Golden Gate National Recreation Area Federal Fleet Tiger Team EVSE Site Assessment

Leidy Boyce, Jesse Bennett, and Ranjit Desai

National Renewable Energy Laboratory

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List of Acronyms

BEV	battery electric vehicle
EO	executive order
EV	electric vehicle
EVI-LOCATE	electric vehicle infrastructure localized charging assessment tool and estimator
EVSE	electric vehicle supply equipment
FAST	Federal Automotive Statistical Tool
FEMP	Federal Energy Management Program
GOGA	Golden Gate National Recreation Area
GOV	government-owned vehicle
GSA	U.S. General Services Administration
HDV	heavy-duty vehicle
LDV	light-duty vehicle
MDV	medium-duty vehicle
PHEV	plug-in hybrid electric vehicle
POV	privately owned vehicle
S&SW	sedans and station wagons
SAE	Society of Automotive Engineers
SIN	standard item number
SUV	sport utility vehicle
ZEV	zero-emission vehicle
ZPAC	Zero Emission Vehicle Planning and Charging tool

Table of Contents

List of Figures

List of Tables

1 Introduction

The U.S. Department of Energy Federal Energy Management Program (FEMP) helps federal agencies reduce petroleum consumption and increase alternative fuel use through its resources for the Sustainable Federal Fleets program. A key element of this assistance involves supporting agencies in the transition to zero-emission vehicles (ZEVs), including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). The White House has established a policy for the federal fleet to lead by example and accelerate the transition to electric transportation through two executive orders (EOs)—EO 14008: Tackling the Climate Crisis at Home and Abroad (signed on January 27, 2021) and EO 14057: Catalyzing America's Clean Energy Industries and Jobs through Federal Sustainability (signed on December 8, 2021).

EO 14008 establishes the policy of the current administration to "organize and deploy the full capacity of its agencies to combat the climate crisis." Specifically, EO 14008 calls on all agencies to transition to ZEVs.

EO 14057 further details the EO 14008 policy by requiring, in Section 102 (a)(ii), that each agency ensure that all light-duty vehicle (LDV) acquisitions are ZEVs by fiscal year (FY) 2027 and that all vehicle acquisitions are ZEVs by the end of FY 2035. To support the transition of the federal fleet to ZEVs, Section 201 requires agencies to work with the White House Council on Environmental Quality and the Office of Management and Budget to propose and establish targets for the annual (FY 2022 and onward) acquisition of ZEVs and the deployment of charging infrastructure. Key to this effort is the requirement to annually update a ZEV fleet strategy that includes "optimizing fleet size and composition; deploying [ZEV] refueling infrastructure; and maximizing acquisition and deployment of zero-emission light-, medium-, and heavy-duty vehicles where the General Services Administration (GSA) offers one or more ZEV options for that vehicle class."

In developing and implementing their ZEV fleet strategies, agencies should focus on evaluating electric vehicle (EV) deployment opportunities at individual fleet locations, which have unique site, vehicle operating, and utility service characteristics. This is best achieved through site assessments to evaluate opportunities for ZEV acquisitions, identify optimal ZEV candidates, and determine optimal electric vehicle supply equipment (EVSE) deployment strategies.

This site report supports the development of a ZEV deployment plan for the Golden Gate National Recreation Area (GOGA), which can ultimately be incorporated into the overall U.S. Department of the Interior ZEV fleet strategy.

1.1 Electric Vehicle Supply Equipment Tiger Teams

FEMP offers technical assistance to agencies developing fleet electrification goals, including planning for charging infrastructure, through EVSE Tiger Teams. Tiger Teams include National Renewable Energy Laboratory engineers and fleet experts who review site ZEV acquisition opportunities and EV charging needs and develop ZEV acquisition and EVSE installation recommendations that minimize costs while accommodating long-term charging needs.

1.2 Site Overview

The Tiger Team provided 2020 fleet data to GOGA from the Federal Automotive Statistical Tool (FAST) that showed an inventory of 177 vehicles, including 172 GSA-leased vehicles and 5 vehicles that are agency-owned. Figure 1 provides a breakdown of GOGA's fleet by vehicle type. The majority of the fleet—65%, or 114 vehicles—comprises LDVs, which are the focus for 2022 EV acquisitions. The remainder of the fleet primarily consists of medium-duty vehicles (MDVs)— 29%, or 51 vehicles—with the remaining 6% split between heavy-duty vehicles (HDVs) and vehicles that are not reported in FAST. Currently, 13 of the 114 LDVs are ZEVs, including 4 BEVs and 9 PHEVs. Because electric LDVs are more commonly available through the GSA, this poses an excellent opportunity for GOGA to electrify the remaining 111 LDVs.

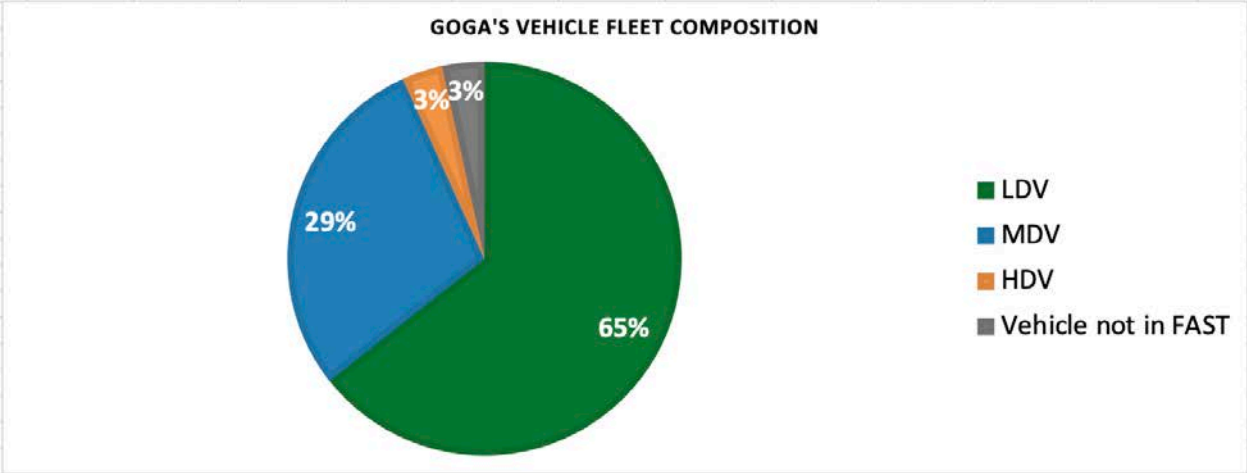

Figure 1. GOGA's vehicle fleet composition

2 Fleet Electrification Planning

GOGA's vehicle acquisition plan for FY 2022 includes the replacement of 10 vehicles, with 3 of those replacements planned as BEVs. In addition to the FY 2022 acquisitions, GOGA has planned for up to 69 ZEV acquisitions throughout the next 5 years, as shown in Figure 2. This vision for fleet electrification requires additional electrical charging infrastructure beyond the existing seven EVSE ports available throughout GOGA's facilities. The EVSE Tiger Team supported the evaluation of new electrical charging infrastructure at Fort Mason and Fort Cronkhite to support the rapid expansion of BEVs and PHEVs planned at those locations, as detailed in Table 1.

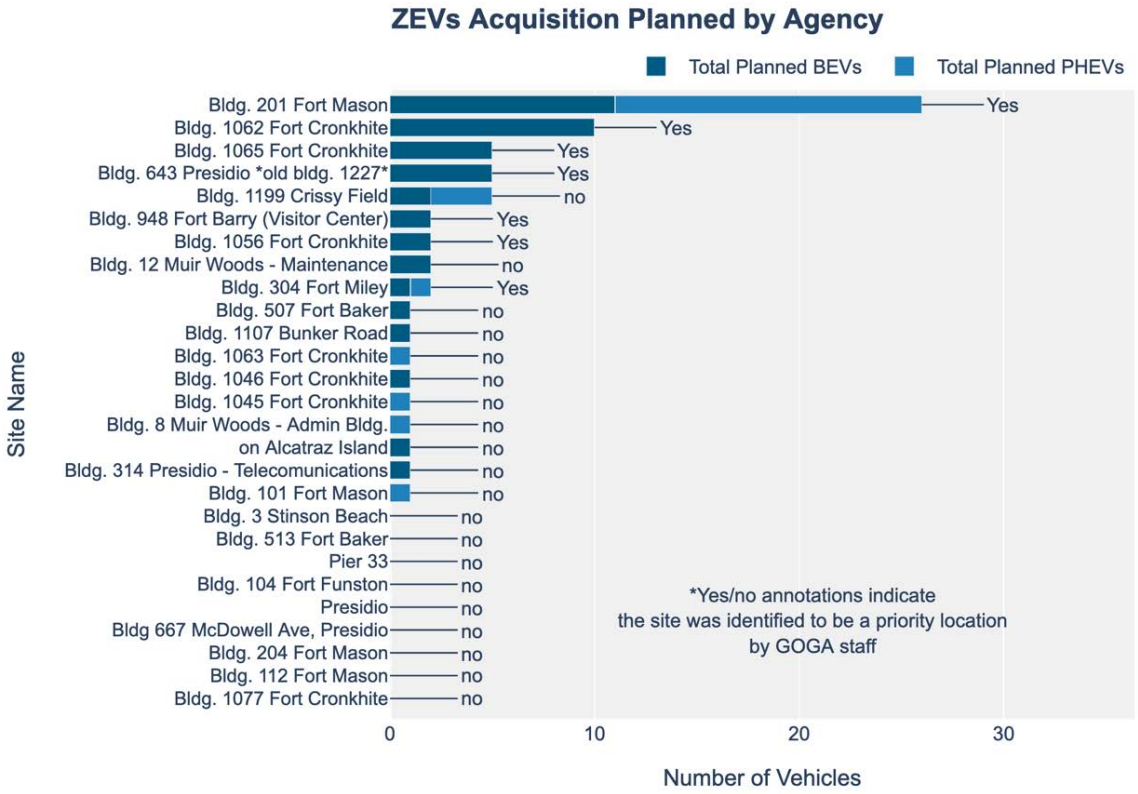

Figure 2. ZEV acquisition planned by GOGA as of December 20, 2021

Table 1. GOGA's Priority Sites for Charging Infrastructure

	Fort Mason Building 201	Fort Cronkhite Building 1056	Fort Cronkhite Building 1062	Fort Cronkhite Building 1065
Existing EVSE ports	5	0	0	2
Planned ZEVs	26	2	10	5
Remaining vehicles	7	0	3	2

2.1 Existing Infrastructure Projects

In addition to the rapid electrification plans, GOGA is currently pursuing multiple service upgrade projects at both Fort Cronkhite and Fort Mason. Fort Cronkhite is planning to upgrade the electric service at a series of buildings to support the installation of new heat pumps as part of a building electrification effort. The building electrification plans were developed in coordination with the utility Pacific Gas and Electric Company and include additional capacity to support the installation of new EVSE. Unlike at Fort Cronkhite, the distribution equipment at Fort Mason is currently owned and operated by GOGA; however, Fort Mason is currently undergoing a distribution upgrade project for Pacific Gas and Electric Company to own and operate the distribution circuits throughout the area. As part of this project, the transformers serving buildings 201 and 204 are being upgraded and will have the capacity to support EVSE. Table 2 details the proposed electric service panels at each location, with the estimated spare capacity in each as provided by GOGA. These ongoing electrical upgrade efforts are well timed with GOGA's fleet electrification plans and will support the installation of fleet EVSE by reducing the need to support electric service and distribution upgrades.

Table 2. Proposed Electric Service Upgrades at Buildings of Interest

Building	New Service Panel Rating	Spare Capacity (A)
Fort Cronkhite Building 1066	200 A, 120/240 V	200
Fort Cronkhite Building 1067	200 A, 120/240 V	100
Fort Cronkhite Building 1068	200 A, 120/240 V	100
Fort Cronkhite Building 1069	200 A, 120/240 V	100
Fort Cronkhite Building 1070	200 A, 120/240 V	100
Fort Mason Building 201	600 A, 208Y/120 V	291
Fort Mason Building 204	200 A, 120/240 V	85

2.2 Zero-Emission Vehicle Planning and Charging Analysis

In addition to the FAST data, the Tiger Team shared the ZEV Planning and Charging (ZPAC) tool with GOGA. ZPAC helps federal agencies identify ZEV candidates based on vehicle mission and parking location. GOGA evaluated 177 fleet vehicles, identifying 69 potential candidate vehicles for replacement with ZEVs throughout the next 5 years. A summary of the ZPAC results are outlined in Figure 3, and Table 3 lists each potential vehicle candidate and their equivalent standard item number (SIN) replacement based on the GSA Vehicle Availability Listing (General Services Administration 2022). For the full list of the GOGA fleet, see Appendix A to view the current vehicle inventory organized by existing SIN and vehicle type.

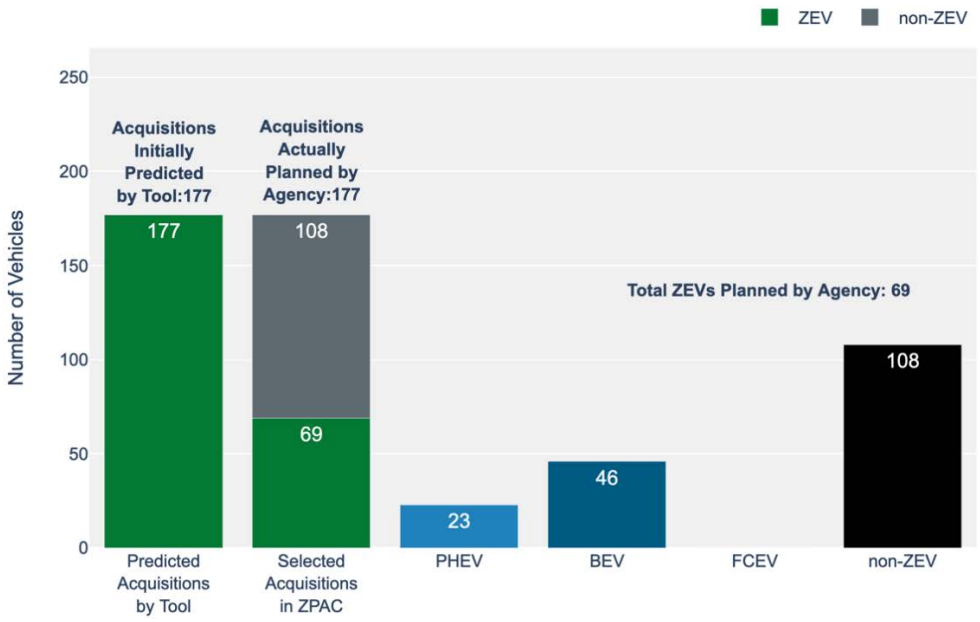

Figure 3. ZPAC summary results as of December 20, 2021

Table 3. Potential EV Candidates Based on ZPAC Results

Vehicle Ownership	Vehicle SIN	Vehicle Type	Vehicle Count	BEV SIN	PHEV SIN
GSA leased	20	LD[a] minivan 4x2	13		20P
GSA leased	8	S&SW[b] subcompact	12	8E	8P
GSA leased	9	S&SW compact	9	9E	
GSA leased	46	LD pickup 4x4	9	67E	
GSA leased	66	LD pickup 4x4	6	67E	
GSA leased	67	LD pickup 4x4	4	67E	
GSA leased	105	LD SUV[c] 4x4	2		
GSA leased	99	LD SUV 4x4	2		99P
GSA leased	98	LD SUV 4x2	2	98E	
GSA leased	100	LD SUV 4x2	1		
GSA leased	91	LD SUV 4x2	1	91E	
GSA leased	30	LD minivan 4x2 (cargo)	2	30Y	
GSA leased	50	LD pickup 4x2	1		
Agency-owned	Unknown	S&SW compact	1	9E	
Agency-owned	Unknown	S&SW midsize	1	NA	NA
Agency-owned	Unknown	MV S&SW subcompact, hybrid	1	NA	NA
Agency-owned	Unknown	LD SUV 4x4	1	NA	NA
Agency-owned	Unknown	S&SW subcompact	1	NA	NA

[a] light-duty, [b] sedans and station wagons, [c] sport utility vehicle

2.3 Workplace Charging Needs

In addition to fleet electrification, GOGA has identified eight employee privately owned vehicle (POV) parking spots at Fort Mason that might also require access to EVSE. Although the inclusion of workplace charging for employees is not the primary concern for GOGA, it was requested that the installation of EVSE be considered for employee parking, where possible. GOGA does not currently have a workplace charging program where POVs can access EVSE to charge, but it is interested in providing that option for their employees. In addition to providing POVs access to EVSE, GOGA will be required to recoup the costs of providing energy to employee vehicles per the FAST Act and as outlined in the FEMP *Workplace Charging Program Guide* (Bennett and Hodge 2020).

2.4 Electric Vehicle Supply Equipment Deployment Needs

A critical element to fleet electrification, in addition to ZEV acquisition planning, is the deployment of EVSE to provide the energy these new vehicles will require to fulfill their daily mission needs. As mentioned in section 2 and detailed in Table 4, only seven EVSE ports are currently available for fleet vehicles across Fort Mason and Fort Cronkhite. The current EVSE installed at these locations will likely not be able to support the charging needs of the 26 and 17 ZEVs planned at Forts Mason and Cronkhite, respectively, throughout the next 5 years. Additional EVSE must be installed throughout GOGA to support these vehicles, with an ideal EV-to-EVSE ratio of 1:1 to ensure that each vehicle has its own dedicated EVSE. This will ensure that vehicles are always charged and capable of supporting their mission, although in some instances, additional EVSE might be suggested to plan for fleet electrification beyond 5 years.

Table 4. Existing EVSE Units at Priority Sites

Site	Type	Rating (A)	Port Count
Fort Mason, Building 204	Eaton	32	1
Fort Mason, Building 201	Clipper Creek LCS-25	20	4
Fort Cronkhite, Building 1066	Clipper Creek LCS-25	20	2

2.5 Parking Layout at Sites

Fort Mason has a series of government-owned vehicle (GOV) and POV parking around buildings 201 and 204, as displayed in Figure 4. The red polygons represent fleet parking spaces, for a total of 25 parking slots, whereas the yellow polygon covers 8 spaces assigned for employee parking (west of Building 201). Although these parking spots are currently designated specifically for GOVs or POVs, GOGA indicated that these designations could change if needed. Among these 33 parking spots, 5 existing EVSE ports to the west of Building 204 have historically been used for GOVs. The top priority at Fort Mason was to install EVSE to accommodate fleet vehicles, and POV parking could be moved if it would provide a more economic EVSE deployment solution; however, GOGA is also interested in developing a workplace charging program and would like to provide EVSE for POV access, if possible.

Figure 4. Fort Mason current parking lot layout

Two separate locations at Fort Cronkhite were considered to support EVSE installations. The first area includes buildings 1066 through 1070 located on Kirkpatrick Street, at the northern end of a series of residential buildings near Rodeo Beach, as indicated in Figure 5. The second area is around Building 1046, referred to as the maintenance building, which is to the east of Kirkpatrick Street, as indicated in Figure 6. The parking layouts at these two areas are different, with Kirkpatrick Street offering a series of small parking surfaces (2–4 vehicles) and parallel street parking, whereas the maintenance building has angled, pull-in street parking. Many of these parking spaces are designated for fleet vehicles, with little to no opportunities for POV use.

Figure 5. Fort Cronkhite Kirkpatrick Street parking

Figure 6. Fort Cronkhite Building 1046 parking lot

2.6 Electric Vehicle Supply Equipment Installation Design Guidelines

EVSE must be installed to provide the charging power ZEVs will require. Because of the large energy demand from fleet mobility needs, the power ratings of these devices are much higher than most other electrical devices. This requires specific installation considerations that are outlined in the National Fire Protection Association's Standard 70: National Electric Code and in the FEMP EV Champion Training Series (Federal Energy Management Program, n.d.).

Most ZEVs available in the United States are capable of charging from the Society of Automotive Engineers (SAE) Standard J1772 EVSE charge coupler. This standard provides two common charging levels, 1 and 2, which provide AC power directly to the vehicle, which is then converted to DC power for the battery through the vehicle's onboard charger. Level 1 charging provides a maximum of 1.9 kW of power and is typically plugged into a standard 120-V receptacle, which is best served through a dedicated 20-A circuit breaker to provide a maximum 16 A of current to the vehicle. These chargers are best suited for PHEVs or BEVs that travel a low number of daily vehicle miles. For most BEVs, however, the higher-power Level 2 charging option is preferrable to ensure that the vehicle can always receive a full charge after each day of driving. These chargers are typically hardwired, dual-port, pedestal units and are capable of supplying either 208 V or 240 V to the vehicle, depending on whether the building is receiving a three-phase (3Φ) or single-phase (1Φ) electric service from the utility. They also require a double-pole breaker that is typically rated at 40 A. The power capabilities for these chargers depends on the service voltage and 32 A of charging current, with 208 V and 240 V providing 6.7 kW and 7.7 kW, respectively. These options and requirements are outlined in Table 5.

Table 5. SAE J1772 AC Charging Options

EVSE	Typical Charging Power	Typical Service Type	Typical Installation Requirements
AC Level 1	1.9 kW (16 A @ 120 V)	120/240-V 1Φ or 208Y/120-V 3Φ	Portable EVSE, 120-V receptacle, 20-A single-pole circuit breaker
AC Level 2	6.7 kW (32 A @ 208 V) 7.7 kW (32 A @ 240 V)	208Y/120-V 3Φ 120/240-V 1Φ	Hardwired EVSE, 40-A double-pole circuit breaker

3 Electric Vehicle Supply Equipment Installation Planning at Fort Mason

The Tiger Team evaluated two different designs at the Fort Mason site. Both options leverage the service panel capacity outlined in Table 2 and involve the relocation of the current employee parking to minimize the costs of trenching through concrete. Option A includes the installation of 18 new charging ports, which would provide a total of 24 ports and is just shy of the 5-year acquisition plans at Fort Mason for 26 ZEVs. Option B expands on Option A by planning for the installation of 10 additional charging ports, which would require trenching through concrete, to support additional GOVs or to provide POVs access to workplace charging. Table 6 outlines each design, including brief overviews of their advantages and disadvantages.

Table 6. EVSE Deployment Options at Fort Mason

Design	Description	Advantages	Disadvantages
Option A	Install five Level 2 dual-port, pedestal units along the exterior of the parking surface at Building 204 and four Level 2 dual-port, pedestal units on the parking lot located to the west side of Building 201.	Avoids extensive trenching through concrete	Requires employee parking to move to the north side of Building 201 (5 spaces) and south of Building 204 (3 spaces)
Option B	Expanding on Option A, install two Level 2 dual-port, pedestal units in the northeast corner of Building 204 and three dual-port, wall-mounted units on the north wall of Building 201.	Includes EVSE to support POV workplace charging	Additional cost as a result of extensive trenching through concrete and greater capacity needs

3.1 Fort Mason Option A: Fleet Vehicles Only

Option A provides enough EVSE to support a majority of GOGA's ZEV acquisition plans throughout the next 5 years. This design also requires the POV parking (8 spaces) to be relocated to the north side of Building 201, making the current employee parking spaces available for fleet vehicles. As a result, four new Level 2 dual-port, pedestal EVSE units (P1–P4) can be installed, as shown in Figure 7 and described in Table 7. This option also includes the installation of five additional Level 2 dual-port, pedestal EVSE units (P5–P9) in the adjacent parking lot of Building 204. This includes EVSE P5–P6 to the east of the transformer and EVSE P6–P9 to the west of the transformer. These additional EVSE units will minimize extensive trenching through concrete and should be supported by the planned 600-A 208Y/120-V service panel that will be installed near the transformer. In case there is not sufficient (physical or electrical) capacity in this new panel, however, each new dual-port EVSE could employ a power-sharing feature that would reduce the service panel requirements by sharing one double-pole breaker between two EVSE ports, effectively halving the service panel capacity requirements.

Figure 7. Fort Mason Option A EVSE deployment outline

Table 7. Fort Mason Option A EVSE Installations

Building	Existing EVSE Ports	Planned New EVSE Ports	Recommendations	Considerations
Building 204	5	10	Install five Level 2 dual-port pedestal EVSE units	New service from existing transformer
West side of Building 201	0	8	Install four Level 2 dual-port pedestal EVSE units	New service from existing transformer
Total	**5**	**18**	**Install a 600-A service panel with power provided by the 208Y/120-V three-phase transformer**	

3.2 Fort Mason Option A: Cost Estimate

The National Renewable Energy Laboratory Electric Vehicle Infrastructure Localized Charging Assessment Tool and Estimator (EVI-LOCATE) was used to estimate the cost of each option proposed by the Tiger Team. Note that these cost estimates do not include the cost of any electrical upgrades that might be necessary for the EVSE deployment plans due to the existing distribution upgrade projects currently underway. The total estimated cost for Option A includes nine dual-port, pedestal EVSE units (ChargePoint model CT4021-1) and amounts to approximately $166,000, including EVSE units, materials, and labor (ChargePoint 2022). The details of this cost breakdown, including the trenching distances and EVSE unit counts, are summarized in Table 8.

Table 8. Fort Mason Option A Conduit Raceway/Trenching Distances

Reference EVSE for Distance	EVSE Unit Count	From Electrical Source	Closest EVSE to Electrical Source	Distance (ft)
P5–P6	2	Transformer	P6	70
P7–P9	2	Transformer	P7	34, 72
P1–P4	4	Transformer	P4	203

3.3 Fort Mason Option B: Workplace Charging

Option B at Fort Mason expands on Option A to maximize the EVSE deployment capabilities around buildings 201 and 204. This plan includes 10 new EVSE ports in addition to the 18 new ports outlined in Option A. This would provide charging access for all 26 current and future fleet ZEVs planned for this location as well as 7 additional ports that could be used for POVs in a workplace charging program. This design includes the installation of 28 new EVSE ports distributed as shown in Figure 8 (P1–P11 and W1–W3) and Table 9.

Figure 8. Fort Mason Option B EVSE deployment outline

Table 9. Fort Mason Option B EVSE Installations

Building	Existing EVSE Ports	Planned New EVSE Ports	Recommendations	Considerations
Building 204	5	14	Install seven Level 2 dual-port, pedestal EVSE units	New service from existing transformer
West side of Building 201	0	8	Install four Level 2 dual-port, pedestal EVSE units	New service from existing transformer
North side of Building 201	0	6	Install 3 level 2 dual-port, wall-mounted EVSE units	New service from existing transformer
Total	**5**	**28**	**Install two 600-A service panels with power provided by the 208Y/120-V three-phase transformer**	

3.4 Fort Mason Option B: Cost Estimate

The EVI-LOCATE estimate for Option B includes 11 dual-port, pedestal EVSE units (ChargePoint model CT4021-1) and three dual-port wall-mounted EVSE units (ChargePoint model CT4023-GW1) and amounts to approximately $257,000, including EVSE units, materials, and labor. The details of this cost breakdown, including the trenching distances and EVSE unit counts, are summarized in Table 10.

Table 10. Fort Mason Option B Conduit Raceway/Trenching Distances

Reference EVSE for Distance	EVSE Unit Count	From Electrical Source	Closest EVSE to Electrical Source	Distance (ft)
P10–P11	2	Transformer	P10	145
W1–W3	3	Transformer	W1	64

4 Electric Vehicle Supply Equipment Installation Planning at Fort Cronkhite

The Tiger Team evaluated two different designs at the Fort Cronkhite site. Option A focuses on LDV electrification and leverages the service panel capacity outlined in Table 2 that is part of the building electrification project. It includes the installation of 18 new charging ports along Kirkpatrick Street, which would provide a total of 20 ports and slightly exceed the 5-year acquisition plans at Fort Mason for 17 light-duty ZEVs. Option B expands on Option A by planning for the installation of 10 additional charging ports, which would require trenching through concrete, to support additional GOVs or to provide POVs access to workplace charging. Table 11 outlines each design, including brief overviews of the advantages and disadvantages.

Table 11. EVSE Deployment Options at Fort Cronkhite

Design	Description	Advantages	Disadvantages
Option A	Install seven Level 2 dual-port, pedestal units along Kirkpatrick Street at buildings 1066–1070 and four Level 2 single-port, wall-mounted units on buildings 1066–1070	Leverages service panel upgrades from the building electrification project	Focuses all EVSE deployment along Kirkpatrick Street
Option B	Install four Level 2 dual-port, pedestal units along Edison Street near Building 1046	Provides an EVSE plan for future truck electrification	Requires a new service from the electric utility

4.1 Fort Cronkhite Option A: Kirkpatrick Street

Option A focuses most EVSE needs at Fort Cronkhite along Kirkpatrick Street near buildings 1066, 1067, 1068, 1069, and 1070. This location provides the best opportunity for off-street parking between each building and has the most space for on-road parallel parking, relative to all the buildings in that area. These sites are also undergoing building electrification with the installation of heat pumps to replace propane heating. The additional electrical capacity that is being developed for this project is being leveraged to reduce EVSE installation costs. In addition to the two existing EVSE ports next to Building 1066, one Level 2 wall-mounted EVSE unit (W1) will be installed next to the building for off-street parking, and one Level 2 dual-port, pedestal EVSE unit (P1) will be installed in front of the building for street parking, leveraging the planned 200-A, 120/240-V service panel. Another new service panel dedicated for EVSE use is planned for Building 1067 and will support the installation of three Level 2 dual-port, pedestal units (P2–P3) for street parking. The remaining buildings—1068, 1069, and 1070—will leverage the remaining 100-A capacity planned for the new service panels at these buildings to install one Level 2 dual-port EVSE unit (P5, P6, and P7) as well as a single Level 2 wall-mounted EVSE unit (W2, W3, and W4) at each of the three buildings. This would provide a total of 20 EVSE ports along Kirkpatrick Street, as outlined in Figure 9, with a detailed installation review in Table 12.

Figure 9. Fort Cronkhite Option A EVSE deployment outline

Table 12. Fort Cronkhite Option A EVSE Installations

Building	Existing EVSE Ports	Proposed Pedestal Ports	Proposed Wall-Mounted Ports	Service Panel	Remaining Capacity
Building 1066	2	2	1	200-A 120/240-V 1Φ EVSE panel	New
Building 1067	0	6	0	200-A, 120/240-V 1Φ EVSE panel	New
Building 1068	0	2	1	200-A, 120/240-V 1Φ building panel	100 A
Building 1069	0	2	1	200-A, 120/240-V 1Φ building panel	100 A
Building 1070	0	2	1	200-A, 120/240-V 1Φ building panel	100 A
Total	**2**	**14**	**4**		

4.1.1 Fort Cronkhite Option A: Cost Estimate

The EVI-LOCATE estimate for Option A includes seven dual-port, pedestal EVSE units (ChargePoint model CT4021-1) and three single-port, wall-mounted EVSE units (ChargePoint model 3703-1000-W-21-36-41-xx) and amounts to approximately $150,000 including EVSE units, materials, and labor. The details of this cost breakdown, including the trenching distances and EVSE unit counts, are summarized in Table 13.

Table 13. Fort Cronkhite Option A Conduit Raceway/Trenching Distances

Reference EVSE for Distance	EVSE Unit Count	From Electrical Source	Closest EVSE to Electrical Source	Distance (ft)
P1	1	Service panel at Building 1066	P1	65
P2–P4	3	Service panel Building 1067	P2	48
P5	1	Service panel Building 1068	P5	90
P6	1	Service panel at Building 1069	P6	60
P7	1	Service panel at Building 1070	P7	12
W1–W4	1	Service panel at each building	Wall-mounted unit (3 ft x 4 ft)	12

4.1.2 Fort Cronkhite Option B: Building 1046

In addition to the light-duty fleet, Fort Cronkhite hosts many of the fleet's MDVs at Building 1046, also referred to as the maintenance building. Throughout the site, there are seven MDVs that do not have immediate options for a ZEV replacement but will eventually be electrified; therefore, EVSE deployment to support EV charging can be considered at a later stage, but it is presented here for future electrical building upgrade considerations. To support the energy needs of these future vehicles, four Level 2 dual-port, pedestal EVSE units should be installed along Edison Street near Building 1046. There are no immediate plans for building electrification or other electric service upgrades at the maintenance building; therefore, a new electric service and 400-A, 120/240-V service panel will be required as well. This would provide a total of eight EVSE ports along Edison Street, as outlined in Figure 10, with a detailed installation review in Table 14. Also, at the time of this installation, consideration should be made for the energy needs of these new MDVs, and more powerful EVSE might be required. More powerful Level 2 EVSE will still require a double-pole breaker for each EVSE port, but the rating of those breakers could be as high as 100 A for an EVSE rated to supply up to 80 A and 19 kW of charging power.

Figure 10. Fort Cronkhite Option B EVSE deployment outline

Table 14. Fort Cronkhite Option B EVSE Installations

Building	Existing EVSE Ports	Planned New EVSE Ports	Recommendations	Considerations
Building 1046	0	8	Install four Level 2 dual-port, pedestal EVSE units	New service from Transformer B
Total	**0**	**8**	**Install 400-A, 120/240-V service panel with power provided by Transformer B**	

4.1.3 Fort Cronkhite Option B: Cost Estimate

The EVI-LOCATE estimate for Option B includes four dual-port, pedestal EVSE units (ChargePoint model CT4021-1) and amounts to approximately $67,000, including EVSE units, materials, and labor. The details of this cost breakdown, including the trenching distances and EVSE unit counts, are summarized in Table 15.

Table 15. Fort Cronkhite Option B Conduit Raceway/Trenching Distances

Reference EVSE for Distance	EVSE Unit Count	From Electrical Source	Closest EVSE to Electrical Source	Distance (ft)
P1–P4	4	Service Panel at Building 1046	P1	65

5 Tiger Team Recommendations

In conclusion, the Tiger Team thinks that both Fort Mason and Fort Cronkhite pose great opportunities for EVSE deployment to support GOGA's fleet electrification plans. It is recommended that GOGA move forward with EVSE deployment Option A for both locations(Table 16). Fort Mason currently has 5 EVSE ports and 26 planned ZEV acquisitions during the next 5 years. Option A proposes the installation of 18 additional EVSE ports to support nearly all these new vehicles and maximizes the value of the planned transformer upgrades. Option B would provide more EVSE than required by the fleet, leaving charging capacity available for a workplace charging program; however, the EVSE planned in this option would likely exceed the available capacity in the planned distribution upgrades at Building 204 and would require either an EVSE power-sharing solution or expensive distribution upgrades. Fort Cronkhite currently has two EVSE ports and Option A proposes the installation of 20 additional EVSE ports along Kirkpatrick Street to support the planned 17 light-duty ZEVs by maximizing the value of the electrical capacity that will be installed as part of the building electrification projects (Table 16).

Table 16. Minimum Recommended Fort Mason EVSE Installations by Site

Site	Existing EVSE Ports	Planned New EVSE Ports	Recommendations	Considerations
Fort Mason	5	18	Option A	New service from existing transformer
Fort Cronkhite	2	20	Option A	Service panel upgrade in progress
Total	7	38		

5.1 Next Steps

To fully support an electrified fleet, agency locations will require EVSE to support the energy needs of these new vehicles. The plans outlined in this report provide a framework for where and how EVSE could be effectively installed at Fort Mason and Fort Cronkhite. The next steps in this process are for GOGA to reach out to EVSE installers to request quotes for the installations described in section 3.1 and 4.1 and compare the cost estimates to those presented in the appendices. During this time, GOGA should also coordinate these installations with their local utility, facility managers, and building electrification project managers. The FEMP Tiger Team is also available to provide guidance or technical support throughout this process. Ensuring that each stakeholder is appropriately engaged throughout the EVSE installation process will ensure that robust and reliable EVSE are available to the fleet throughout the fleet electrification process.

References

Bennett, Jesse and Cabell Hodge. 2020. *Federal Workplace Charging Program Guide.* Washington, DC: Federal Energy Management Program. DOE/GO-102020-5442. https://www.energy.gov/eere/femp/articles/federal-workplace-charging-program-guide.

ChargePoint. 2022. "Everything You Need to Know About ChargePoint Stations." Accessed May 18, 2022. https://www.chargepoint.com/products/guides#ct4000.

Federal Energy Management Program. n.d. "Electric Vehicle Training." Accessed May 18, 2022. https://www.energy.gov/eere/femp/electric-vehicle-training.

General Services Administration. 2022. "GSA Vehicle Availability Listing." Accessed May 18, 2022. https://autochoice.fas.gsa.gov/AutoChoice/VehicleAvailability.

Appendix A. GOGA's Vehicle Inventory

Table A-1. GOGA's Full Vehicle Inventory as of December 2020

Vehicle Ownership	Existing SIN	Existing Vehicle Type	Vehicle Count
GSA leased	61	LD pickup 4x2	17
GSA leased	105	LD SUV 4x4	15
GSA leased	100	LD SUV 4x2	13
GSA leased	20	LD minivan 4x2 (passenger)	13
GSA leased	8	Sedan/St Wgn subcompact	12
GSA leased	82	MD other	12
GSA leased	46	Sedan/St Wgn compact	9
GSA leased	9	Sedan/St Wgn compact	8
GSA leased	49	MD pickup	7
GSA leased	66	LD pickup 4x4	6
GSA leased	67	LD pickup 4x4	5
GSA leased	89	MD other	5
GSA leased	98	LD SUV 4x2	4
GSA leased	22	MD van (passenger)	3
GSA leased	88	MD other	3
GSA leased	87	MD other	3
GSA leased	57	MD pickup	3
GSA leased	41	LD pickup 4x2	3
GSA leased	149	HD	3
GSA leased	99	LD SUV 4x4	2
GSA leased	30	LD minivan 4x2 (cargo)	2
GSA leased	162	MD van (cargo)	2
GSA leased	129	MD other	2
GSA leased	124	MD other	2
GSA leased	83	MD other	2
GSA leased	44	MD pickup	2
GSA leased	24	MD van (passenger)	2
GSA leased	287	LD van 4x2 (passenger)	1
GSA leased	91	LD SUV 4x2	1
GSA leased	55	LD pickup 4x4	1
GSA leased	50	LD pickup 4x2	1
GSA leased	31	LD van 4x2 cargo	1
GSA leased	147	MD other (4x4 utility service 12,0000 lbs)	1
GSA leased	122	MD other	1
GSA leased	21	Van 4x2	1
GSA leased	543	HD	1
GSA leased	159	HD	1
GSA leased	79	HD	1
GSA leased	49C	NA	1
Agency-owned	Unknown	NA	5