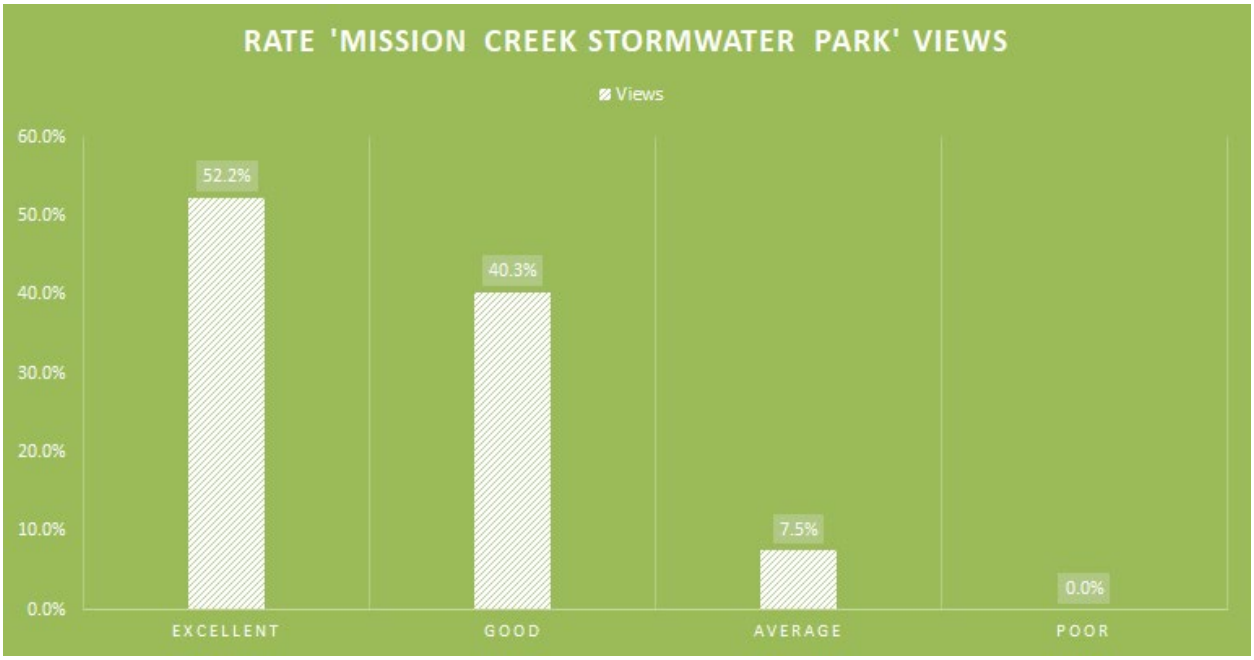


Figure 19: Survey responses to the question: Rate 'Mission Creek Park' views? 64 responses.

Sources:

Warren, Greg. n.d. “Landscape Aesthetics - A Handbook for Scenery Management.”

Nassauer, Joan. n.d. “Cultural Sustainability: Aligning Aesthetics and Ecology.” Accessed May 12 2024. https://deepblue.lib.umich.edu/handle/2027.42/49350?show=full.

Limitations:

- There is a possibility that some survey respondents might feel pressured to provide agreeable or positive answers due to our presence during on-site responses.
- When responding to these questions, participants were able to select more than one option, so the total number of answers is larger than other survey questions.
- As we mentioned in the survey overview, the opinions are representative of a limited number of participants *(see Survey Overview).*

Promotes alternative modes of transportation. 89% of 65 surveyed visitors reported preferring walking as their main mode of nearby transportation, and 25% reported using public transportation to commute locally. 77% of surveyed visitors reported using the park to travel to nearby amenities.

Background:

Mission Creek Stormwater Park was built with Mission Bay Development walkability goals in mind. Walkability principles include creating clear, continuous pedestrian access, and creating fine-grained pedestrian circulation. As mentioned previously, Mission Creek Stormwater Park is a part of a larger corridor of parks along Mission Creek Channel and is meant to help connect pedestrian circulation throughout the area *(refer to previous social benefits for more information)*.

Method:

We asked survey participants what their preferred mode of transportation around the local area is. We also asked if they use the park to travel to nearby places such as shops, work or school.

Calculations:

Survey result:

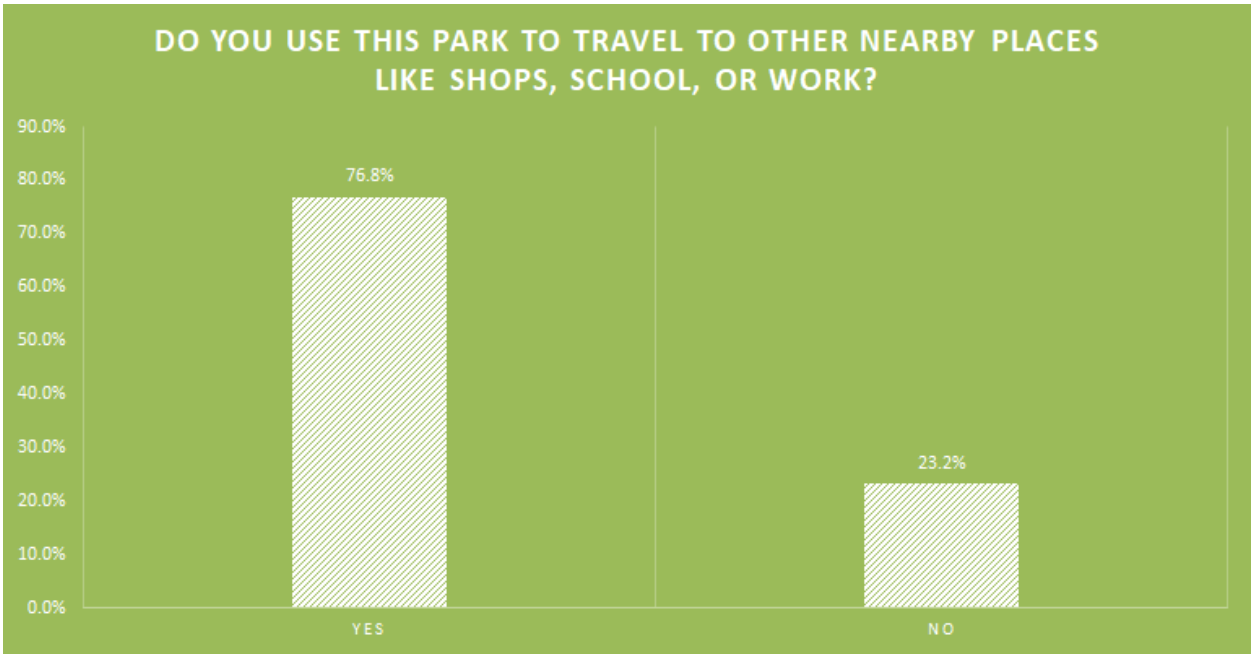


Figure 20: Survey responses to the question: Do you use this park to travel to other nearby places like shops, school, or work ?
69 responses.

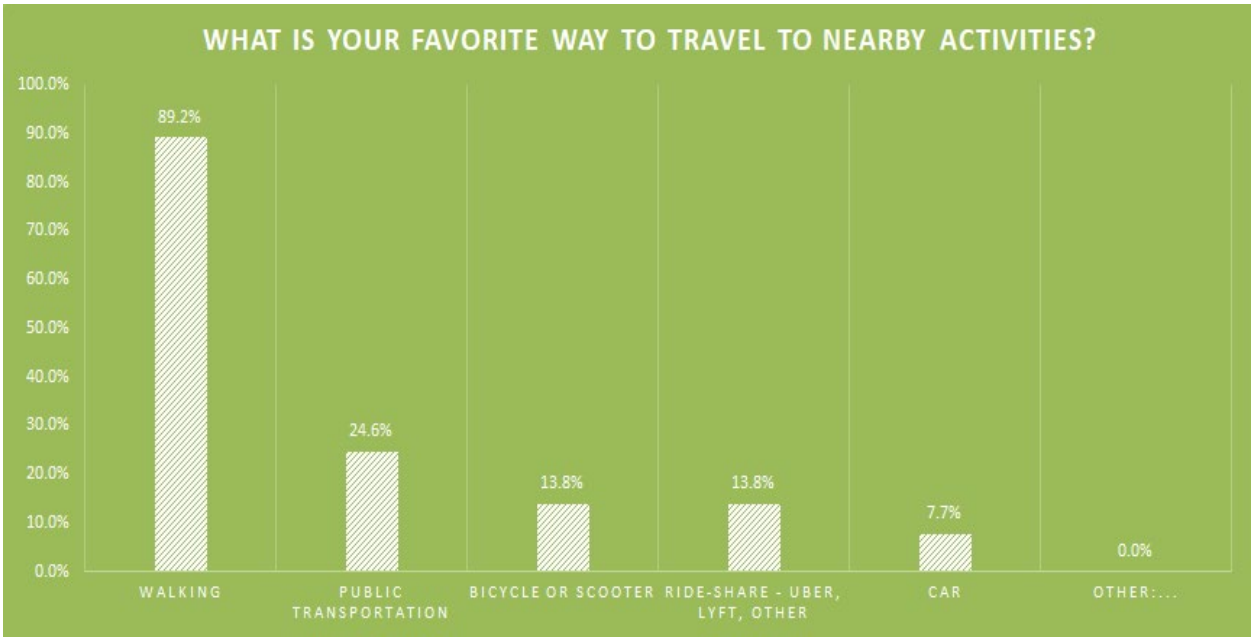


Figure 21: Survey responses to the question: What is your favorite way to travel to nearby activities?
65 responses.

***Sources** (see Survey Overview):*

SPUR. “Mission Bay.” n.d. Design for Walkability. Accessed June 25, 2024. http://www.designforwalkability.com/casesix.

Limitations:

- As we mentioned in the survey overview, the opinions are representative of a limited number of participants *(see Survey Overview).*
- People commuting to an appointment were likely less inclined to stop to answer the survey. As a result, the number of commuters may be underrepresented by the survey results.

Economic Benefits

Catalyzed a 373% increase in average property values in the adjacent residential building, compared to a 234% increase in a similar condo building along a street near Mission Creek Channel.

Background:

A houseboat community has occupied part of the area along Mission Creek Channel since 1960. Prior to the development of the Mission Bay District in 1998, the surrounding area of Mission Creek (or China Basin) was an underutilized and polluted post-industrial landscape. The San Francisco Giants constructed a ballpark in the year 2000 along the south side of the Mission Creek, the first redevelopment project in the area. The plot where Mission Creek Stormwater Park sits was primarily used as an overflow parking for the stadium known as '4th St/Channel St Parking Site.'

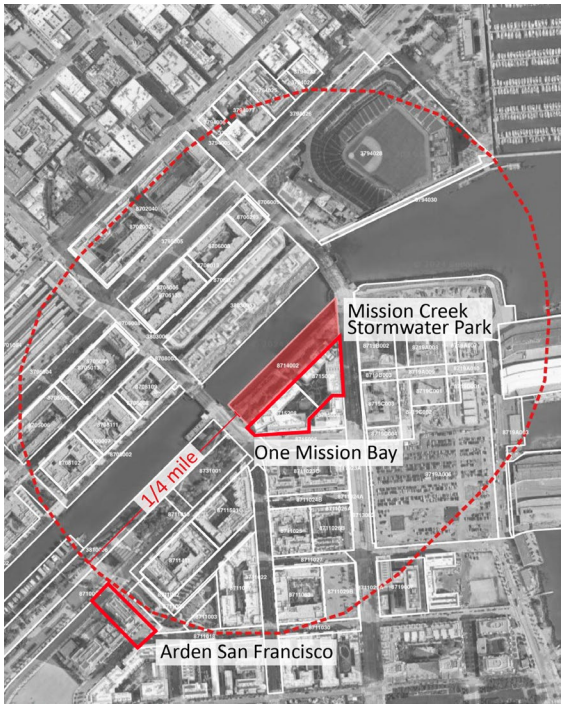
"One Mission Bay" is the building adjacent to the park, completed in 2018. It features 350 residences located at 110 Channel Street and 1000 3rd Street in San Francisco's Mission Bay neighborhood. The residences range from studios to one-, two-, and three-bedroom units. Amenities include a heated outdoor pool with poolside cabanas, private meeting rooms, firepits with outdoor patio barbecues, a private dining room, an indoor lounge with a chef's catering kitchen, an outdoor courtyard lounge, a fitness center with a sauna, a business center with a library, an adjacent hotel and restaurant, ground floor retail shops, and a guest suite (table 06).

A similar building, located quarter of a mile from Mission Bay Stormwater Park, is "Arden San Francisco". The main difference between both condos is that "Arden San Francisco" is adjacent to the street while "One Mission Bay" is directly next to the park (table 06).

Completed in 2016, "Arden San Francisco" features 263 residences, all residents have access to luxury amenities similar to those of One Mission Bay. Approximately 200 residences have two bedrooms, 45 have three bedrooms, and around 12 have one bedroom. Building amenities include landscaped rooftops, an outdoor lap pool and spa, a fireside lounge with an outdoor fireplace and grilling area, a social lounge with a library, and a pet grooming area (table 06).

Method:

We compared the land values per square foot of two residential properties adjacent to Mission Creek Channel. We analyzed the values of the condominium units adjacent to the Mission Creek Stormwater Park and compared these values to a similar building located 0.25 miles away, built only two years earlier, but adjacent to a street instead of directly to the creek shoreline. We studied the price fluctuations between the first year of the building's completion.



One Mission Bay *110 Channel St, San Francisco, CA 94158* Parcels/Block: 8715 Year Built: 2018	**Arden San Francisco** *718 Long Bridge Street, San Francisco, CA 94158* Parcels: 8710/010-276 Year Built: 2016
Outdoor pool & spa	75' rooftop lap pool and spa
Poolside cabanas	Social Lounge with kitchen
Private meeting rooms	Library
Firepits & barbeques	Resident lounge
Private dining room	Firepits & barbeques
Chef's catering kitchen	Outdoor lounge
Resident lounge	Two designer lobbies with attendants
Courtyard lounge	Fitness studio
Fitness center	Secure Garage
Sauna	Controlled building, amenity and elevator access
Library	EV chargers
Private Meeting Rooms	Secured Bike Storage
Game Room	
Guest suite	
Dog Wash	

Table 06: Residential Buildings Location and Community Amenities

To analyze the data available at "Assessor Historical Secured Property Tax Rolls | Socrata API Foundry", we wrote code in Python following the OSEMN framework (Observe, Scrub, Explore, Model, Interpret). To write the code we first identified blocks with suitable residential buildings. We downloaded the data by block, applying similar steps to each area in order to calculate the property value per square footage. We concluded with an interpretation where we overlay and compare the data sets (code in appendix G).

Obtain	+ Inquire data from data.sfgov.org per city block
Scrub	+ Select columns to use: *'closed_roll_year', 'parcel_number', 'lot', 'use_definition', 'lot_area', 'property_area', 'assessed_land_value'* + Delete rows where the property value is less than 0. + Select rows where the use definition is 'Single Family Residential'
Explore	+ Calculate the land value per square footage and create quick graphs. Formula: *$ per sq. ft. = Assessed Land Value/Property Area*
Model	+ Group data by year and calculate average value per square foot per year
iNterpret	+ Tie together the data analysis from the selected blocks, calculate the increase in property value between the first year of completion Formula: *($ per sq. ft. Year completed/ $ per sq. ft. Year of Study) x 100*

Table 07: OSEMN Framework for Data Analysis

Calculations:

Year	**One Mission Bay** Block: 8715	**Arden San Francisco** Block: 8710
2016	N/A	$ 224.24 per sq.ft
2017	N/A	$ 525.10 per sq.ft
2018	$ 195.99 per sq.ft	$ 561.18 per sq.ft
2019	$ 731.93 per sq.ft	$ 589.65 per sq.ft
2020	$ 734.60 per sq.ft	$ 610.19 per sq.ft
2021	$ 730.53 per sq.ft	$ 582.04 per sq.ft
2022	$ 741.10 per sq.ft	$ 623.99 per sq.ft

Table 08: Average Property Land Value per square feet from year completed to 2021

Formula:

Fluctuation Rate = (*$ per sq. ft.* Year of Study / *$ per sq. ft.* Year completed) x 100

One Mission Bay = ($ 731.93 per sq.ft/$ 195.99 per sq.ft) x 100

One Mission Bay = 373.45% increase in property value between its first year of completion

Arden San Francisco = ($ 525.10 per sq.ft/$ 224.24 per sq.ft) x 100

Arden San Francisco = 234.16 % increase in property value between its first year of completion

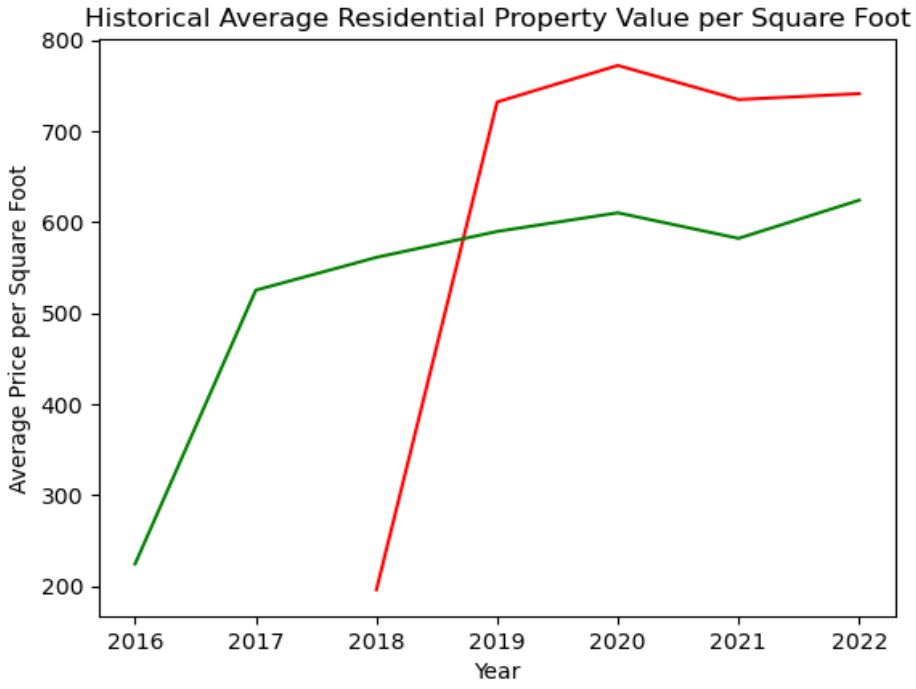


Figure 22: Rate of Property Land Value Fluctuation per square foot between 2016 and 2022

Sources:

"Assessor Historical Secured Property Tax Rolls | Socrata API Foundry." n.d. Accessed May 29, 2024. https://dev.socrata.com/foundry/data.sfgov.org/wv5m-vpq2.

SPUR (San Francisco Bay Area Planning and Urban Research Association). 2016. "The Evolution of Mission Creek." https://www.jstor.org/stable/resrep22910.5.

"SF PIM | Property Information Map | SF Planning." n.d. Accessed May 30, 2024. https://sfplanninggis.org/PIM/.

"U.S. Bureau of Labor Statistics." n.d. Bureau of Labor Statistics. Accessed June 6, 2024. https://www.bls.gov/home.htm.

Hotz, Nick. 2022. "OSEMN Data Science Life Cycle." Data Science Process Alliance. December 31, 2022. https://www.datascience-pm.com/osemn/.

"Arden." n.d. *Jackson Fuller Real Estate San Francisco* (blog). Accessed June 26, 2024. https://jacksonfuller.com/sf/mission-bay/the-arden/.

Limitations:

- The comparison is only between two apartment buildings; for a more accurate study we would need to compare to more apartment buildings in the Mission Bay District.
- The data available from the Historical Secured Property Tax Rolls is limited. As a result, the selection of properties for comparison was restricted to the available data.
- The park opened to the public in 2022, and initially, we wanted to calculate its impact on property value. However, the data available from the Property Tax Roll for this city block only includes data up until 2022, so we were unable to study the effects the park's official opening had on property values in 2023/2023.
- The average property value data from the 'Assessor Historical Secured Property Tax Rolls | Socrata API Foundry' does not represent the market value of the property; as such, the value is lower than the market sale price. *(Refer to the next benefit for an analysis based on the market property value.)*

Supports to an assessed property value that is $232 higher per sf for condos with views of Mission Creek Stormwater Park as compared to similar units overlooking the interior of the building.

Background:

The park's city block has a triangular shape; as such, the adjacent building has an irregular shape. The construction occupies the block's perimeter, leaving space for an interior garden with a pool and other

communal amenities. One of the challenges of this analysis was that the condo's layout varies, making it difficult to compare condos with the same number of bedrooms and bathrooms and equal surface area. That's why we decided to look for similar condos and calculate their selling price per square foot.

On the other hand, the condo's plans available on One Mission website do not include the apartment numbers. To overcome this challenge, we went into Zillow and studied the photos and descriptions of each apartment (Figure 23). This detailed process allowed us to identify which condos overlook the Mission Creek Stormwater Park and the interior garden.

Figure 23: Sample photos from Unit 516 (Creek View) and Unit 526 (Interior View). Source: Zillow

Method:

To compare the average value per square foot of condos facing Mission Creek Stormwater Park with those overlooking the interior garden, we analyzed sold apartments listed on Zillow. First, we examined the pictures and descriptions of the apartments to determine whether they were located on the Mission Creek Stormwater Park side (Figure 23). Then, we compiled their information into two tables, one for the condos on the creek side, and one for the interior garden. Each table includes the unit number, general characteristics (such as the number of bedrooms and bathrooms, and square footage), the sale price, and the date of sale (Table 09 & 10). This allowed us to calculate the price paid per square foot.

Based on the sale's date, we adjusted the sale prices for inflation to reflect their current value in 2024. We used an inflation calculator (SmartAsset) to find the cumulative inflation rate up to this date and applied it to the original sale prices. Finally, we calculated the average value per square foot for 2024 and compared the values of condos facing Mission Creek Stormwater Park with those overlooking the interior garden to determine the difference.

Calculations:

Formulas:

Sold Price ($/sq. ft) = Sold Price ($) / Area (sq. ft)

2024 Price ($/sq. ft.) = [*Sold Price (*$/sq ft) * Cumulative Inflation(Year Sold-2024)] + *Sold Price (*$/sq ft)

Residential Building at 110 Channel St., San Francisco, CA *Condos overlooking Mission Creek*								
Unit	*Bedroom*	*Bath*	*Area (sq. ft.)*	*Sold Price ($)*	*Sold Price ($/sq ft)*	*Sale Date (m/d/y)*	*Cumulative Inflation*	*2024 Price ($/sq ft)*
106	2	2	1196	$1,455,000.00	$1,216.56	7/12/21	15.76%	$1,408.28
414	1	1	759	$1,038,000.00	$1,367.59	5/9/22	6.90%	$1,461.95
313	1	1	758	$1,069,000.00	$1,410.29	3/3/22	6.90%	$1,507.60
514	1	1	758	$1,075,000.00	$1,418.21	8/23/21	15.76%	$1,641.72
516	1	1	508	$839,000.00	$1,651.57	5/4/22	6.90%	$1,765.53
616	1	1	508	$600,000.00	$1,181.10	12/25/23	3.23%	$1,219.25
								Average 2024 Price: $1,500.72 sq. ft.

Table 09: Price Analysis of Units Overlooking Mission Creek Stormwater Park

Residential Building at 110 Channel St., San Francisco, CA *Condos overlooking Interior Garden*								
Unit	*Bedroom*	*Bath*	*Area (sq. ft.)*	*Sold Price ($)*	*Sold Price ($/sq ft)*	*Sale Date (m/d/y)*	*Cumulative Inflation*	*2024 Price ($/sq ft)*
409	1	1	823	$1,045,000.00	$1,269.74	11/12/21	15.76%	$1,469.86
402	1	1	837	$808,000.00	$965.35	5/9/22	6.90%	$1,031.96
421	1	1	763	$888,000.00	$1,163.83	4/10/24	0.00%	$1,163.83
318	1	1	767	$975,000.00	$1,271.19	4/26/23	3.23%	$1,312.25
526	1	1	835	$975,000.00	$1,167.66	9/15/22	6.90%	$1,248.23
626	1	1	835	$1,078,000.00	$1,291.02	7/8/21	15.76%	$1,494.48
								Average 2024 Price: $1,286.77 sq. ft.

Table 10: Price Analysis of Units Overlooking Interior Garden

Price difference per sq ft

Mission Creek Side (~ $/sq. ft.) - Interior Garden Side (~ $/sq. ft.) = Price difference (~ $/sq. ft.)

$1,500.72 sq. ft. - $1,286.77 sq. ft. = **$213.95 sq. ft.**

Sources:

SmartAsset. “Inflation Calculator 2024 - Calculate U.S. Inflation by Year.” SmartAsset. Accessed July 2, 2024. https://smartasset.com/investing/inflation-calculator.

Zillow, Inc. n.d. “110 Channel St San Francisco CA.” Zillow. Accessed July 2, 2024. https://www.zillow.com/b/110-channel-st-san-francisco-ca-9k8YcT/.

Limitations:

- The data available for recently sold condos on Zillow is not complete, therefore the results are representative but not completely accurate.
- The value per square foot might only consider general characteristics of the property, if we consider more specific features the analysis might show other nuances.
- The One Mission Bay building overlooks the park, but also provides views of the channel. It may be that the views of Mission Creek Channel are influencing the price of the units, and we have not determined whether it is the park or the views of Mission Creek Channel itself that may explain the higher value of units facing the park and channel.
- The units facing the park are oriented Northeast, which may have also had some influence on the value of the units.

Contributed to a 40-fold increase, from $87,000 to $3.5 million, in annual property tax revenue collected from the surrounding city block in 2022 compared to the same area in 2013 before the park and buildings were built.

Background:

Historically, the plot where Mission Creek Stormwater Park and the adjacent buildings sit was an industrial area primarily used by Southern Pacific Rail Yards. Prior to the Mission Bay Development, it was primarily used as overflow parking for the stadium known as the ‘4th St/Channel St Parking Site.’

From a legal standpoint, the park became parcel 8714/002 (previously block 3795) in 1999, shortly after Mission Bay Development Group acquired the property. Based on information from “SF PIM | Property Information Map | SF Planning”, the parcel’s assessed land value after being acquired is $0, probably because Mission Bay Development Group planned the site as a public open area. The rest of block 3795 became block 8715, a single 118,745 square foot lot. In 2015, lot 8715 was subdivided into three parts to build two residential buildings and a hotel. The residential building, One Mission Bay, was completed in 2018, with each apartment becoming a single lot, adding up to 353 lots within block 8715. None of these units are planned as affordable housing, therefore tax exemptions are not considered.

Method:

To calculate the changes in tax revenue, first we determined the assessed land value of block 8715 in 2013. We multiplied this value by the tax rate from San Francisco City for the tax year 2013/2014. Next, we calculated the total assessed land value of all properties in block 8715 in 2022 and applied the same 2013/2014 tax rate. We used an inflation calculator (SmartAsset) to find the cumulative inflation rate from 2013 to 2022 and applied the tax revenue in 2013. Finally, the tax revenue from 2013 adjusted to 2022 value was subtracted from the total tax revenue in 2022 to find the difference. This method quantifies the impact of the park and building development on tax revenue over the years.

To analyze the data available at "Assessor Historical Secured Property Tax Rolls | Socrata API Foundry", we wrote code in Python following the OSEMN framework (Observe, Scrub, Explore, Model, Interpret). The code follows these steps and calculation (code in appendix H):

Obtain	+ Inquire data from data.sfgov.org per city block
Scrub	+ Select columns to use: *'closed_roll_year', 'parcel_number', 'lot', 'use_definition', 'lot_area', 'property_area', 'assessed_land_value'* + Delete rows where the property value is less than 0.
Explore	+ Study the lot subdivision along the years to select the most suitable years to compare
Model	+ Calculate the assessed land value per year and multiply by the tax rate of the corresponding year
iNterpret	+ Calculate the Tax Revenue increase between 2013 and 2022

Table 11: OSEMN Framework to Analyze Tax Revenue Data in Python

Calculations:

Block #8715 - Total Tax Revenue - Year 2013	
Total Parcels	1
Total Assessed Value	$ 5,810,598
City and County of San Francisco Tax Rate (Fiscal Year 2013-14)	1.188%

Formula: Total Assessed Value * Tax Rate = Tax Revenue	Tax Revenue 2013: $ 5,810,598 * 1.188% = **$ 69,029.9**
Tax Revenue 2013 value in 2022: (Tax Revenue 2013 * Cumulative Inflation(2013-2022)) + Tax Revenue 2013	Tax Revenue 2013 value in 2022: ($ 69,029.9 * 25.96%) + $ 69,029.9 = **$ 86,950.06**

Table 12: Results from Tax Revenue Analysis Block #8715 - Year 2013

Block #8715 - Total Tax Revenue - Year 2022	
Total Parcels	353
Total Assessed Value (sum of all lots)	$ 296,071,153
City and County of San Francisco Tax Rate (Fiscal Year 2022-23)	1.17769%
Formula: Total Assessed Value * Tax Rate = Tax Revenue	Tax Revenue 2022: $ 296,071,153 * 1.17769% = **$ 3,486,811.67**

Table 13: Results from Tax Revenue Analysis Block #8715 - Year 2022

Tax Revenue increase between 2013 and 2022

Formula:

Tax Revenue difference between 2013-2022 = (Tax Revenue 2022) - (Tax Revenue 2013 in 2022)
Tax Revenue difference between 2013-2022 = $ 3,486,811.67 - $ 86,950.06
Tax Revenue difference between 2013-2022 = **$ 3,399,861.61**

Tax Revenue increase 2013-2022 = Tax Revenue 2022 / Tax Revenue 2013 in 2022
Tax Revenue increase 2013-2022 = $ 3,486,811.67 / $ 86,950.06
Tax Revenue increase 2013-2022 = **40.1 times or 3,910%**

Sources:

"Assessor Historical Secured Property Tax Rolls | Socrata API Foundry." n.d. Accessed May 29, 2024. https://dev.socrata.com/foundry/data.sfgov.org/wv5m-vpq2.

"Secured Property Taxes." 2023. Treasurer & Tax Collector. November 29, 2023. https://sftreasurer.org/property/secured-property-taxes.

Hotz, Nick. 2022. "OSEMN Data Science Life Cycle." Data Science Process Alliance. December 31, 2022. https://www.datascience-pm.com/osemn/.

SmartAsset. “Inflation Calculator 2024 - Calculate U.S. Inflation by Year.” SmartAsset. Accessed July 2, 2024. https://smartasset.com/investing/inflation-calculator.

“SF PIM | Property Information Map | SF Planning.” n.d. Accessed May 30, 2024. https://sfplanninggis.org/PIM/.

Limitations:

- The calculations only considered Secured Property Taxes and do not consider exemptions, sales taxes, or supplements taxes. As such the value is an average that might change if one considers more specific information.
- If we compare the tax revenue to earlier years, the increase might be even higher. Due to data availability, we decided to choose the year the developer acquired the land with the residential building planned, rather than before the Mission Bay Development Group bought the land.
- This calculation isolates the park’s block as a unique entity. However, it is part of a larger development, and the increase in property value is not solely due to the park but also to the overall improvement in neighborhood quality.
- We only studied the revenue from property taxes and did not include exemptions.
- We did not calculate the tax revenue generated by the sale of the units.

Appendix A: Surface Area Calculations

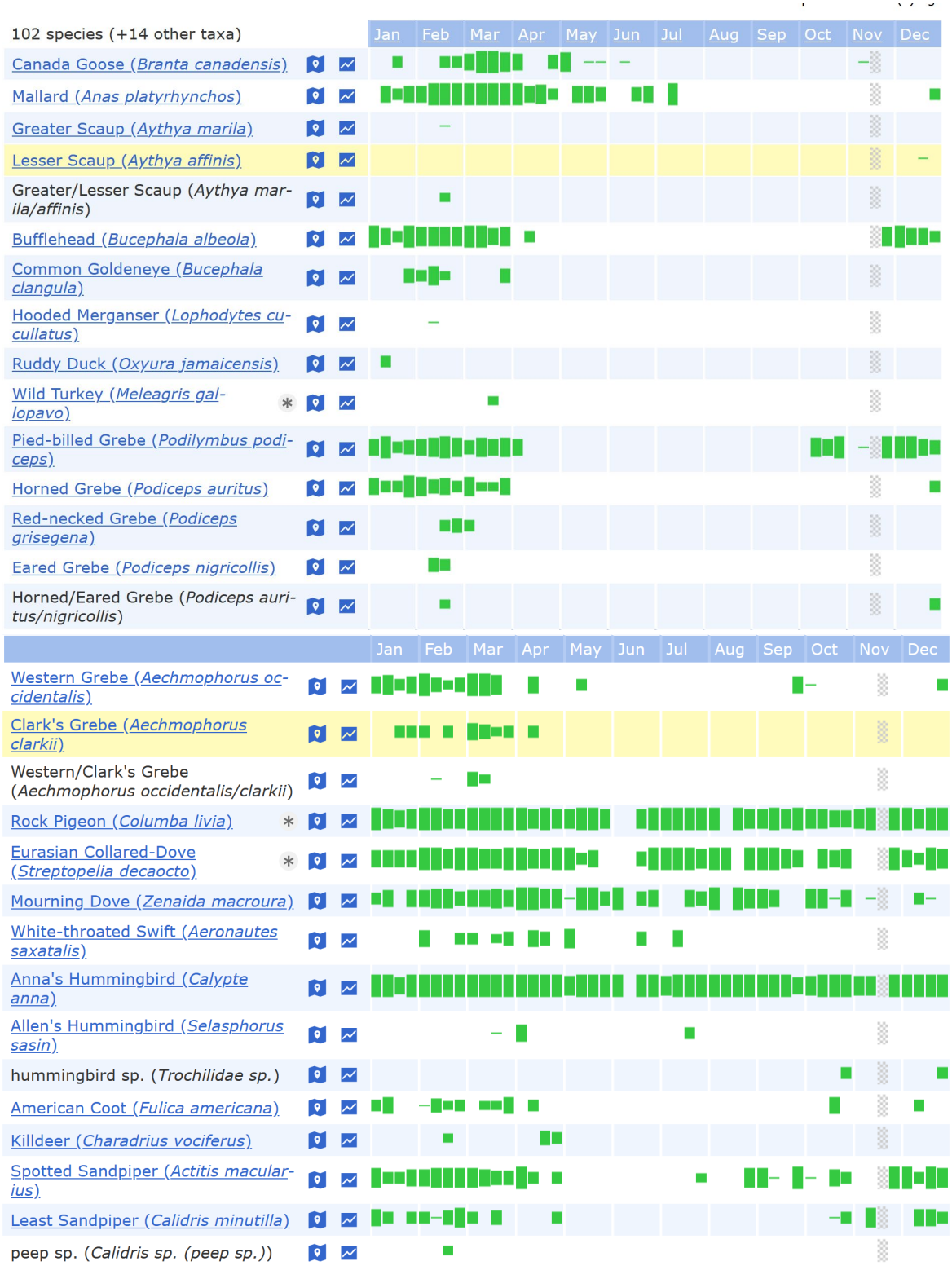
Mission Bay Stormwater Park Area	*sq. ft*	*acres*
Pavement + Boardwalks	37,928.30	0.88
Permeable Pavement	1,796.73	0.04
Planters *(next to basins and building)*	5,734.97	0.13
Bioretention Basins	6,482.00	0.15
Total Area	**51,942.00**	**1.19**
Calculations based on the area	*sq. ft*	*acres*
Total Softscape *(Planters + Bioretention Basins)*	12,216.97	0.28
Total Hardscape *(Pavement + Boardwalks + Permeable Pavement)*	39,725.03	0.91
Drainage Management Area 1 **(Total Park Area - Bioretention Basins)**	**45,460**	**1.04**
Shoreline Area	*sq. ft*	*acres*
Rip-rap	4,575.30	0.11
Shoreline Planting	11,063.03	0.25
Total Shoreline Area	**15,638**	**0.36**

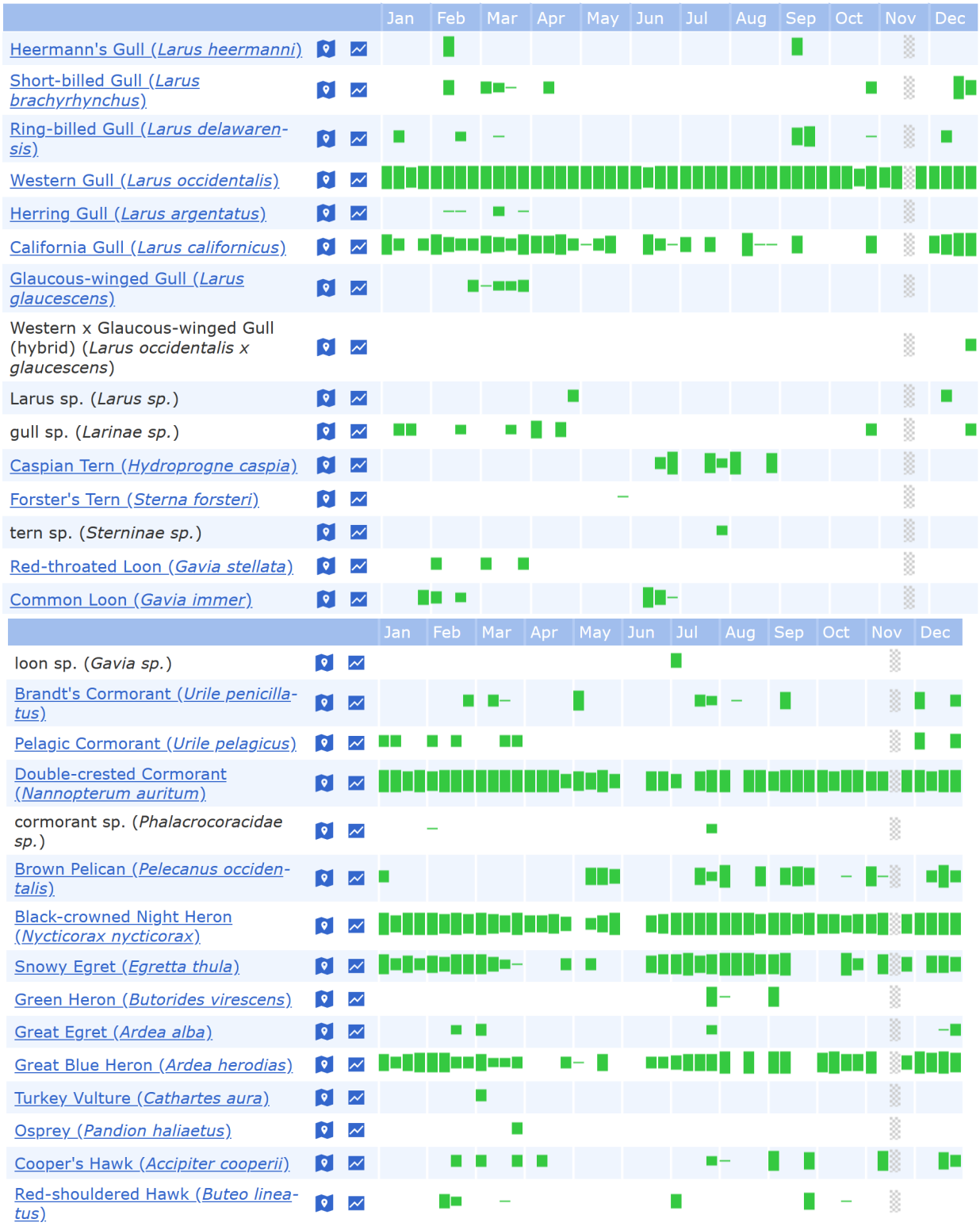
Appendix B: Plant and Habitat Survey

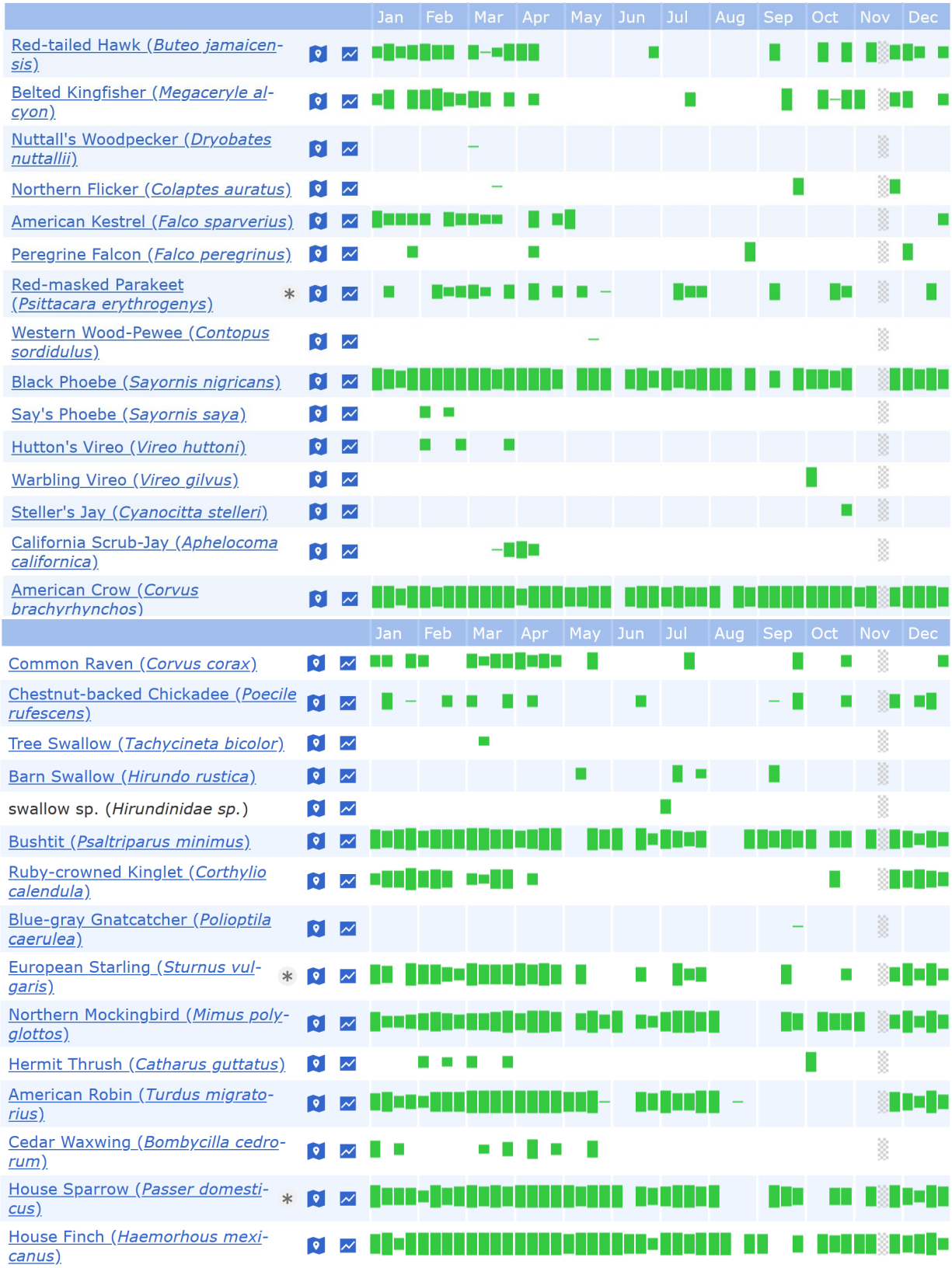
BASED ON CONSTRUCTION DOCUMENTS AND FIELD OBSERVATION													
TREES													
Scientific name	Common Name	California Native	Native	Species	%	Observed on site	Pollinator Friendly	%	special value- pollinators	attracts birds	Larval Host	Attracts butterflys/ moths	Attracts Bees/ other insects
Acer negundo 'Sensation'	CALIFORNIA BOX ELDER	CALIFORNIA NATIVE	1	1		YES	1		Butterflies	Songbirds	YES- VARIOUS SPEC	YES	
Lophostemon confertus	BRISBANE BOX	NON-NATIVE	0	1		YES	0						
Ginko biloba 'Autmn gold'	FASTIGATA MAIDENHAIR TREE	NON-NATIVE	0	1		YES	0						
Quercus agrifolia	COAST LIVE OAK	CALIFORNIA NATIVE	1	1		YES	1		Butterflies	Songbirds	YES- VARIOUS SPEC	YES	
Salix caprea	PUSSY WILLOW	NON-NATIVE	0	1		YES	1			Songbirds		YES	YES
		Total Native	2	5	40%		3	60%					
SALT MARSH AND BANK PLANTING													
Scientific name	Common Name	California Native	Native	Species	%	Observed on site	Pollinator Friendly	%	special value- pollinators	attracts birds	Larval Host	Attracts butterflys/ moths	Attracts Bees/ other insects
Jaumea carnosa	JAUMEA	CALIFORNIA NATIVE	1	1		YES	1					YES	YES
Calamagrostis nutkaensis	PACIFIC REED GRASS	CALIFORNIA NATIVE	1	1		YES	1			Songbirds			YES (other beneficial insects, not bees)
Festuca mairei	ATLAS FESCUE	NON-NATIVE	0	1		YES	0						
Grindelia hirsutula var. maritima	GUM PLANT	CALIFORNIA NATIVE	1	1		YES	1		Naive bee, Butterflies			YES	YES
Erigeron glaucus	SEASIDE DAISY	CALIFORNIA NATIVE	1	1		YES	1		Honeybees				YES
Baccharis pilularis 'Pigeon Point'	DWARF COYOTE BRUSH	CALIFORNIA NATIVE	1	1		YES	1		Native bees, Beneficial Insects, Butterflies			YES	YES
Ceanothus 'Julia Phelps'	JULIA PHELPS CALIFORNIA LILAC	CALIFORNIA NATIVE	1	1		YES	1		Butterflies, Native Bees, Beneficial Insects		YES - VARIOUS BUT	YES	YES
Achillea millefolium 'Paprika'	YARROW 'PAPRIKA'	CALIFORNIA NATIVE	1	1		YES	1		Native bees	YES		YES	YES
Artemisia californica 'Canyon Gray'	CANYON GRAY CALIFORNIA SAGEBRUSH	CALIFORNIA NATIVE	1	1		YES	1		Native bees	Songbirds		YES	YES
		Total Native	8	9	89%		8	89%					
PARK PLANTING _UPLAND													
Scientific name	Common Name	California Native	Native	Species	%	Observed on site	Pollinator Friendly	%	special value- pollinators	attracts birds	Larval Host	Attracts butterflys/ moths	Attracts Bees/ other insects
Ceanothus gloriosus 'Anchor Bay'	ANCHOR BAY CALIFORNIA LILAC	CALIFORNIA NATIVE	1	1		YES	1		Butterflies, Native Bees, Beneficial Insects		YES - VARIOUS BUT	YES	YES
Erigeron glaucus	SEASIDE DAISY	CALIFORNIA NATIVE	1	1		YES	1		Honeybees				YES
Festuca mairei	ATLAS FESCUE	NON-NATIVE	0	1		YES	0						
Achillea millefolium 'Paprika'	YARROW 'PAPRIKA'	CALIFORNIA NATIVE	1	1		YES	1		Native bees	YES		YES	YES
Artemisia californica 'Canyon Gray'	CANYON GRAY CALIFORNIA SAGEBRUSH	CALIFORNIA NATIVE	1	1		YES	1		Native bees	Songbirds		YES	YES
Anemanthele lessoniana	NEW ZEALAND WIND GRASS	NON-NATIVE	0	1		YES	0						
Dorycnium hirsutum	HAIRY CANARY FLOWER	NON-NATIVE	0	1		YES	0		Hummingbirds, Butterflies	YES		YES	
Penstemon heterophyllus 'Margarita Bop'	FOOTHILL PENSTEMON	CALIFORNIA NATIVE	1	1		YES	1		Native Bees, Bumble Bees, Butterflies		YES (chalcedon che	YES	YES
		Total Native	5	8	63%		5	63%					
PARK PLANTING _TOWNHOME PLANTER		non-repeat	3	5									
Scientific name	Common Name	California Native	Native	Species	%	Observed on site	Pollinator Friendly	%	special value- pollinators	attracts birds	Larval Host	Attracts butterflys/ moths	Attracts Bees/ Other Beneficial insects
RHAMNUS CALIFORNICA 'MOUND SAN BRUNO'	MOUND SAN BRUNO COFFEEBERRY	CALIFORNIA NATIVE	1	1		YES	1			YES			YES
CEANOTHUS GLORIOSUS 'HEART'S DESIRE'	HEART'S DESIRE CALIFORNIA LILAC	CALIFORNIA NATIVE	1	1			1		Butterflies, Native Bees, Beneficial Insects		YES - VARIOUS BUT	YES	YES
LOMANDRA HISTRIX 'TROPIC BELLE'	TROPIC BELLE MAT RUSH	NON-NATIVE	0	1			0						
CALAMAGROSTIS FOLIOSA	MENDOCINO REED GRASS	CALIFORNIA NATIVE	1	1			1						YES
		Total Native	3	4	75%		3	75%					
PARK PLANTING _STORMWATER TREATMENT		non-repeat											
Scientific name	Common Name	California Native	Native	Species	%	Observed on site	Pollinator Friendly	%		attracts birds	Larval Host	Attracts butterflys a/o moth	Attracts Bees a/o Beneficial Insects
Juncus effusus	COMMON RUSH	CALIFORNIA NATIVE	1	1		YES	1			Songbirds			N/A
Calamagrostis nutkaensis	PACIFIC REED GRASS	CALIFORNIA NATIVE	1	1		YES	1			Songbirds			YES (other beneficial insects, not bees)
Festuca mairei	ATLAS FESCUE	NON-NATIVE	0	1		YES	0						
Epilobium canum	CALIFORNIA FUSCHIA	CALIFORNIA NATIVE	1	1		YES	1		Hummingbirds, Moths, Native bees	Hummingbirds, Song Birds	YES (Hyles linneata	YES	YES
Verbena bonariensis	PURPLE TOP VERVAIN	NON-NATIVE	0	1		YES	1		Butterflies (California Dogface, Mournful Duskywing)			YES	YES
Erythranthe guttata	SEEP MONKEY FLOWER	CALIFORNIA NATIVE	1	1		YES	1		Native bees	Hummingbirds, Song Birds		YES	YES
Artemisia californica 'Canyon gray'	CALIFORNIA SAGE BRUSH	CALIFORNIA NATIVE	1	1		YES	1		Native bees	Songbirds		YES	YES
Erythranthe cardinalis	SCARLETT MONKEY FLOWER	CALIFORNIA NATIVE	1	1		YES	1		Hummingbirds	Hummingbirds, Song Birds		YES	YES
Achillea millefolium 'Paprika'	YARROW 'PAPRIKA'	CALIFORNIA NATIVE	1	1		YES	1		Native bees	YES		YES	YES
Carex tumulicola (dumosa)	BERKELEY SEDGE	CALIFORNIA NATIVE	1	1		YES	1						
Carex densa (dudleyi)	DENSE SEDGE	CALIFORNIA NATIVE	1	1		YES	1					YES	
Festuca rubra	RED FESCUE	CALIFORNIA NATIVE	1	1		YES	0						
Calystegia (soldanella?)	BEACH MORNING GLORY	CALIFORNIA NATIVE	1	1		YES			Native bees			YES	YES
		Total Native	11	13	85%		10	77%					
		30 total species											
		23 native species											
		16 species with special value to pollinators											
WEEDS IDENTIFIED ON SITE (NOT PLANTED PURPOSEFULLY)													
Epilobium ciliatum	FRINGED WILLOWHERB	CALIFORNIA NATIVE											
Euphorbia peplus	PETTY SPURGE	NON-NATIVE											
Avena fatua	WILD OATS	NON-NATIVE											
Sonchus oleraceus	SOW THISTLE	NON-NATIVE											

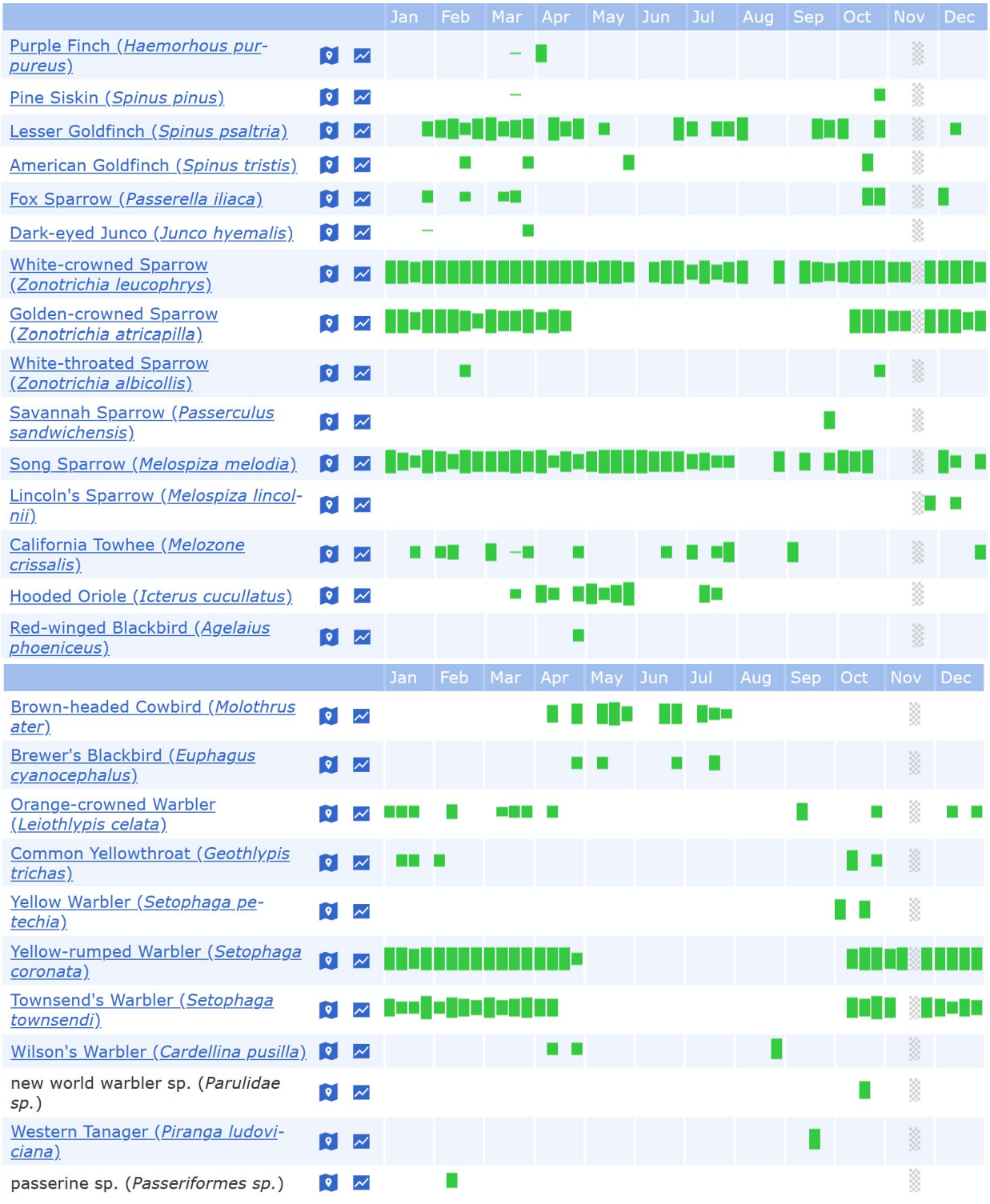
Appendix C: eBird Data Chart for 2020 - June 2024

Chart created using the barchart tool on the eBird website




Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Heermann's Gull (Larus heermanni)
Short-billed Gull (Larus brachyrhynchus)
Ring-billed Gull (Larus delawarensis)
Western Gull (Larus occidentalis)
Herring Gull (Larus argentatus)
California Gull (Larus californicus)
Glaucous-winged Gull (Larus glaucescens)
Western x Glaucous-winged Gull (hybrid) (Larus occidentalis x glaucescens)
Larus sp. (Larus sp.)
gull sp. (Larinae sp.)
Caspian Tern (Hydroprogne caspia)
Forster's Tern (Sterna forsteri)
tern sp. (Sterninae sp.)
Red-throated Loon (Gavia stellata)
Common Loon (Gavia immer)
loon sp. (Gavia sp.)
Brandt's Cormorant (Urile penicillatus)
Pelagic Cormorant (Urile pelagicus)
Double-crested Cormorant (Nannopterum auritum)
cormorant sp. (Phalacrocoracidae sp.)
Brown Pelican (Pelecanus occidentalis)
Black-crowned Night Heron (Nycticorax nycticorax)
Snowy Egret (Egretta thula)
Green Heron (Butorides virescens)
Great Egret (Ardea alba)
Great Blue Heron (Ardea herodias)
Turkey Vulture (Cathartes aura)
Osprey (Pandion haliaetus)
Cooper's Hawk (Accipiter cooperii)
Red-shouldered Hawk (Buteo lineatus)


Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Red-tailed Hawk (Buteo jamaicensis)
Belted Kingfisher (Megaceryle alcyon)
Nuttall's Woodpecker (Dryobates nuttallii)
Northern Flicker (Colaptes auratus)
American Kestrel (Falco sparverius)
Peregrine Falcon (Falco peregrinus)
Red-masked Parakeet (Psittacara erythrogenys) *
Western Wood-Pewee (Contopus sordidulus)
Black Phoebe (Sayornis nigricans)
Say's Phoebe (Sayornis saya)
Hutton's Vireo (Vireo huttoni)
Warbling Vireo (Vireo gilvus)
Steller's Jay (Cyanocitta stelleri)
California Scrub-Jay (Aphelocoma californica)
American Crow (Corvus brachyrhynchos)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Common Raven (Corvus corax)
Chestnut-backed Chickadee (Poecile rufescens)
Tree Swallow (Tachycineta bicolor)
Barn Swallow (Hirundo rustica)
swallow sp. (Hirundinidae sp.)
Bushtit (Psaltriparus minimus)
Ruby-crowned Kinglet (Corthylio calendula)
Blue-gray Gnatcatcher (Polioptila caerulea)
European Starling (Sturnus vulgaris) *
Northern Mockingbird (Mimus polyglottos)
Hermit Thrush (Catharus guttatus)
American Robin (Turdus migratorius)
Cedar Waxwing (Bombycilla cedrorum)
House Sparrow (Passer domesticus) *
House Finch (Haemorhous mexicanus)


Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Purple Finch (Haemorhous purpureus)
Pine Siskin (Spinus pinus)
Lesser Goldfinch (Spinus psaltria)
American Goldfinch (Spinus tristis)
Fox Sparrow (Passerella iliaca)
Dark-eyed Junco (Junco hyemalis)
White-crowned Sparrow (Zonotrichia leucophrys)
Golden-crowned Sparrow (Zonotrichia atricapilla)
White-throated Sparrow (Zonotrichia albicollis)
Savannah Sparrow (Passerculus sandwichensis)
Song Sparrow (Melospiza melodia)
Lincoln's Sparrow (Melospiza lincolnii)
California Towhee (Melozone crissalis)
Hooded Oriole (Icterus cucullatus)
Red-winged Blackbird (Agelaius phoeniceus)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Brown-headed Cowbird (Molothrus ater)
Brewer's Blackbird (Euphagus cyanocephalus)
Orange-crowned Warbler (Leiothlypis celata)
Common Yellowthroat (Geothlypis trichas)
Yellow Warbler (Setophaga petechia)
Yellow-rumped Warbler (Setophaga coronata)
Townsend's Warbler (Setophaga townsendi)
Wilson's Warbler (Cardellina pusilla)
new world warbler sp. (Parulidae sp.)
Western Tanager (Piranga ludoviciana)
passerine sp. (Passeriformes sp.)

Appendix D: Population Overview

ZIP CODE 9158

- **Total Population:** 11,327 (2020 Decennial Census)
- **Median age:** 33.6 (2022 American Community Survey 5-Year Estimates*) (37.9 Median Age in CA)*
- **Total Housing Units:** 5,207 (2020 Decennial Census)
- **Total Households:** 4,501 (2022 American Community Survey 5-Year Estimates)
- **Median Household Income** (2022 American Community Survey 5-Year Estimates)
    - $180,208 (ZIP CODE 9158)
    - $91,551 (California State)
- **Employment:** 76.6%
- **Education:** 75.8% have a Bachelor's Degree or Higher (2022 American Community Survey 5-Year Estimates) *(37.0% Median Age in CA)*
- **Language Spoken at Home** (2022 American Community Survey 5-Year Estimates)
    - English only: 46.2%
    - Spanish: 10.6%
    - Other Indo-European languages: 12.9%
    - Asian and Pacific Islander languages: 29.3%
    - Other languages: 0.9%
- **Poverty:** 7.7% (2022 American Community Survey 5-Year Estimates)
- **Commuting:** 33.1 average time to work (in minutes) (2022 American Community Survey 5-Year Estimates)
- **Means of Transportation to Work (Workers 16 Years and Over)**
    - Drove alone: 19%
    - Carpool: 3.5%
    - Public transportation: 18.3%
    - Walked: 17.9%
    - Bicycle: 3.1%
    - Taxicab, motorcycle, or other means: 2.5%
    - Worked from home: 35.8%

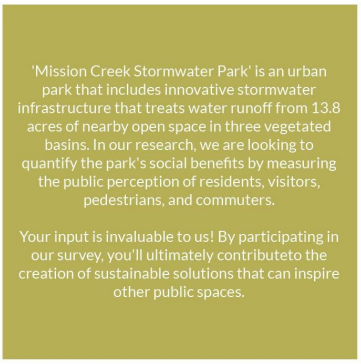
Sources:

"ZCTA5 9158 - Census Bureau Profile." n.d. Accessed May 22, 2024. https://data.census.gov/profile/9158?g=860XX00US94124.

Appendix E: Survey Graphic Material

Name Tag with QR code

Social Media



Flyer

Appendix F: Survey Questionnaire and Results

Berkeley
UNIVERSITY OF CALIFORNIA

What do you think about 'Mission Creek Stormwater Park'?
Public Survey

Hello! We are Victoria Mohr and Mary Devlin, researchers from the department of Landscape Architecture and Environmental Planning at the University of California, Berkeley. We are investigating “Mission Creek Stormwater Park” as part of the Case Study Investigation (CSI) program, a research collaboration and training program for faculty, students, and practitioners sponsored by the Landscape Architecture Foundation.

'Mission Creek Stormwater Park' is an urban park that includes innovative stormwater infrastructure that treats water runoff from 13.8 acres of nearby open space in three vegetated basins. In our research, we are looking to quantify the park's social benefits by measuring the public perception of residents, visitors, pedestrians, and commuters.

Your input is invaluable to us! By participating in our survey, you'll ultimately contribute to the creation of sustainable solutions that can inspire other public spaces.

Eligibility
To be eligible to participate in this survey, you must be over 18 years old and have visited the 'Mission Creek Stormwater Park' at least once.

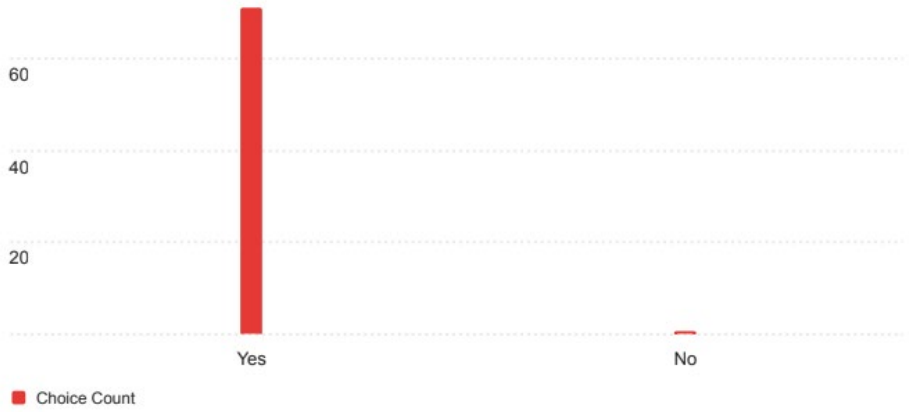
Privacy
We are not collecting any identifying information in order to safeguard participants.

Risks
- If you have encountered negative situations or perceptions in a public park, you may experience mild stress or discomfort when recalling those experiences while answering the questionnaire.
- You may feel uneasy about disclosing personal information, such as frequency of park visits or how far you live from the park. If so, you can skip that question.
- There is a slight risk of a breach of confidentiality if unauthorized individuals gain access to survey data.
- Participation in the survey may require your time and effort, potentially leading to minor inconveniences. However, there are no direct economic or social consequences associated with involvement in the study, and participation is voluntary.

By starting this survey, you voluntarily agree to participate in this research. You have the right to withdraw from the survey at any time without any penalty or consequence.

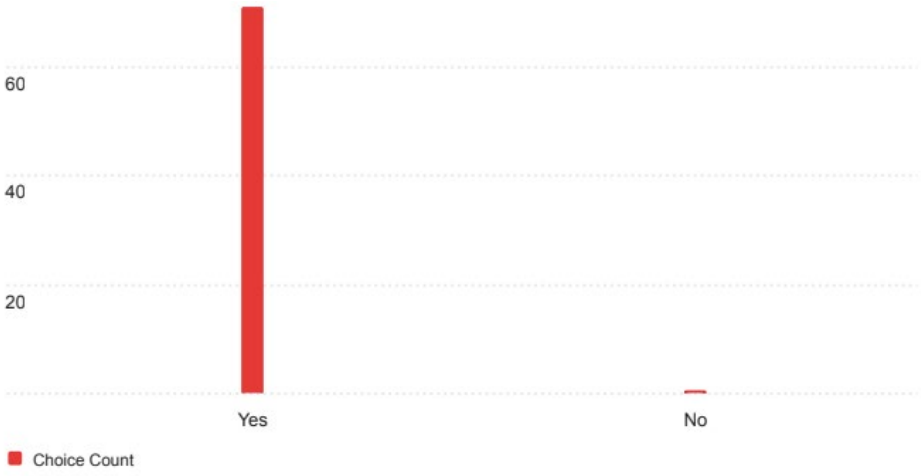
Please answer the following questions to determine your eligibility for this survey. Your responses will help us ensure that participants meet the necessary criteria for this research.

1. Are you over 18?



---

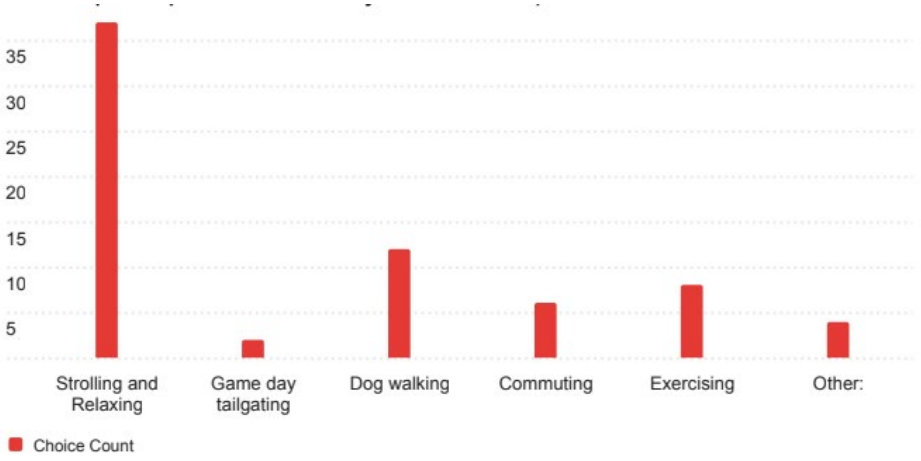
2. Have you visited MIssion Creek Stormwater Park before?



For each of the following questions, please select the option that best represents your opinion or experience. You can only choose one answer per question unless

otherwise specified.

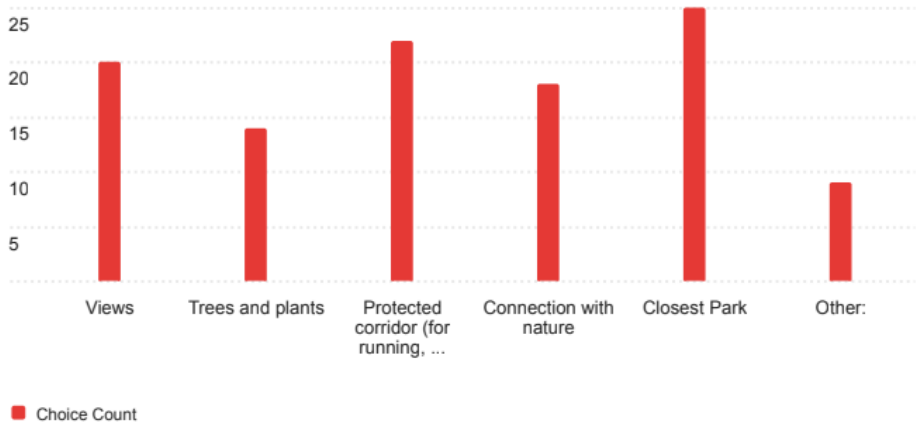
3. What brings you to the park today?



If you selected 'Other,' please specify here:
Dog walking and exercising
walking from home to the Giants game
Also commuting.
Getting from my home to Gus's market.
Doing daily errands (on the prettiest route possible)

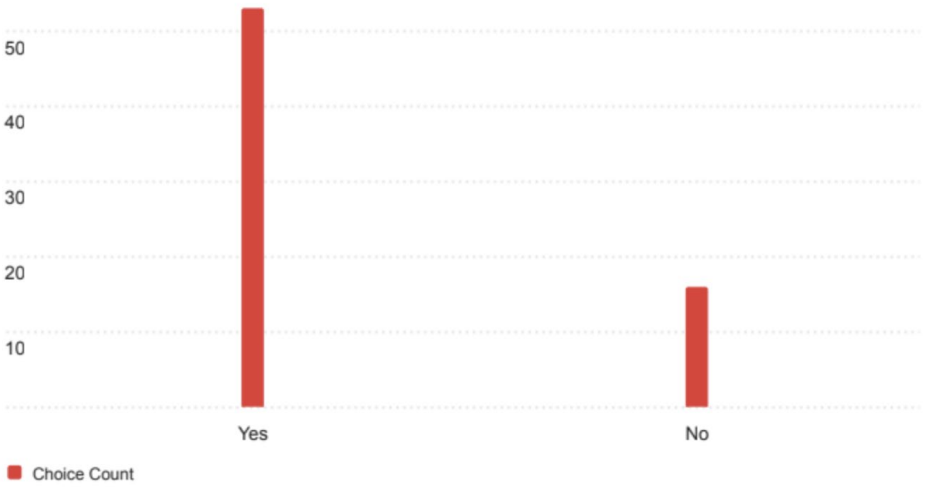
---

4. In general, why do you choose to visit this park?

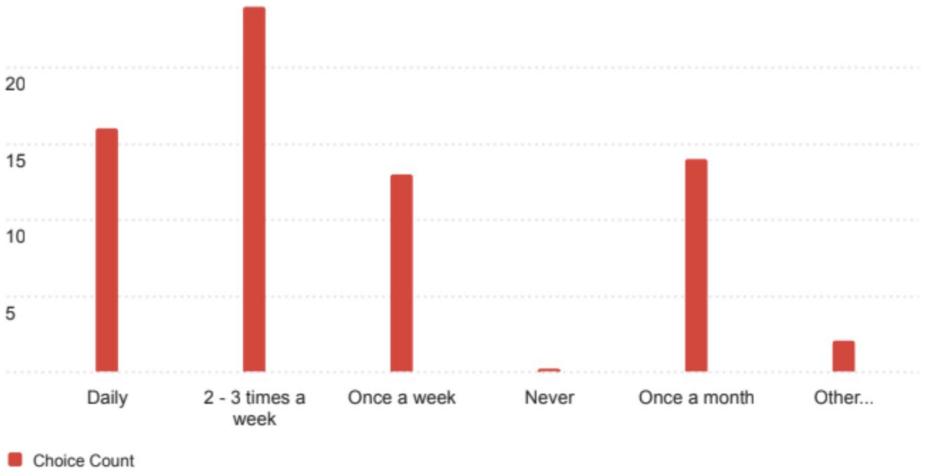


If you selected 'Other,' please specify here:
it connects paths/commuting
Bike ride
I live here
no cars
No cars!!
Cleanliness and feels safe (no vagrants and poop on the ground)
also protected corridor
It was a more pleasant transition from one street to the other on our walk
Hike around city
It's just so nice walking through! Right on the water!
Location close our neighborhood
Just walk upon the park
Views, trees and plants, and connection with nature. It could be better protected for pedestrians (from bicyclists) but is overall a well-protected corridor for walking, and a very pleasant place to walk.
Convenient Walkway. Honestly don't consider it much of a park
The most important reason is for the safe protected multi-use lane for walking and biking. But I certainly enjoy the views of the creek and the lush landscape as well.

5. Do you use this park to travel to other nearby places like shops, schools, or work?



6. How frequently do you visit 'Mission Creek Stormwater Park'?

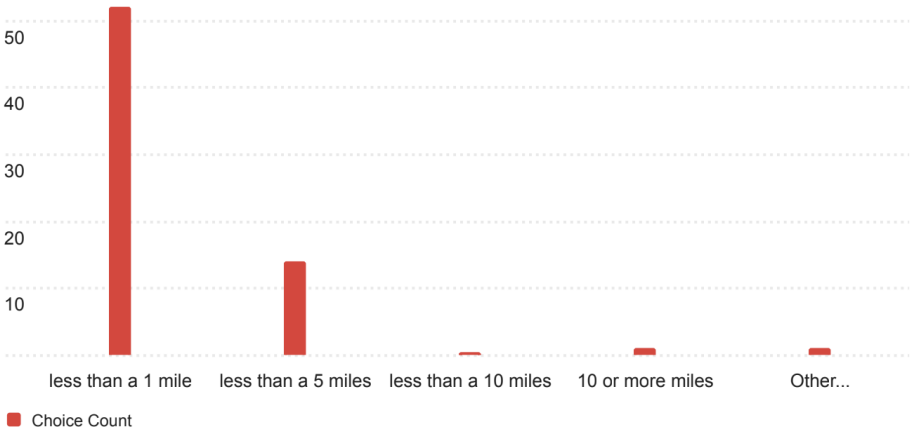


If you selected 'Other,' please specify here:

5 times in a year

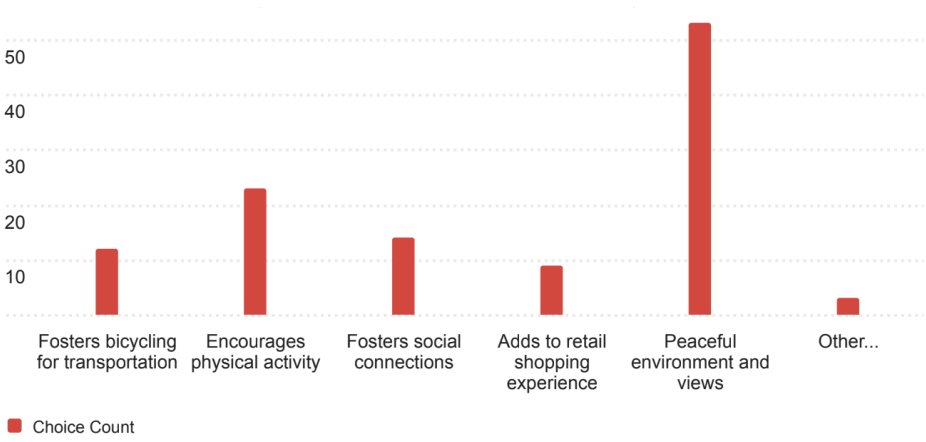
Has an episodic visitor we have visited once or twice

7. How far do you live from 'Mission Creek Stormwater Park'?



If you are a nearby resident, please answer the following multiple -choice questions. Select the option that best represents your opinion or experience.

8. How do you benefit from 'Mission Bay Stormwater Park'?

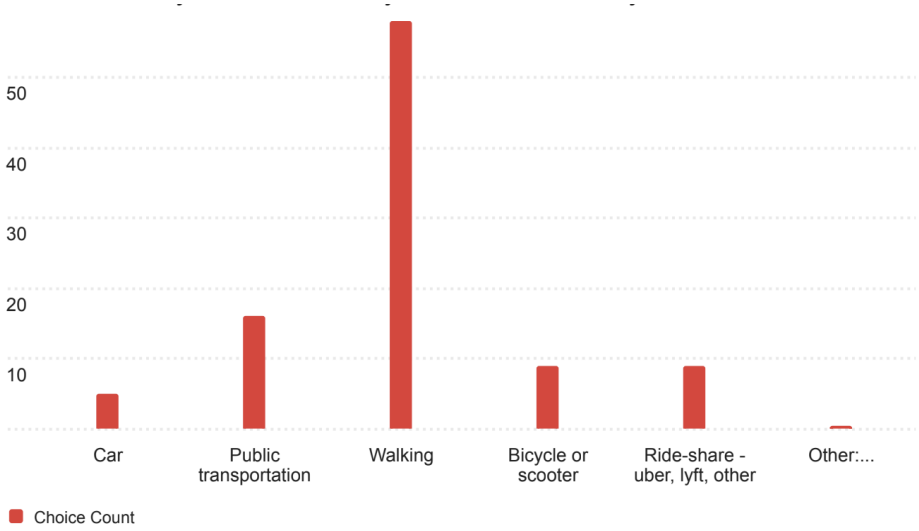


If you selected 'Other,' please specify here:

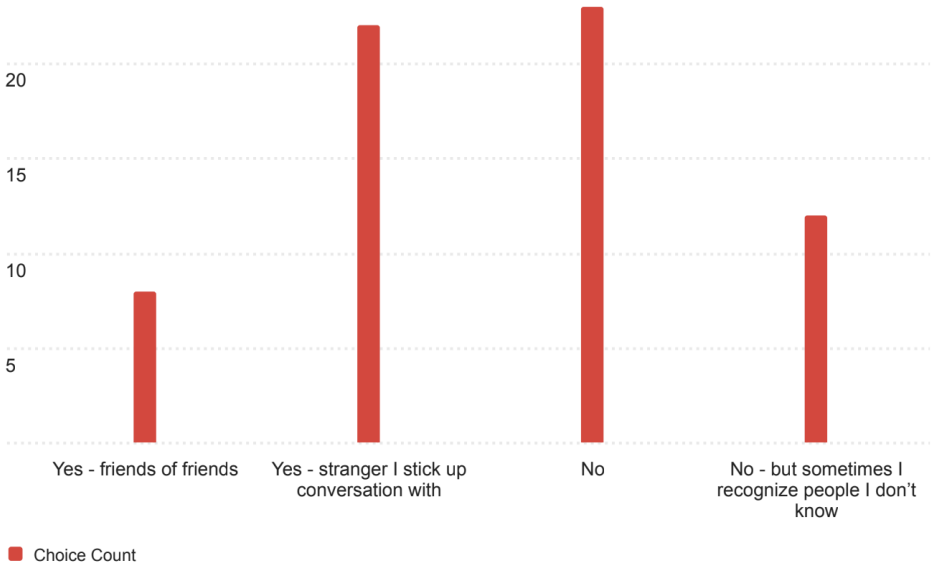
Fosters social connections, adds to retail shopping experience, and provides peaceful environment and views
Encourages phyical activity and social connections, and is a peaceful environment with pretty views.
Convenient walkway

---

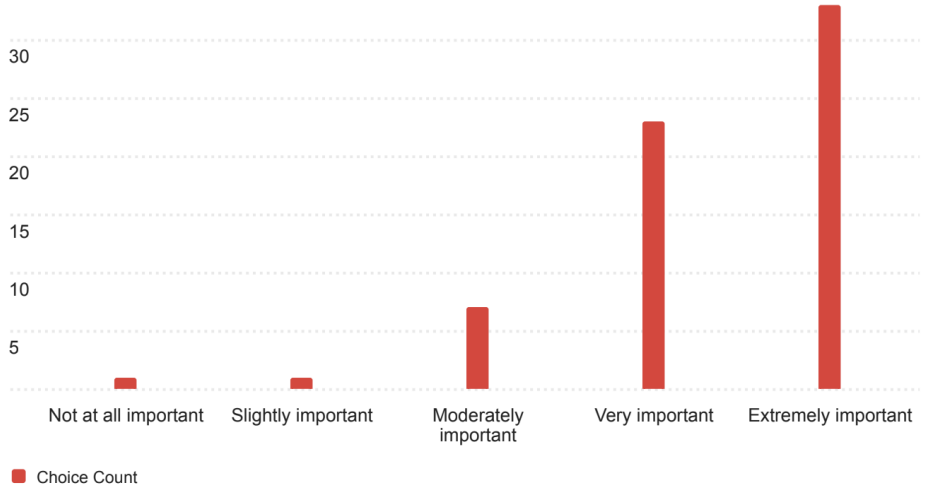
9. What is your favorite way to travel to nearby activities?



10. Have you talked to new people in this park?



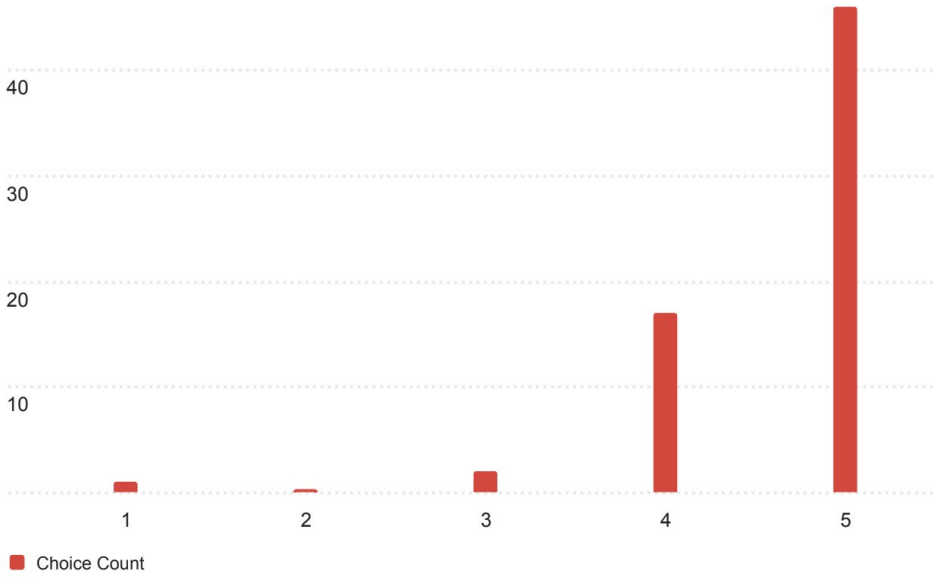
11. How valuable do you think the park is for the area?



For each of the following questions, please rate your experience or opinion. Select the option that best represents your level of agreement or satisfaction.

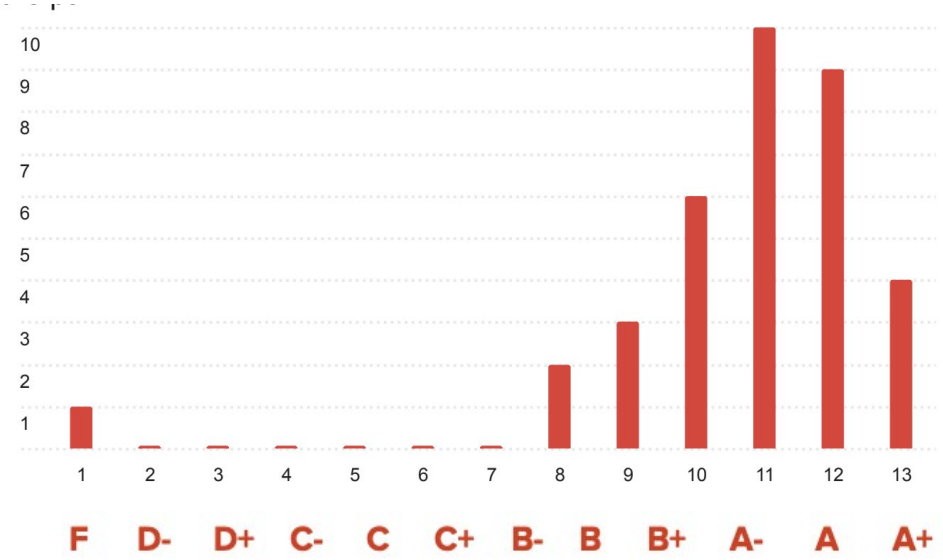
12. How do you feel after visiting 'Mission Creek Park'?

13. How do you like the way 'Mission Creek Park' looks?



---

14. How would you rate the way plants and gardens are arranged in the park? (circle one)



---

15. Rate 'Mission Creek Stormwater Park'...

Field	Min	Max	Mean	Standard Deviation	Variance	Responses	Sum
Connection to Nature	3.00	5.00	4.30	0.69	0.48	67	288.00
Views	3.00	5.00	4.45	0.63	0.40	67	298.00
Resting areas	2.00	5.00	4.28	0.75	0.56	67	287.00
Safety	2.00	5.00	4.16	0.76	0.58	67	279.00
Maintenance	2.00	5.00	4.43	0.67	0.45	67	297.00
Experience	2.00	5.00	4.55	0.63	0.40	67	305.00

We value your feedback! If there is anything else you would like to share about your experience with Mission Creek Park, please feel free to provide your thoughts and comments below. Your insights are important to us.

16. What are your overall impressions of the park?

It is good. Very useful for the neighborhood

it's really quite amazing. very well executed. intelligent.

Clean and well landscaped.

I love it... It's close by to where I live and anyone who comes to this area, I definitely show them this park

We love it!!

Beautifully designed, lovely addition to the waterfront

It's a really good addition to the neighborhood and I like that the plants are low profile so they don't obstruct the view of the creek

Very good local neighborhood park for relaxing and taking walks

Plenty of benches

pretty good

Beautiful addition to the neighborhood, as a way to enjoy more green space in this extremely urban neighborhood

Love the new gathering area

Wonderful space. Connects many buildings. Good for scooting for kids. for

love that it's protected from cars!

Love that there are no cars!

Love it, but could have been nicer and incorporated more ways to help local businesses

Love the park, great part of the area. A+

I like the mix of wide sidewalks that allow room for all types of movement, the seating options, garbage cans, & the watewater management

Positive, feels safr and has a good amount of nature

We love storlling through here

---

17. What do you like most about the park?

Canal

the style and storm water planter aesthetic

Large walkways and bridges.

Water views, landscaping, well maintained walkways, best way to connect 3rd and 4th st

Tranquil area to get executive, walk the dog, and be close to nature in a city we love

I invites outdoor community to enjoy it

I like the wide walkways so I can maintain social distancing even when it's busy

Trees

Birds chirping in the trees

open feel of it and dedicated area for dogs

beautiful plants, with good nice paths for walkways

Proximity to water
The water keeps it quiet and cool
family friendly!
Safe place to walk, bike, have kids on scooters. No cars
Natural landscape
Well maintained, nice and clean. Landscaping is great. Near water.
see above
the canal/bay and grass area near the giant stadium
he landscaping/grassy areas. Also it's very safe and clean. Great place to stroll with our dog

18. What aspects of the park do you dislike?

Too many drug addicts in the park
i wonder if the combo bike lanes and walking lanes area is overkill. i don't know if i have a better solution, but people always seem to be in the wrong portion, or are at least confused. maybe some type of upright stanchions with guidance. maybe somehow integrated into planters, functional water mgmt, or additional shade purpose
Waterfront, and people with dogs..
Lack of public restrooms
Could use a little bit more grass! Maybe more tables too instead of just benches.
Worries me it may be inviting for homeless drug users
I wish there was outdoor seating along the building for the wine & cheese shop
Nothing as of now
Not enough trees
bike lanes could be better advertised
The bike path signs are unclear in terms of whether the path should be shared with pedestrians
Could use more shade
make it bigger!
Lack of areas for local business
Sometimes homeless in the park.
nothing
lots of traffic on streets on weekends
No water fountains or restrooms
Needs a bit more shade on bright days
No water faucet

Appendix G: Python Code to Analyze Property Value

OBTAIN

Import taxes data per block

[77]:
```
url_2009 = 'https://data.sfgov.org/resource/wv5m-vpq2.csv?block=8715'
df = pd.read_csv (url_2009)
df.sample(3)
```

[77]:

	closed_roll_year	property_location	parcel_number	block	lot	volume_number	use_code	use_definition	property_class_code	property_class_cod
976	2021	0000 0110 CHANNEL ST0318	8715250	8715	250	44.0	SRES	Single Family Residential	Z	
814	2021	0000 1000 03RD ST0619	8715088	8715	88	44.0	SRES	Single Family Residential	Z	
530	2019	0000 1000 3RD ST1001	8715158	8715	158	44.0	SRES	Single Family Residential	Z	

3 rows × 46 columns

SCRUB

Select columns to use, fix mistakes in the data

We are studying the property value of apartment buildings, therefore we are only interested in property areas and we are not studying the land value of lot areas.

[99]:
```
#Select the columns to keep

block8715 = df[['closed_roll_year', 'parcel_number', 'lot', 'use_definition', 'property_area', 'assessed_land_value']]
block8715.sample(3)
```

[99]:

	closed_roll_year	parcel_number	lot	use_definition	property_area	assessed_land_value
157	2018	8715158	158	Single Family Residential	1973.0	457598.0
451	2019	8715079	79	Single Family Residential	829.0	587887.0
504	2019	8715132	132	Single Family Residential	787.0	572587.0

[96]:
```
#Delete the rows where the assesed land value is less or equal than 0
block8715_clean = (block8715['assessed_land_value'] > 0)
block8715 = block8715[block8715_clean]
block8715.sample(3)
```

[96]:

	closed_roll_year	parcel_number	lot	use_definition	property_area	assessed_land_value
423	2019	8715051	51	Single Family Residential	1146.0	948600.0
527	2019	8715155	155	Single Family Residential	804.0	690000.0
500	2019	8715128	128	Single Family Residential	961.0	487050.0

Delete all parcels with areas of 0 or less.

[93]:
```
block8715_0area = block8715['property_area'] > 0
block8715_area_clean = block8715[block8715_0area]
block8715_area_clean.sample(3)
```

[93]:

	closed_roll_year	parcel_number	lot	use_definition	property_area	assessed_land_value
921	2021	8715195	195	Single Family Residential	1124.0	1245646.0
457	2019	8715085	85	Single Family Residential	767.0	566467.0
97	2018	8715098	98	Single Family Residential	974.0	135940.0

Filter the data by use definition, keeping only Single Family Residential

[92]:
```
#Select only single family residential use definitions

block8715_residential_only = block8715_area_clean['use_definition'] == 'Single Family Residential'
block8715_residential = block8715_area_clean[block8715_residential_only]
block8715_residential.sample(3)
```

[92]:

	closed_roll_year	parcel_number	lot	use_definition	property_area	assessed_land_value
274	2018	8715275	275	Single Family Residential	746.0	164083.0
524	2019	8715152	152	Single Family Residential	783.0	590580.0
495	2019	8715123	123	Single Family Residential	829.0	600126.0

EXPLORE

Calculate the land value per square footage and create quick graphs to look at the data

Create a new column to calculate the price per square foot for parcel

[130]:
```
block8715_residential = block8715_residential.copy()
block8715_residential['value_sqft'] = block8715_residential['assessed_land_value'] / block8715_residential['property_area']
block8715_residential.sample(3)
```

[130]:

	closed_roll_year	parcel_number	lot	use_definition	property_area	assessed_land_value	value_sqft
420	2019	8715048	48	Single Family Residential	1304.0	915306.0	701.921779
555	2019	8715183	183	Single Family Residential	1218.0	805290.0	661.157635
635	2019	8715263	263	Single Family Residential	1272.0	1009800.0	793.867925

[11]:
```
import matplotlib.pyplot as plt
```

[88]:
```
ax = block8715_residential.plot.scatter (x='closed_roll_year', y='value_sqft', color = 'red')
```

```
<Figure size 640x480 with 1 Axes>
```

MODEL

Calculate average value per square foot per year and create a graph

Group data by year and calculate average value per square foot per year

[102]:
```
print(block8715_residential.groupby('closed_roll_year'))
```

```
<pandas.core.groupby.generic.DataFrameGroupBy object at 0x77fc8668d850>
```

[90]:
```
block8715_average_value_per_year = block8715_residential.groupby('closed_roll_year')['value_sqft'].mean()
block8715_average_value_per_year
```

[90]:
```
closed_roll_year
2018    195.987930
2019    731.937153
2021    730.531116
Name: value_sqft, dtype: float64
```

Appendix H: Python Code to Analyze Tax Revenue

Property Value Study of Block #8715, SF-CA

[37]:
```
import pandas as pd
```

[38]:
```
pip install sodapy
```

```
Requirement already satisfied: sodapy in /srv/conda/lib/python3.11/site-packages (2.2.0) ●●●
```

```
from sodapy import Socrata ●●●
```

OBTAIN

Import taxes data per block

[40]:
```
url_2009 = 'https://data.sfgov.org/resource/wv5m-vpq2.csv?block=8715&$limit=6000'
df = pd.read_csv (url_2009)
df.head()
```

```
<div> ●●●
```

SCRUB

Select columns to use, fix mistakes in the data

We are studying the tax revenue of the block adjacent to the park before the building construction and in 2022, four years after the building completition.

[41]:
```
#Select the columns to keep

block8715 = df[['closed_roll_year', 'parcel_number', 'lot', 'use_definition', 'lot_area', 'property_area', 'assessed_land_value']]
block8715.sample(3)
```

[41]:

	closed_roll_year	parcel_number	lot	use_definition	lot_area	property_area	assessed_land_value
1488	2020	8715048	48	Single Family Residential	0.0	1304.0	933612.0
1436	2022	8715350	350	Single Family Residential	0.0	1183.0	865266.0
1216	2022	8715130	130	Single Family Residential	0.0	783.0	509295.0

[42]:
```
#Delete the rows where the assesed land value is less or equal than 0
block8715_clean = (block8715['assessed_land_value'] > 0)
block8715 = block8715[block8715_clean]
block8715.sample(3)
```

[42]:

	closed_roll_year	parcel_number	lot	use_definition	lot_area	property_area	assessed_land_value
977	2021	8715251	251	Single Family Residential	0.0	765.0	555022.0
371	2015	8715006	6	Multi-Family Residential	46014.0	0.0	5072667.0
1247	2022	8715161	161	Single Family Residential	0.0	1231.0	882000.0

EXPLORE

Study the lot subdivision along the years to select the most suitable years to compare

[55]:
```
print(block8715.groupby('closed_roll_year'))
```

```
<pandas.core.groupby.generic.DataFrameGroupBy object at 0x7b2e6d2c3c50>
```

•[100…
```
block8715_lot_per_year = block8715.groupby('closed_roll_year')['lot'].count()
block8715_lot_per_year
```

[100]:
```
closed_roll_year
2007      2
2008      2
2009      2
2010      2
2012      1
2013      1
2014      1
2015      3
2016      3
2017      3
2018    351
2019    353
2020    353
2021    353
2022    353
Name: lot, dtype: int64
```

MODEL

Calculate the assesed land value per year and multiply by the tax rate of the corresponding year

Year 2013

[74]:
```
block8715_2013 = block8715[block8715['closed_roll_year']==2013]
block8715_2013
```

[74]:

	closed_roll_year	parcel_number	lot	use_definition	lot_area	property_area	assessed_land_value
362	2013	8715004	4	Miscellaneous/Mixed-Use	118745.0	0.0	5810598.0

[123]:
```
block8715_2013tax = block8715_2013['assessed_land_value'] * (1.188/100)
block8715_2013tax
```

[123]:
```
362    69029.90424
Name: assessed_land_value, dtype: float64
```

Year 2022

[129]:
```
block8715_2022['assessed_land_value'].count()
```

[129]:
```
353
```

[134]:
```
block8715_2022value = block8715_2022['assessed_land_value'].sum()
block8715_2022value
```

[134]:
```
296071153.0
```

[124]:
```
block8715_2022tax = block8715_2022value * (1.17769382/100)
block8715_2022tax
```

[124]:
```
3486811.6716837445
```

Tax Revenue increase between 2013 and 2022

[132]:
```
tax_increase = round(block8715_2022tax) - round(block8715_2013tax)
tax_increase
```

[132]:
```
362    3417782.0
Name: assessed_land_value, dtype: float64
```