Electric Vehicle Charging Feasibility Study

City of Phoenix Aviation Department

May 2023

Executive Summary

The purpose of the Electric Vehicle (EV) Charging Feasibility Study (Study) is to set specific EV initiatives for airport users, employees, and AVN light-duty fleet at Phoenix Sky Harbor International Airport (PHX), Phoenix Deer Valley Airport (DVT), and Phoenix Goodyear Airport (GYR). With forecasts predicting there may be up to 280,000 EVs on the road in Phoenix by the year 2030, and the current market desire for the electrification of transportation, the City of Phoenix (City) has a responsibility to prepare for the forthcoming demand for EVs and the associated EV charging infrastructure.

An inventory of existing EV charging infrastructure and fleet vehicles at PHX was completed in January 2022 ("EV Charging Inventory and Goal Setting Report"), and targets were established to meet City Aviation Department (AVN) 2030 goals. This Study includes an implementation plan, identification of infrastructure needs and opportunities, priority groups for implementation, and proposed EV charging draft policy.

ES.1 Industry Best Management Practices

Emerging practices used at other airports that applicable to PHX, DVT and GYR include a range of EV charger types to choose from and understand, consideration for networked vs. non-networked charging, as well as hard wired load management vs. wireless load management systems. Pros and cons associated with types of EV charging interface types, or physical charging layouts (e.g., plug-in, overhead, and wireless charging) are also addressed.

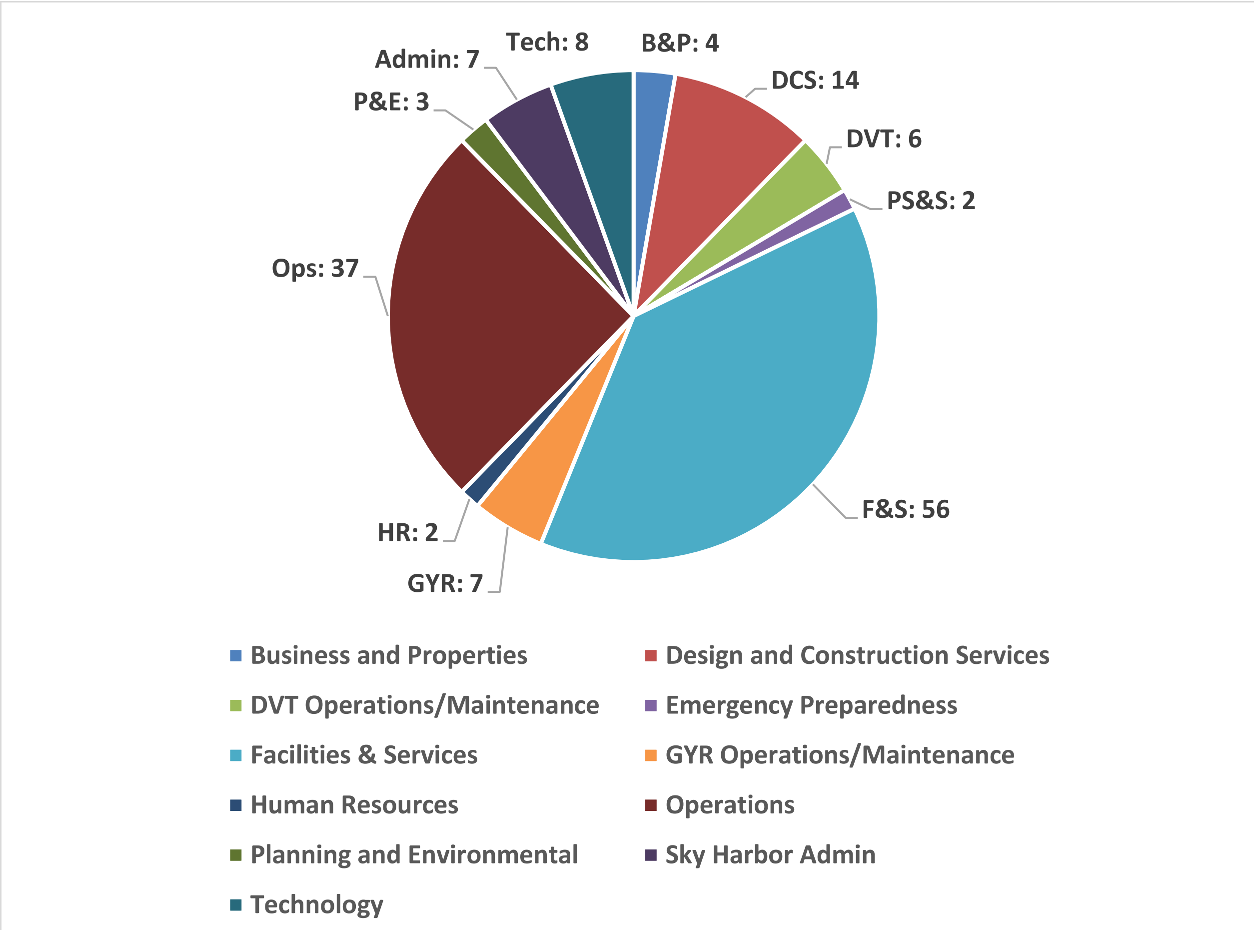
ES.2 Type of Chargers by User Group

Eight primary user groups were identified for this Study: short-term revenue public parking, long-term revenue public parking, non-revenue public parking, ground transportation, AVN employee private vehicles, non-AVN employee private vehicles (e.g., airlines and concession employees), AVN light-duty fleet vehicles, and shuttle buses. The parking locations at PHX that currently serve each of the eight primary user groups were identified, along with the number of existing EV-installed parking stalls at each of the locations, and the recommended charging type (E.g., Level 1, 2 or DC Fast) for each group.

ES.3 AVN Light-Duty Fleet EV Replacement

In support of the City's overall efforts, AVN has established a goal to replace all applicable light-duty fleet vehicles with EVs as vehicles become due for replacement and where vehicle utility allows. The City's EV Roadmap to 2030 includes an EV fleet transition purchasing policy that prioritize EV as a first-choice option. AVN fleet vehicles that are eligible for EV replacement by division are included in **Figure ES-1**. Through discussions with staff, an additional 14 vehicles were identified that could be EV-replacement eligible based on the vehicle's usage and function. In total, there are 146 AVN fleet vehicles eligible for EV replacement.

Figure ES-1: AVN Eligible Vehicles for EV Replacement(1)



Source: Fleet vehicle list, Facilities & Services Fleet, July 12, 2022, and HNTB analysis.

Notes:
(1) Note that there are 132 existing AVN light-duty fleet vehicles that are eligible for EV replacement and an additional 14 vehicles that are eligible for replacement after right-sizing based on fleet use surveys conducted with Section Heads.

A phased implementation would allow time to gradually train vehicle operators and fleet technicians on proper EV operation and maintenance as the fleet is replaced. A list of recommended EVs to replace the existing fleet vehicles currently available on the market is provided and consists of Chevrolet Bolt/Bolt EUV, Ford F-150 Lightning or Ford E-Transit, the Chevrolet Equinox EV (in 2024), and the Ford Explorer EV (2025). Replacement targets in the short-, medium, and long-term are recommended in the Study. **Table ES-1** provides a high projection of AVN light-duty fleet vehicles to be replaced with EVs annually between 2023 and 2030.

Table ES-1: High Projection of EV Light-Duty Replacement by Fiscal Year

	2023	2024	2025	2026	2027	2028	2029	2030
Projected Number of AVN Fleet Vehicle EV Replacement	16 (1)	25 (1)	13	18	18	19	19	18

Source: AVN Ordered EVs Spreadsheet, accessed 12/1/2022, and HNTB analysis.

Notes:

(1) The projected number of EV replacements for FY 2023 and FY 2024 is based on best available information as of 12/1/22 and is subject to change due to supply chain issues / procurement challenges. Projections for future years (FY 2025 through 2030) are estimated based on vehicle age, historical light-duty fleet vehicle replacement data, and feasibility for EV replacement resulting from interviews with Section Heads.

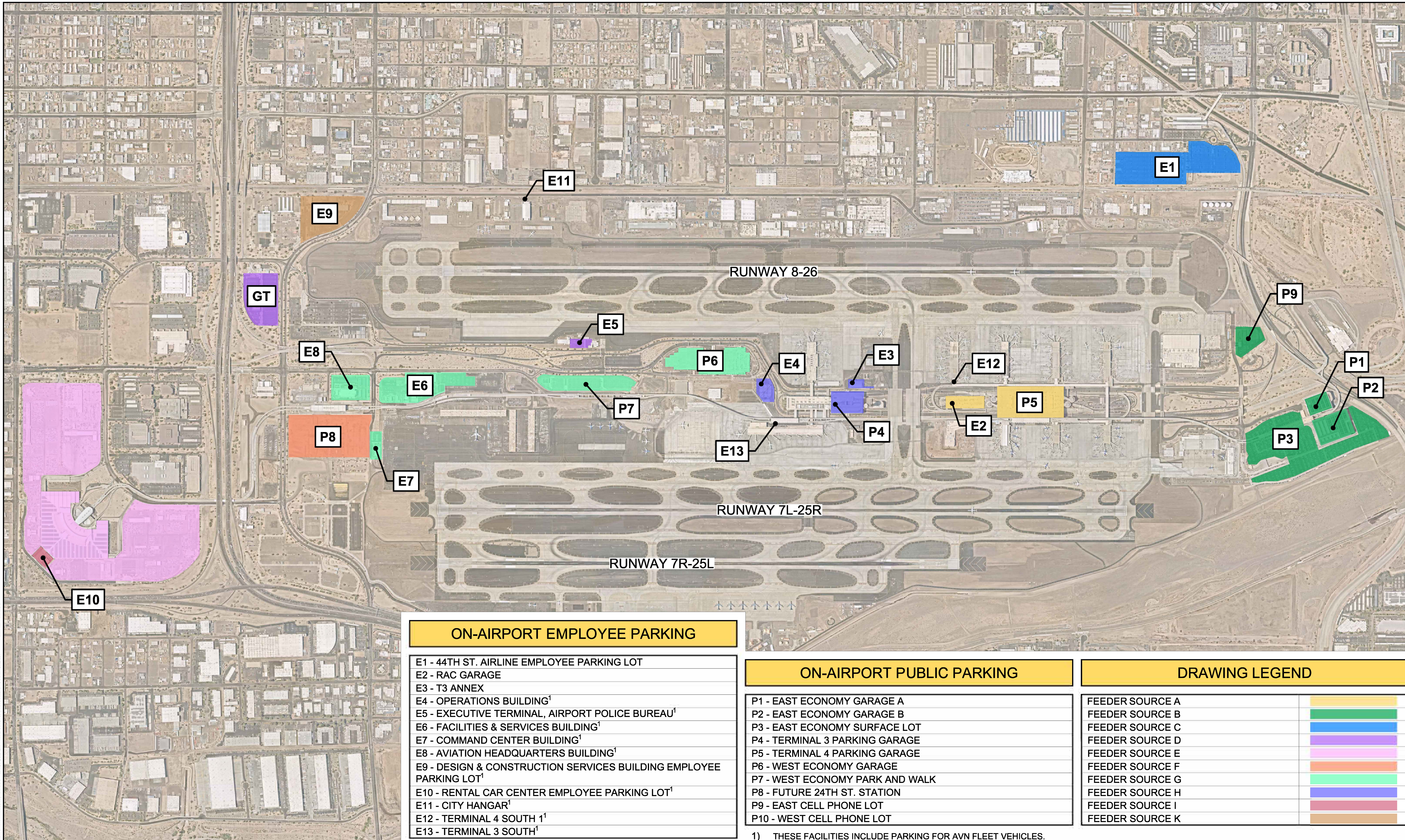
ES.4 Analysis of Existing Electrical Infrastructure

The methodology used to review existing electrical infrastructure included review of the local infrastructure (panels, switchboards, and Service Entrance Sections [SESs]) and upstream infrastructure (Arizona Public Service [APS] feeders) to determine available capacity. As part of this, as-built drawings were reviewed and site investigations were conducted at panels in proximity to PHX parking lots to field verify existing electrical infrastructure. 30-day metering was also conducted on viable panels to meet the 30-day load study requirements of National Electrical Code (NEC) 220.87. Following the metering data, the maximum number of chargers that can be fed by the existing electrical infrastructure with and without the implementation of load management was determined.

Figure ES-2 illustrates the feeder source for each of the potential locations for future EV chargers at PHX. The projected EV charger demand was then compared to the available electrical capacity on each circuit to identify, for each location, the EV charger installation thresholds that can be achieved without overloading APS circuits, which is depicted graphically in **Figure ES-3.**

ES.5 Proposed Distribution Approach

The proposed distribution approach and the associated Rough Order of Magnitude (ROM) cost estimate for implementing EV chargers is presented for the PHX parking facilities. The ROM cost estimate accounts for the EV chargers and any associated installation and network service cost (where applicable). Additionally, any additional infrastructure needed to support the recommended number of EV stalls (e.g., new SES, new panels, new APS circuits and infrastructure) are also accounted for in the ROM cost estimate. Note that these are hard construction costs and do not include any soft costs. The ROM also does not include any potential offsite upgrades that may be required. **Table ES-2** summarizes the total quantity of EV charging stalls and the associated ROM cost estimate with and without load management for each of the opportunity sites identified in the prior sections. The ROM costs include the EV chargers, as well as the additional infrastructure needed to support the recommended number of EV stalls (e.g., new SES, new panels, new APS circuits and infrastructure).



ON-AIRPORT EMPLOYEE PARKING
E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING[1]
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU[1]
E6 - FACILITIES & SERVICES BUILDING[1]
E7 - COMMAND CENTER BUILDING[1]
E8 - AVIATION HEADQUARTERS BUILDING[1]
E9 - DESIGN & CONSTRUCTION SERVICES BUILDING EMPLOYEE PARKING LOT[1]
E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT[1]
E11 - CITY HANGAR[1]
E12 - TERMINAL 4 SOUTH 1[1]
E13 - TERMINAL 3 SOUTH[1]

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE
P5 - TERMINAL 4 PARKING GARAGE
P6 - WEST ECONOMY GARAGE
P7 - WEST ECONOMY PARK AND WALK
P8 - FUTURE 24TH ST. STATION
P9 - EAST CELL PHONE LOT
P10 - WEST CELL PHONE LOT

1) THESE FACILITIES INCLUDE PARKING FOR AVN FLEET VEHICLES.

DRAWING LEGEND	
FEEDER SOURCE A	
FEEDER SOURCE B	
FEEDER SOURCE C	
FEEDER SOURCE D	
FEEDER SOURCE E	
FEEDER SOURCE F	
FEEDER SOURCE G	
FEEDER SOURCE H	
FEEDER SOURCE I	
FEEDER SOURCE K	

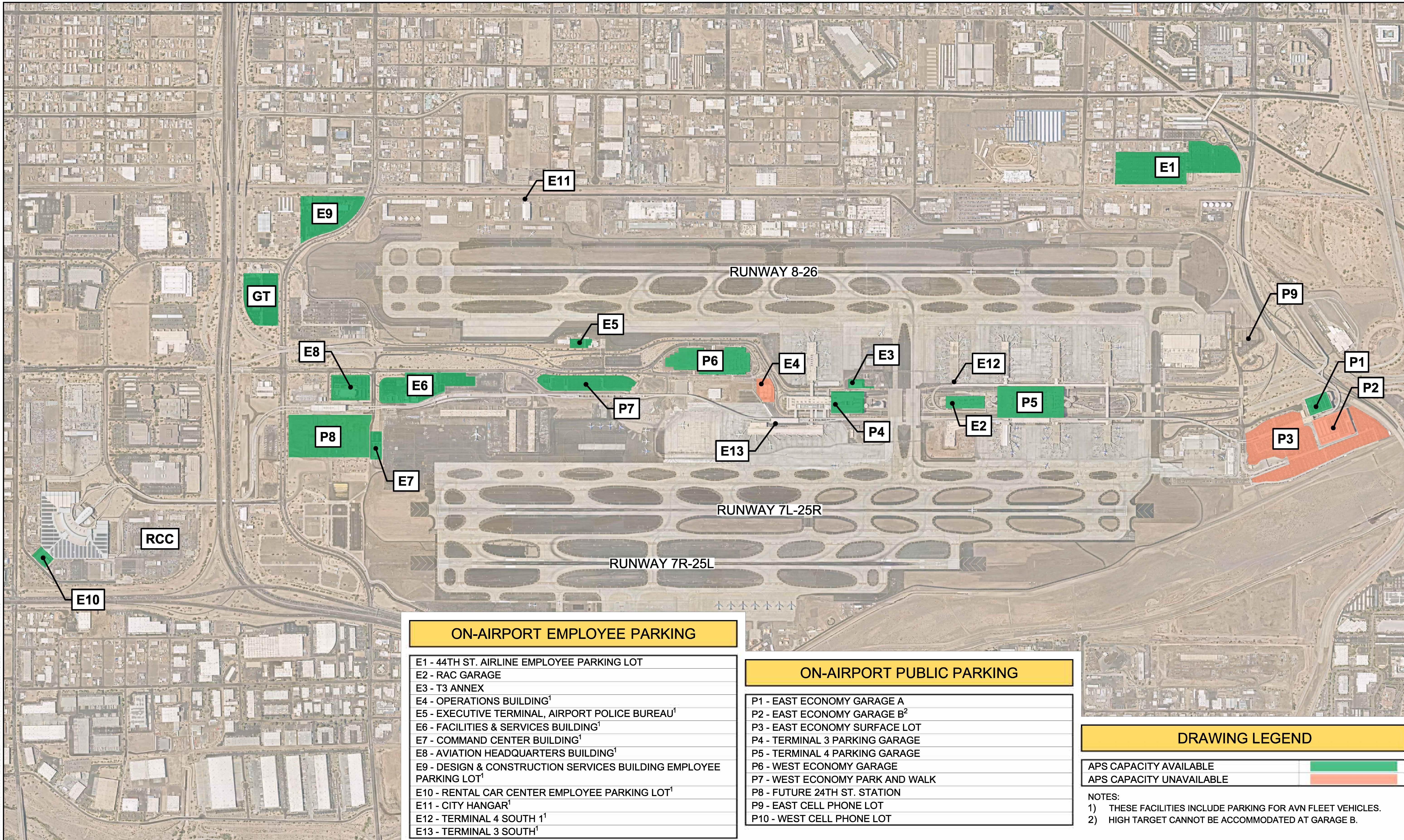
PHX

City of Phoenix

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

FIGURE ES-2 MAY 2023

FEEDER SOURCES AT POTENTIAL LOCATIONS FOR FUTURE EV CHARGERS



ON-AIRPORT EMPLOYEE PARKING
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E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT[1]
E11 - CITY HANGAR[1]
E12 - TERMINAL 4 SOUTH 1[1]
E13 - TERMINAL 3 SOUTH[1]

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B[2]
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE
P5 - TERMINAL 4 PARKING GARAGE
P6 - WEST ECONOMY GARAGE
P7 - WEST ECONOMY PARK AND WALK
P8 - FUTURE 24TH ST. STATION
P9 - EAST CELL PHONE LOT
P10 - WEST CELL PHONE LOT

DRAWING LEGEND	
APS CAPACITY AVAILABLE	(green)
APS CAPACITY UNAVAILABLE	(orange)

NOTES:
1) THESE FACILITIES INCLUDE PARKING FOR AVN FLEET VEHICLES.
2) HIGH TARGET CANNOT BE ACCOMMODATED AT GARAGE B.

PHX City of Phoenix

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N

0 1,300' 2,600'

FIGURE ES-3 MAY 2023

APS CAPACITY TO SERVE AT POTENTIAL LOCATIONS FOR FUTURE EV CHARGERS

Table ES-2: Summary of ROM EV Chargers Maximum Implementation Cost

Facility	User Group (1)	No Load Management			With Load Management		
		Type of EV Chargers	Maximum Number of EV-Installed Stalls	ROM Total Cost(2)	Type of EV Chargers	Maximum Number of EV-Installed Stalls	ROM Total Cost(2)
T3 Parking Garage	• Short-term Public	• Level 2 (7.2kW to 11.4kW)	61	$1,168,000	• Level 2 (7.2kW to 11.4kW)	122	$1,722,000
T4 Parking Garage	• Short-term Public	• Level 2 (7.2kW to 11.4kW)	82	$1,895,000	• Level 2 (7.2kW to 11.4kW)	164	$2,428,000
East Economy Garage A (3)	• Long-term Public	• Level 2 (Reduced Power Output)	245	$4,968,000	• Level 2 (Reduced Power Output)	469	$6,484,000
East Economy Garage B	• Long-term Public	• Level 2 (Reduced Power Output)	59	$596,000	• Level 2 (Reduced Power Output)	118	$1,066,000
East Economy Lot	• Long-term Public • Shuttle Buses	• Level 2 (Reduced Power Output) • 350kW DCFC	181 Level 2 2 DCFC	$4,700,000	• Level 2 (Reduced Power Output) • 350kW DCFC	364 Level 2 2 DCFC	$6,013,000
West Economy Garage	• Non-AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	58 Level 1 17 Level 2	$574,000	N/A (4)		
West GT Lot	• Ground Transport	• 80kW DCFC	8	$3,250,000	• 150kW DCFC(6)	8	$3,808,000
24th Street Express Pay Parking	• Long-term Public	• Level 2 (Reduced Power Output)	83	$764,000	• Level 2 (Reduced Power Output)	165	$1,352,000
West Economy	• Long-term Public	• Level 2	10	$156,000	• Level 2	20	$227,000

Facility	User Group (1)	No Load Management			With Load Management		
		Type of EV Chargers	Maximum Number of EV-Installed Stalls	ROM Total Cost(2)	Type of EV Chargers	Maximum Number of EV-Installed Stalls	ROM Total Cost(2)
Park & Walk		(Reduced Power Output)			(Reduced Power Output)		
Operations Building Parking Lot	• AVN Fleet	• High Output Level 2 (Up to 19.2kW)	22	$1,471,000	• High Output Level 2 (Up to 19.2kW)	22	$1,301,000
Facilities & Services Building Parking Lot	• AVN Fleet	• High Output Level 2 (Up to 19.2kW)	36	$1,052,000	• High Output Level 2 (Up to 19.2kW) • 150kW DCFC	40 Level 2 4 DCFC	$2,356,000
AVN HQ Parking Lot	• AVN Fleet • AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW) • High Output Level 2 (Up to 19.2kW)	• 15 Level 1 • 5 Level 2 • 25 High-Output Level 2	$960,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW) • High Output Level 2 (Up to 19.2kW)	• 30 Level 1 • 5 Level 2 • 25 High-Output Level 2	$806,000
Command Center Parking Lot	• AVN Fleet	• High Output Level 2 (Up to 19.2kW)	15	$478,000	• High Output Level 2 (Up to 19.2kW)	15	$393,000
DCS Building Parking Lot	• AVN Fleet • AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW) • High Output Level 2 (Up to 19.2kW)	• 40 Level 1 • 7 Level 2 • 17 High-Output Level 2	$1,633,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW) • High Output Level 2 (Up to 19.2kW)	• 40 Level 1 • 7 Level 2 • 17 High-Output Level 2	$1,461,000
44th Street Airline Employee Parking Lot	• Non-AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	168 Level 1 56 Level 2	$3,233,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	337 Level 1 112 Level 2	$3,876,000

Facility	User Group (1)	No Load Management			With Load Management		
		Type of EV Chargers	Maximum Number of EV-Installed Stalls	ROM Total Cost(2)	Type of EV Chargers	Maximum Number of EV-Installed Stalls	ROM Total Cost(2)
RAC Garage	• Non-AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	41 Level 1 14 Level 2	$1,241,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	83 Level 1 28 Level 2	$1,401,000
Executive Terminal	• AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	5 Level 1 1 Level 2	$583,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	10 Level 1 2 Level 2	$594,000
Rental Car Center Employee Parking	• AVN Fleet	• High Output Level 2 (Up to 19.2kW)	2	$114,000	• High Output Level 2 (Up to 19.2kW)	2	$114,000
East Cell Phone Lot	• Short-term Public	• 2 150kW DC Fast Chargers	2	$811,000	• 2 150kW DC Fast Chargers	2	$811,000
	Total	**$29,647,000**			**$36,787,000 (5)**		

Source: HNTB analysis, 2022-2023.

Notes:
(1) The user group(s) identified in this column classify users that have future chargers assigned to them in the implementation plan (based on limitations due to existing infrastructure), and do not represent all users that are currently parking at that facility.
(2) The ROM total costs are hard construction costs and do not include any soft costs.
(3) The evaluation of the existing electrical infrastructure reveals that East Economy Garage B is a better candidate for implementing EV chargers between East Economy Garages A and B as it can support a high number of chargers at a lower implementation cost in comparison to Garage A. The ROM cost and number of EV-installed stalls are included for illustration purposes.
(4) Note that the bulk of the chargers recommended for the West Economy Garage are Level 1 chargers (120-V receptacles), which do not provide any load management capabilities.
(5) Note that this ROM total cost accounts for West Economy Garage (without load management).
(6) As an alternative, fewer 250kW chargers could be used in place of the 150 kW chargers for faster charging.

ES.6 Phased Implementation Plan

Implementation Priorities

A phased implementation plan is recommended that assigns the priorities (Priority Groups 1 through 3 with Priority 1 as the most critical need) for each of those locations and the preferred distribution approach, which considers the most critical needs, potential implementation costs, and the feasibility to implement. The intent of dividing the potential locations to future EV chargers priority groups allows AVN to implement additional projects/infrastructure upgrades in any given year should there be additional funding available and/or if the parking facility is undergoing major alterations. **Figure ES-4** illustrates the parking facilities included in all three priority groups. The priority groups are summarized as follows:

Priority Group 1 includes the parking facilities with the highest priority for EV charger implementation. **Table ES-3** identifies the initial and maximum number of EV-Installed parking spaces that can be accommodated at each of the parking facilities above and the corresponding ROM cost estimate for each.

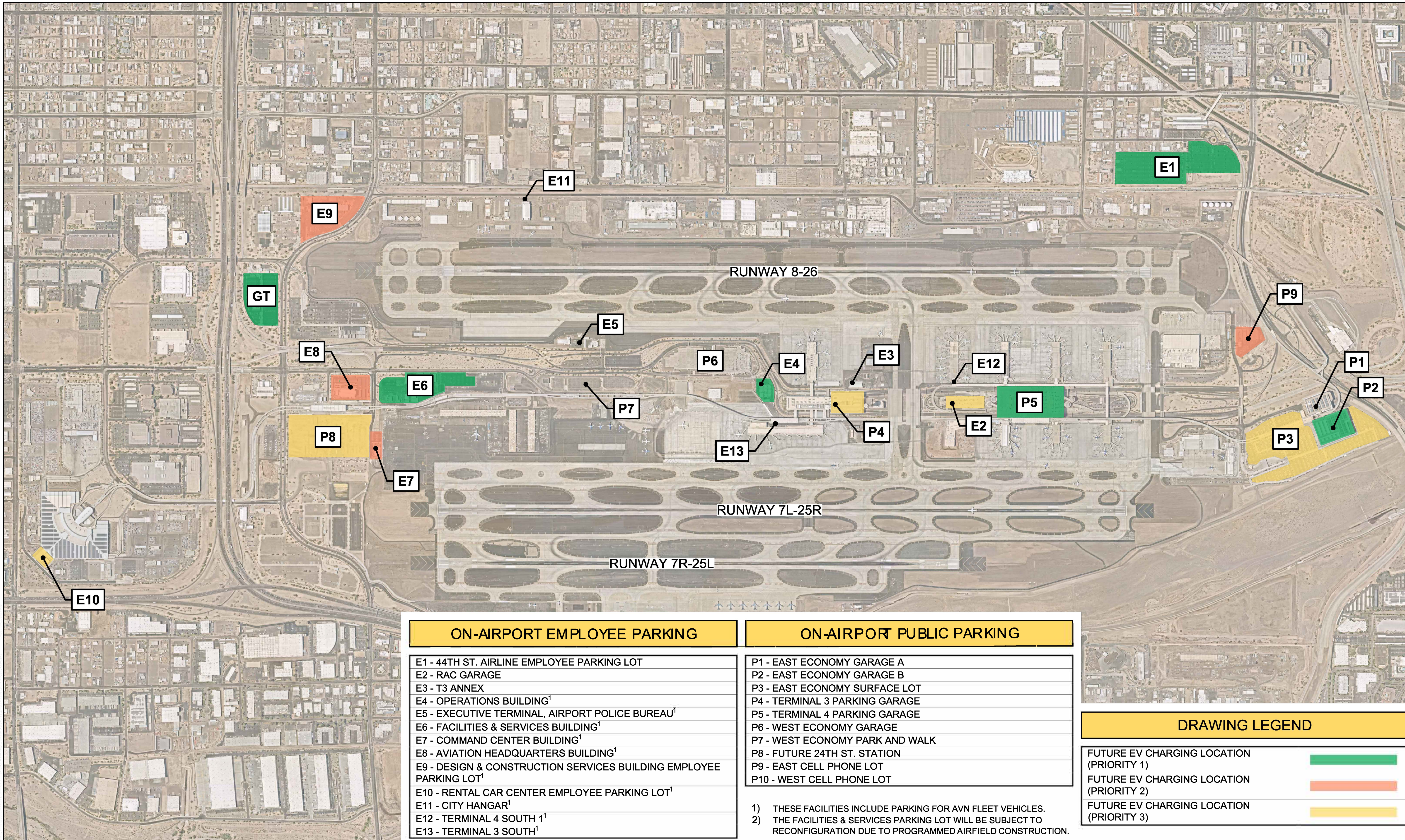
Priority Group 2 consists of the next group of parking facilities with priority for EV charger implementation. **Table ES-4** identifies the maximum number of EV-Installed parking spaces for each of the parking facilities listed above and the corresponding ROM cost estimate for each.

Priority Group 3 consists of the remaining parking facilities for EV charger implementation. **Table ES-5** identifies the initial and maximum number of EV-Installed parking spaces for each of the parking facilities listed above and the corresponding ROM cost estimate for each.

Funding Sources

Initial programs identified as possible funding sources include the following, discussed in more detail in *Section 7.2, Funding Sources*. The team is monitoring these opportunities and working with AVN to identify relevant grants to apply for.

- Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA)
- Charging and Fueling Infrastructure Grants
- National Electric Vehicle Infrastructure Formula Program:
- Energy Efficiency and Conservation Block Grant (EECBG) Program
- Voluntary Airport Low Emissions (VALE) Program
- Zero Emissions Vehicles (ZEV) Program



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1) THESE FACILITIES INCLUDE PARKING FOR AVN FLEET VEHICLES.
2) THE FACILITIES & SERVICES PARKING LOT WILL BE SUBJECT TO RECONFIGURATION DUE TO PROGRAMMED AIRFIELD CONSTRUCTION.

DRAWING LEGEND	
FUTURE EV CHARGING LOCATION (PRIORITY 1)	green
FUTURE EV CHARGING LOCATION (PRIORITY 2)	orange
FUTURE EV CHARGING LOCATION (PRIORITY 3)	yellow

PHX City of Phoenix

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N
0 1,300' 2,600'

FIGURE ES-4 MAY 2023

EV CHARGING STATIONS IMPLEMENTATION (ALL PRIORITY GROUPS)

Table ES-3: EV-Installed Parking Spaces Implementation (Priority 1)

Location	User Group	Initial Number of EV-Installed Stalls	Maximum Number of EV-Installed Stalls	Load Managed (Y/N)	Initial ROM Cost (if applicable)	Total ROM Cost (Maximum)
F&S Building Parking Lot	AVN Fleet	40 High-Output Networked Level 2 4 Networked 150kW DCFC	40 High-Output Networked Level 2 4 Networked 150kW DCFC	Y	$2,356,000	$2,356,000
Operations Building Parking Lot	AVN Fleet	22 High-Output Networked Level 2	22 High-Output Networked Level 2	Y	$1,301,000	$1,301,000
T-4 Parking Garage	Short-term Public (Revenue)	50 Networked Level 2	164 Networked Level 2	Y	$1,636,000	$2,428,000
East Economy Garage B	Long-term Public (Revenue)	50 Networked Level 2 (Reduced Power Output)	118 Networked Level 2 (Reduced Power Output)	Y	$635,000	$1,066,000
44th Street Airline Employee Parking Lot	Non-AVN Employee Private Vehicles	50 Level 1 (120-V Receptacles) 9 Networked Level 2	337 Level 1 (120-V Receptacles) 112 Networked Level 2 (1)	Y	$3,083,000	$3,876,000
West GT Lot	Ground Transportation	8 Networked 150kW DCFC	8 Networked 150kW DCFC(2)	Y	$3,808,000	$3,808,000
				Total	**$12,819,000**	**$14,835,000**

Source: HNTB analysis, 2022-2023.

Notes:

(1) Note that the maximum number of EV-Installed parking stalls at the 44th Street Airline Employee Parking Lot corresponds to *the high target* (20% of total number of parking stalls) established from Phase 1 of EV study. The number of EV chargers are maximized at this location as it already requires a new 3000A SES and associated APS infrastructure upgrades to accommodate additional employees' charging at this location.

(2) As an alternative, fewer 250kW chargers could be used in place of the 150 kW chargers for faster charging.

Table ES-4: EV-Installed Parking Spaces Implementation (Priority 2)

Location	User Group	Maximum Number of EV-Installed Stalls[1]	Load Managed (Y/N)	Total ROM Cost (Maximum)
AVN Headquarters Parking Lot	AVN Fleet and AVN Employee Private Vehicles	30 Level 1 (120-V Receptacles) 5 Networked Level 2 25 High-Output Networked Level 2	Y	$806,000
Command Center Parking Lot	AVN Fleet and AVN Employee Private Vehicles	15 High-Output Networked Level 2	Y	$393,000
DCS Building Parking Lot	AVN Fleet and AVN Employee Private Vehicles	40 Level 1 (120-V Receptacles) 7 Networked Level 2 17 High-Output Networked Level 2	Y	$1,461,000
East Cell Phone Lot	Public (Non-Revenue)	2 Networked 150kW DCFC	Y	$811,000
			Total	**$3,471,000**

Source: HNTB analysis, 2022-2023.

Notes:

(1) The recommendation for initial installation and maximum installation are the same for Priority 2 because the recommended number of chargers is fewer than 50 at each of the locations.

Table ES-5: EV-Installed Parking Spaces Implementation (Priority 3)

Location	Type of Charging	Initial Number of EV-Installed Stalls	Maximum Number of EV-Installed Stalls	Load Managed (Y/N)	Initial ROM Cost (if applicable)	Total ROM Cost (Maximum)
T-3 Parking Garage	Short-term Public (Revenue)	50 Networked Level 2	122 Networked Level 2	Y	$1,233,000	$1,722,000
24th Street Express Pay Parking Lot	Long-term Public (Revenue)	50 Networked Level 2 (Reduced Power Output)	165 Networked Level 2 (Reduced Power Output)	Y	$529,000	$1,352,000
East Economy Lot	Long-term Public (Revenue)	50 Networked Level 2 (Reduced Power Output) 2 Networked 350kW DCFC	364 Networked Level 2 (Reduced Power Output) 2 Networked 350kW DCFC(1)	Y	$4,019,000	$6,013,000
RAC Garage	Non-AVN and AVN Employee Private Vehicles	50 Level 1 (120-V Receptacles) 9 Networked Level 2	83 Level 1 (120-V Receptacles) 28 Networked Level 2(1)	Y	$1,280,000	$1,401,000
RCC Employee Parking Lot	AVN Fleet and AVN Employee Private Vehicles	2 High-Output Networked Level 2	2 High-Output Networked Level 2	Y	$114,000	$114,000
				Total	**$7,175,000**	**$10,602,000**

Source: HNTB analysis, 2022-2023.

Notes:

(1) Note that the maximum number of EV-Installed parking stalls at the East Economy Surface Lot and RAC Garage corresponds to *the high target* (20% of total number of parking stalls) established from Phase 1 of EV study. The number of EV chargers are maximized at this location as it already requires major infrastructure upgrades (including new SES and associated APS infrastructure upgrades) to provide additional chargers at this location.

ES.7 Additional EV Policies

As a starting point, additional EV policies have been identified for the City to consider as it develops policy and guidance for and implementing the use of EVs at PHX, DVT and GYR. These include new construction requirements for 5% of the total number of parking spaces to be EV-installed parking spaces and an additional 15% to be EV-capable parking spaces; compliance with a U.S. Access Board provisions for accessible mobility features; fleet EV policies that follow U.S. Department of Energy guidelines for drivers, operators, staff and technicians; and policies related to EV charger signage and wayfinding.

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1.0 Introduction

The purpose of the Electric Vehicle (EV) Charging Feasibility Study is to work with the City of Phoenix (City) Aviation Department (AVN) and the City Manager's Office of Sustainability staff to set specific EV initiatives for airport users, employees, and AVN light-duty fleet at Phoenix Sky Harbor International Airport (PHX), Phoenix Deer Valley Airport (DVT), and Phoenix Goodyear Airport (GYR). These EV initiatives will help support the City's implementation of the 2022 Transportation Electrification Action Plan (TEAP), which is intended to support and accelerate the City's transition to EVs*.* City of Phoenix Mayor Kate Gallego launched an Ad Hoc Committee in 2021 to prepare recommendations for the 2022 TEAP. With forecasts predicting there may be up to 280,000 EVs on the road in Phoenix by the year 2030, and the current market desire for the electrification of transportation, the City has a responsibility to prepare for the forthcoming demand for EVs and the associated EV charging infrastructure. The 2022 TEAP made recommendations to facilitate the transition to EVs. To align with the 2022 TEAP and adequately accommodate projected EV growth, the EV Charging Feasibility Study includes the following key objectives:

- Collect information on all existing EV infrastructure, EV chargers, and inventory available electrical infrastructure
- Summarize anticipated demand for each user group and identify opportunities for new EV charging stations
- Review and evaluate each EV charging opportunity and its power needs
- Develop draft policy guidance surrounding EV charging

To inform this study, an inventory of existing EV charging infrastructure and existing fleet vehicles at PHX, DVT and GYR was completed in January 2022 ("EV Charging Inventory and Goal Setting Report"). Refer to **Appendix A** for the inventory and also for the initial establishment of AVN 2030 goals completed as part of that information gathering process.

<u>The following tasks were identified to support the analysis and findings in this Study</u>:

Create an implementation plan identifying the following:
- Overall industry best management practices and charging types
- Type of chargers by facility location and user group
- AVN fleet EV replacement targets
- Identify infrastructure needs to install chargers (e.g., additional chargers, electrical infrastructure improvements, new conduit) and proposed distribution approach

Establish draft policy surrounding EV charging:
- Determine implementation priorities and identify priority groups for EV infrastructure development by user group and location
- Identify initial funding sources and opportunities to consider
- Recommend current and future policies to meet AVN goals (e.g., percent of required EV stalls for new construction, level of chargers, fleet)

2.0 Industry Best Management Practices

In general, EV BMPs for airports are still being established in the industry. However, there are emerging practices being used at other airports that are applicable to PHX, DVT, and GYR. These practices include use of load management, and considerations for networked vs. non-networked chargers. Note that **Appendix B** includes a list of abbreviations and definitions that are utilized in this report.

2.1 Comparison of EV Chargers

There are various EV charging types which vary in price, how quickly they charge an EV battery, built in software/hardware capabilities, and space efficiency. **Table 2-1** summarizes the typical parameters for the following EV chargers: Level 1, Level 2, and DC Fast Chargers (DCFC), and key pros and cons in utilizing each type.

Level 2 chargers are primarily used by the public at many airports as they typically come with more advanced software capable of better integrating with load management systems, which gives them an advantage over Level 1 chargers. Moreover, these chargers are capable of charging a fee for usage, are simpler to maintain, and can store usage data. They are also capable of manipulating the amount of electricity to avoid electricity demand charges or overuse, further discussed in **Section 2.3**, *Load Management*. Level 2 chargers are also capable of charging vehicles up to 10 times faster than Level 1 chargers. San Francisco International Airport (SFO) and Seattle-Tacoma International Airport (SEA) both use Level 2 charging for public parking, and both airports have goals to increase the number of Level 2 chargers for public charging in their most recent EV readiness roadmaps.

Typically, a combination of Level 1 and Level 2 EV chargers is preferred for employees' private vehicles in large workplaces, including airports. Offering free access to Level 1 EV charging at the workplace can help incentivize the purchase and adoption of EVs by employees, while Level 2 chargers may be made available for use with a fee on occasions that employees need additional or faster charging. Level 2 chargers are more expensive but can supply a large amount of electricity (240V) in a shorter amount of time than a Level 1 charger. A Level 1 charger would not be able to charge an EV from near-empty to near-full over the course of an 8-hour workday, however Level 1 charging systems are inexpensive in hardware and installation cost and would be sufficient for most employees' commute home after a workday (estimated average commute time is 26 minutes[1]).

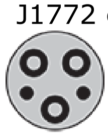
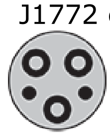
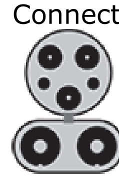
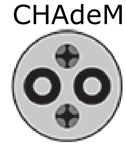
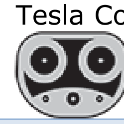
There is a lot of focus by municipalities, including city-owned airports like PHX, on the replacement of light-duty fleet vehicles to EVs. For example, the San Francisco Zero Emission Vehicle (ZEV) Municipal Fleet Ordinance requires all City of San Francisco-owned light-duty vehicles to be ZEVs by December 31, 2022. High-output

[1] City of Phoenix and Maricopa Association of Governments, *Commute Shed Analytics*, April 2022, https://azmag.gov/Portals/0/Maps-Data/Commute-Shed-Reports/Phoenix.pdf?ver=TXS4CInaml-w_tmnt4A10A%3d%3d.

networked Level 2 charging infrastructure equipped with load management is SFO's preferred charging type for light-duty vehicles due to the capability to store usage data, and the ability to reduce peak consumption by manipulating the amount of electricity output during peak demand periods. Networked chargers also provide the capability to troubleshoot without human intervention.

DCFCs are commonly the preferred charging type for medium- and heavy-duty airport fleets or airport users that need a quicker time to charge to return to service (e.g., shuttles, cell phone lots, Transportation Network Companies [TNCs]). In the case of San Diego International Airport (SAN), to achieve California's zero-emission airport shuttle regulation requiring airport shuttle operators to transition to 100% zero-emission vehicle technologies by the end of 2035, their EV Roadmap includes recommendation for opportunities to identify sites to co-locate high power DCFC charging equipment for their airport shuttles.

Table 2-1: Comparison of EV Chargers

Parameter	Level 1	Level 2	DC Fast
Graphical Representation			
Voltage	120V 1-Phase Alternative Current (AC)	208V 1-Phase AC	480V 3-Phase AC
Amps	12 to 16 Amps	12 to 80 Amps (Typical 32 Amps)	<125 Amps (Typical 60 Amps)
Connector Type	Compatible with: • J1772 connector 	Compatible with: • J1772 connector 	Compatible with: • Combined Charging System (CCS) Connector  • CHAdeMO Connector  • Tesla Connector 
Typical Power Output	1.4 to 1.9 kW	2.5 to 19.2 kW (Typical 7 kW)	50 to 350 kW

Parameter	Level 1	Level 2	DC Fast
Range	2 to 5 miles of range per 1 hour of charging	10 to 30 miles of range per 1 hour of charging	150 to 350+ miles of range per 1 hour of charging
Cost (Unit Cost/ Install Cost) (1)	• 120V Receptacle: $100 / $500	• Level 2 Single (Wallmount): $3,600/ $2,000 • Level 2 Dual (Pedestal): $7,200-$8,400/ $2,800	• 80kW DCFC: $15,000 / $10,300 • 150kW DCFC: $50,000/ $22,300 • 350kW DCFC: $100,000/ $36,500
Pros	• Cost efficient • Typically fed with 120V outlet • Space efficient for installation of large clusters of chargers	• Can be equipped with better payment and networked software • Built-in software capable of providing useful charging session data and analytics • Faster charge than Level 1 charger counterparts • Up to 6 chargers per 30/40A, 2-pole breaker • Typically load management ready and supported by vendors that provide load management hardware and software in addition to the clusters of EV chargers	• Significantly faster charging capability than regular AC charging stations • Delivers DC power directly to the EV battery without requiring the onboard charger to convert it
Cons	• Very few options with built-in payment software or compatible with load management systems • Longer charge times	• More costly than Level 1 chargers • Require load management if implemented in clusters that exceed available electrical capacity	• More costly to produce, install and operate than Level 1 and Level 2 chargers • Larger size than AC chargers and may require more space

Note:
(1) ROM cost estimates based on vendor data from BLINK, Clipper-Creek, EVSE LLC, and SemaConnect, 2022, and HNTB analysis. Does not include cost associated with load management.

2.2 Networked vs. Non-Networked Charging

EV chargers can be connected remotely to a larger network or be standalone hardwired chargers (non-network). Both types of chargers provide the energy necessary to power an EV; however, they have significant differences in the initial costs, ongoing costs, accessibility, and maintenance.

2.2.1 Networked Charging

Networked chargers, or "smart" chargers, can send and receive communication for data exchange. Using an internet-based networking service provides the capability to collect usage data, manage charger access, and set pricing. Networked chargers also allow for remote maintenance and troubleshooting, improved cost management, and mapping of EV charger availability. Networking allows EV owners to monitor charging activity and detect failures in real time over a desktop or mobile device. Additionally, usage and demand data obtained from networked chargers can be provided to utility providers who can better plan for high demand events.

Cloud-based communication service is also available from some networking services and provides additional functionality, making it possible for interface between the owner and the user. Most networked chargers use the Open Charge Point Protocol (OCPP), making them compatible with most network providers. Networked chargers that use only proprietary communications protocols, however, are likely to only communicate with their vendor's network services, which restrict the choices for selecting other network providers in the future. While EV chargers' vendors provide the software for networked or cloud-based communications, their software's reliability is dependent on the quality of the available internet connection. Networked charging also makes it easier to track usage and collect usage data of the EV chargers, which some grant funding requires for eligibility. For example, the Federal Aviation Administration's (FAA) Airport Zero Emissions Vehicle and Infrastructure Pilot Program indicates that the airport sponsor must track and maintain records of ZEV-funded equipment use.

2.2.2 Non-Networked Charging

In comparison, non-networked (or hardwired) chargers do not have network access. They are stand-alone units that charge EVs, are typically less expensive to purchase and operate, but do not have many of the benefits associated with networked chargers. Non-networked chargers are not connected to a network of connected chargers, nor do they have remote access to online management tools through any online portals of an EV chargers' network and must be manually added to the EV driver resources online. Since non-networked chargers are not able to access the internet, they are not able to monitor usage or charge a fee for usage, and also require physical visits by technicians for troubleshooting and necessary maintenance.

2.3 Load Management

Load management systems have become essential in the EV market and are widely used where there are clusters of EV charging at locations such as airports. Traditionally, load management is applied in a public charging or managed fleet scenario, where vehicles can be parked for longer periods than needed to receive enough charge, and the load management software distributes the charging time based upon available capacity and pricing constraints. Also known as load shifting, load control, load curtailment, and load restricting, load management controls the maximum total power made available to a group of EV chargers. The load management system is connected to the Airport power management system to determine the power available for EV charging and uses system input to balance the power output among the EV chargers and other energy consuming assets relying on power. It includes demand response capability that connects to the electric utility and other third-party software platforms, and it controls how the available power is shared across a group of EV chargers.

The load management system can be programmed to prioritize costs by balancing the electrical grid and demand pricing. For example, the load management system can be programmed with a maximum consumption limit to avoid peak demand pricing or programmed to consume more electricity at times when the grid has more capacity than demand. Benefits include the ability to operate EV chargers within the design capacity of existing electrical infrastructure, thus minimizing electrical installation requirements, maximizing the total number of parking spaces outfitted with EV chargers using existing electrical infrastructure, reducing the need for upgrades, and reduced demand for energy, resulting in lower electricity/energy costs.

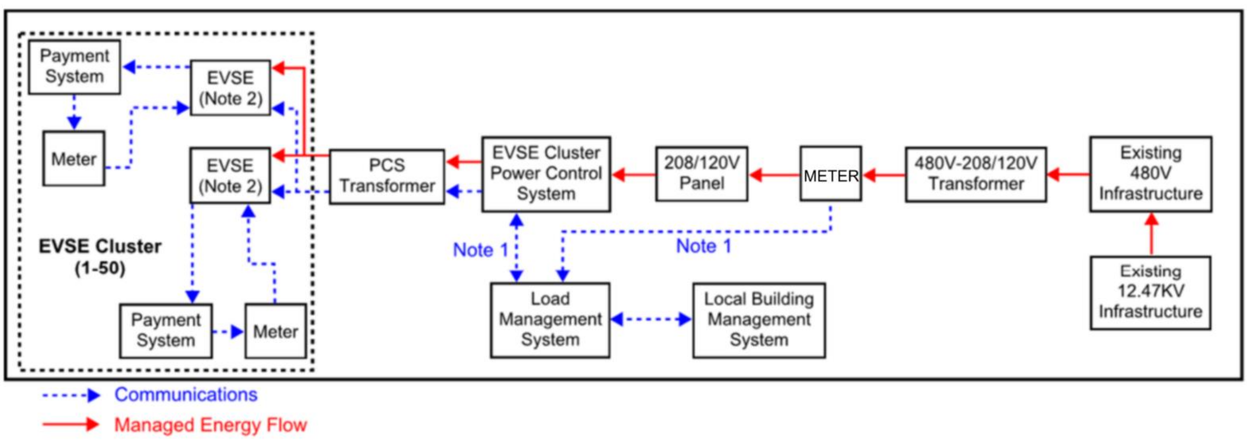
One of the advantages of the load management system is that it can be designed to manage EV charging while also protecting essential building services (air conditioning, elevators, computers, lighting etc.) using the same electrical power supply during peak load periods. This would provide benefits at PHX, where management of EV charging loads can be used to eliminate peak demand charges while maximizing the amount of EV chargers available in garages and parking lots. Load management allows the use of an existing electrical panel's power capacity to charge multiple EVs via EV chargers by allowing the EV chargers to communicate with each other, distributing a steady electrical current to each one. This also provides a significant reduction in utility demand charges during peak load periods. Systems with these types of controls have been deployed at various locations throughout the country.

EV chargers controlled by a load management system either reduce power output feeding the cluster of EV chargers or communicate with individual EV chargers to adjust the output depending on the configuration of the load management system. For example, if an electrical panel provides 80 amps, but there are four EV chargers that each need 40 amps at full charging capacity, if each EV charger worked at full capacity at the same time, they would demand more electricity than what the electrical panel can provide, causing issues and overwhelming the electrical panel. However, when the EV chargers can communicate with each other, electricity can be spread out amongst all four EV chargers to distribute 20 amps to each, providing an even load between the four EV chargers. If one EV leaves, each EV charger would begin distributing 26 amps. Load management software and system components can either be provided by the vendor of the EV chargers, or from a third party that integrates with new and existing EV chargers.

2.3.1 Hard Wired Load Management System

In a hard-wired load management system, the networking device that runs the load management system is approximately the size of a desktop computer and can be wall-mounted in a garage. An algorithm determines the charger schedule for each EV. **Figure 2-1** demonstrates how a hard-wired load management system operates. Hardwired Load management system costs are based on the required hardware that controls a set array of chargers. More robust Power Control Systems (PCSs) can control up to 50 EV chargers simultaneously, though distance can limit the quantity of chargers that can be supported by a single PCS. For each set of 50 EV chargers, the power management hardware, software, and additional features can cost between $4,000 and $5,000 dollars. This cost does not include the cost of running network cables, such as CAT5/6, to the individual chargers, the cost of installing the hardware, or annual software fees. Additionally, these PCS systems are generally controlled by a local interface that may require an enclosure or a room dedicated to adjusting the PCS system settings. These costs can add between $250 and $500 per charger depending on distance from the PCS.

Figure 2-1: Example System Diagram for Hardwired Load Management



Note 1 - EVSE Cluster Power Control System and the local Building Management System will communicate using existing fiber where available. Remote Parking Facilities may use Wireless communication to interface with the Building Management System.

Note 2 - Each EVSE should be capable of individual control and have its own breaker, separate metering, and payment interface.

Source: HNTB Corporation.

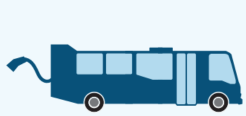
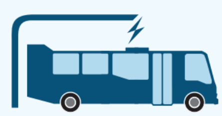
2.3.2 Wireless Load Management System

Wireless load management systems use a cellular network to communicate with the EV chargers and do not require a power control monitoring system. Wireless load managed charging clusters, system configuration, peak demand limits, user fees, EV charger access, and all other load management technology are controlled online through the cloud, and typically through a vendor website. Since there is no hardware required, installation cost and labor may be lower. There is also no limit to the quantity of EV chargers controlled by a single wireless load management system, and there is no limit to the number of charging cluster locations either. Alterations to a wireless load management system can be easily made online and remotely. As with networked charging, reliability is dependent on the quality of the available internet connection. Cellular network signal strength can also become an issue at the lower levels of parking garages, depending on the number of floors. The wireless network generally requires an annual fee for each charger, ranging from $200 to $350, though this is generally negotiable when a large quantity of chargers is being purchased for a single area. This would be in lieu of the upfront costs for the hard wired load management system.

2.4 EV Charging Interfaces

The three basic types of EV charging interfaces, or physical charging layouts, are shown in **Figure 2-2** and summarized in **Table 2-2** with key pros and cons for each interface type.

Figure 2-2: Basic EV Charging Interface Types

Type	Plug-in	Overhead	Wireless
Activation	Manual	Automated	Automated
Connection	 Conductive	 Conductive	 Wireless
Power range	Up to 350 kW	Typically 350-500 kW	Up to 250 kW
Voltage type	AC, DC and AC + DC	DC	AC

Source: PG&E, "Take Charge: A Guidebook to Fleet Electrification and Infrastructure," 2019, Figure 10.

Table 2-2: Comparison of EV Charging Interface Types

Interface Type	Pros	Cons
Plug-In Charges via a charging cord that is manually plugged into an EV's charging receiver. This is considered "conductive" because power is transferred to the vehicle via conductors in the plug and receptacle.	• Proven solution (standard EV charging approach) • Lower capital cost per charge port • Very high power (>300 kW) • Subsurface work generally limited to trenching for power cabinets	• Requires personnel to plug in and unplug vehicle for charging • Cable management
Overhead Provide power by connecting an EV to a DCFC using a pantograph. Because the pantograph can handle large conductors that would be difficult for an individual to manage in a manual plug-type interface, overhead systems can charge at higher power levels than plug-type interfaces. Currently, overhead charging is mostly used in specific transit bus applications.	• No delay waiting for personnel to connect EV • Similar subsurface work as manual systems	• Cable management/ connection logistics • Higher capital cost per port • Large footprint • Parking misalignment can prevent charging
Wireless A nonconductive interface that transfers power from a ground-mounted "transmitter" coil to a receiving coil mounted to the bottom of a vehicle. In practice, it is similar to wireless cell phone charging. Wireless charging systems with power levels as high as 250 kW have been demonstrated.	• No delay waiting for personnel to connect EV • No cable management issues • No operator action required to begin charging	• Slightly lower power range (50-250 kW typical) • Higher capital cost per port • Requires retrofit of vehicle to incorporate interface • Parking misalignment can prevent charging • Requires extensive subsurface work

Source: PG&E, "Take Charge: A Guidebook to Fleet Electrification and Infrastructure," 2019, and HNTB analysis.

3.0 Type of Chargers by User Group

The following user groups were defined upon initial inventory for the Study (See Appendix A):

- Revenue public vehicles (e.g., self-serve parking and valet parking)
- Non-revenue public vehicles (e.g., cell phone lot users)
- Revenue employee private vehicles (e.g., airlines and concessions employees)
- Non-revenue employee private vehicles (e.g., AVN staff)
- AVN fleet vehicles
  - *Note that official police pursuit vehicles are not included in Phase 1 of the AVN fleet vehicle EV replacement plan*
- Ground transportation (e.g., Taxi, TNC vehicles)
- Shuttle buses

There are 72 total EV stalls at PHX. **Table 3-1** summarizes the number of existing EV-installed stalls available at each location by the EVSE Levels 1 and 2.

Table 3-1: Number of Existing EV-installed Parking Stalls at PHX

Location	User Groups	Number of EV-installed Stalls		
		Level 1	Level 2	Total
44th St. Airline Employee Parking Lot	Revenue Employee Private Vehicles	0	6	**6**
Aviation Headquarters Building	Employee Private Vehicles, AVN Fleet Vehicles, and Non-revenue Public Vehicles (Visitor Parking)	22	0	**22**
Command Center Building	Non-revenue Employee Private Vehicles	2	0	**2**
Design & Construction Services Building	Non-revenue Employee Private Vehicles	1	0	**1**
Rental Car Center Employee Parking Lot	Non-revenue Employee Private Vehicles	1	0	**1**
Facilities & Services Building	Non-revenue Employee Private Vehicles	18	0	**18**
	AVN Fleet Vehicles	0	2	**2**
Executive Terminal, Airport Police Bureau	AVN Fleet Vehicles	2	0	**2**
Terminal 3 Parking Garage	ACE Parking	0	4	**4**
	Revenue Public Vehicles (Self-serve Parking)	0	12 (Blink)	**12**
Terminal 4 Parking Garage	Revenue Public Vehicles (Self-serve Parking)	0	2 (Blink)	**2**
	Total	**46**	**26**	**72**

Source: City of Phoenix EVSE Master List, dated September 10th, 2021, and HNTB analysis.

In determining the recommended type of chargers, the user groups listed above were further summarized into the following eight primary user groups:

1) Short-term revenue public parking
2) Long-term revenue public parking
3) Non-revenue public parking
4) Ground transportation
    - Accounts for taxis and TNC vehicles
5) AVN employee private vehicles
6) Non-AVN employee private vehicles
    - Accounts for airlines and concessions employees
7) AVN light-duty fleet vehicles
8) Shuttle buses

The following sections identify the parking locations at PHX that currently serve each of the eight primary user groups as well as the recommended charging type for each group. The recommended number of EV chargers will be discussed in **Section 6.0**, *Proposed Distribution Approach*.

3.1 Short-term Revenue Public Parking

Short-term revenue public parking at PHX is comprised of the garages adjacent to the terminal buildings and charges a higher daily maximum rate (approx. $30-$39) than long-term revenue public parking, which is located outside of the terminal area. The average parking duration in these garages is shorter than the average duration in the long-term facilities. Short-term revenue parking for the public is provided at the following locations at PHX:

- Terminal 3 (T-3) Parking Garage
- Terminal 4 (T-4) Parking Garage

The **Level 2 chargers (7.2 kW to 11.4 kW)** are the recommended charging type for both the T-3 and T-4 Parking Garages due to the shorter average duration of stay. Level 2 chargers output more power than Level 1 chargers and therefore require less time to charge. In addition, it is recommended that these EV chargers be **networked** and **load managed** allowing for the ability to collect usage data, manage EV charger access, set pricing and monitor EV charger's performance. Load management increases the quantity of EV chargers that can be installed using the existing electrical infrastructure and effectively manages the electrical load during peak demand periods thus reducing the cost of electricity during peak pricing periods. While these lots have a shorter duration of stay than the long-term revenue lots and accommodate meters and greeters who stay for under two hours, many vehicle still occupy parking spaces for eight hours or more and load management can help spread the electrical load among those vehicles.

3.2 Long-term Revenue Public Parking

Long-term revenue public parking at PHX is comprised of surface and garages farther from the terminal buildings outside of the terminal area and charge a lower daily maximum rate (approx. $9-$16) than short-term revenue parking. Long-term revenue parking for the public is provided at the following locations at PHX:

- West Economy Garage
- West Economy Park and Walk
- East Economy Garage A
- East Economy Garage B
- East Economy Lot
- 24th Street Express Pay Parking

The power output from a Level 1 charger is sufficient for long-term public parking locations due to the vehicle's longer duration of stay, which allows for longer charging at lower voltage. However, it is important to note that Level 1 charging is typically provided through access to a 120-V outlet, which requires the EV drivers to use their own cordset to charge the vehicle. In addition, Level 1 charging (provided through access to a 120-V outlet) do not provide any payment software, nor does it have the ability to store usage data. Therefore, the recommended charging option for all long-term public parking locations is to tie **six networked** and **load managed Level 2 chargers to a single breaker** (a single breaker normally supports one Level 2 charger), which will result in lower-output to 2kW. Networked charging allows AVN to collect usage data, manage EV charger access, set pricing and monitor EV charger's performance. Groups of six are recommended due to a standard breaker being able to accommodate a maximum of six 1.2kW charger loads per the NEC.

The advantage in tying multiple load-managed Level 2 chargers to a single breaker is the reduction in required electrical infrastructure while maintaining the payment interface and integral load management software required to manage a large array of EV chargers. These added features would be lost if a simpler Level 1 charging alternative were utilized. Most of the time, not all of the tied Level 2 chargers will be actively charging a vehicle and many vehicles may be charged up to six times faster relative to a non-load managed Level 1 charger. However, given the charging infrastructure would be sized for Level 1 charger output levels – the required quantity of panels, copper conductor, conduit, and installation effort will be reduced. For comparison, providing Level 2 chargers at full charging output regardless of operating condition could result in a 400%-600% increase in the amount of infrastructure required to support an EV charging system, drastically increasing the installation costs.

Note that there are tentative plans to demolish the West Economy Garage and the West Economy Park and Walk lot in the future. It is important to note that the EV chargers installed at these locations can be relocated to other locations in the future (to both short-term and long-term public parking locations as the type of EV chargers introduced among both user groups are the same). Additionally, EV charging introduced at both the East Economy Garages A and B can be consolidated at one of the East Economy garages to lower the cost of infrastructure upgrades and for easier wayfinding for EV's owners as well. The evaluation of the existing electrical infrastructure reveals that Garage B is a better candidate as it can support a high number of EV chargers at a lower implementation cost in comparison to Garage A.

These factors will be considered when determining the priorities for EV infrastructure development and are discussed further in **Section 7.0**, *Phased Implementation Plan*.

3.3 Non-Revenue Public Parking

Non-revenue waiting areas for the public are provided at the following locations at PHX:

- West Cell Phone Lot
- East Cell Phone Lot
- 44th Street PHX Sky Train Station Cell Phone Lot

Networked and **load managed DC Fast chargers (150 kW)** are recommended for cell phone lots as vehicles parking at these lots are typically there for a short period of time and they can also serve public or employee vehicles needing a charge to reach their destinations who were not able to utilize a charger while parked at the airport. However, noting that the West Cell Phone Lot will ultimately be impacted by future development as described in the Comprehensive Asset Management Plan (CAMP), EV charging (providing DC Fast chargers) is only recommended at the East Cell Phone Lot. It is important to note that any planned cell phone lots should provide the ability to charge EVs using DC Fast chargers in the future.

Additionally, the 44th Street PHX Sky Train Station Cell Phone Lot could also be equipped with DC fast charging. The load capacity was not calculated as part of this study and would need to be determined prior to installation.

3.4 Ground Transportation

Ground transportation staging areas are provided at the West Ground Transportation (GT) lot at PHX.

Networked and **load managed DC Fast chargers (150 kW)** are recommended for ground transportation staging areas as vehicles (taxis and TNC vehicles) parking in the staging area are typically there for a short period of time.

3.5 AVN Employee Private Vehicles

Parking lots used by AVN employees for their private vehicles at PHX include the following:

- AVN Headquarters Building
- Command Center Building
- Facilities & Services (F&S) Building
- Operations Building
- Design & Construction Services (DCS) Building
- Executive Terminal, Airport Police Bureau
- Rental Car Center Employee Parking
- T-3 Annex Building
- RAC Garage (both AVN and Non-AVN)

Level 1 charging (by providing access to a 120-V outlet) and **networked** and **load managed Level 2 chargers (7.2kW to 11.4kW)** are the recommended charging type for the AVN employees. A combination of Level 1 and 2 chargers, with Level 1 chargers as the primary type of charging (approximately 85% of EV infrastructure) and Level 2 chargers as the secondary type of charging (approximately 15% of EV infrastructure) are the recommended charging type for the AVN employees parking lots. Level 1 chargers could be provided at no fee to AVN employees and would allow them to receive a sufficient charge during the work day to return home, however for employees that need more range or a faster charge, access to Level 2 chargers, with payment required, would be available. The networked Level 2 chargers would allow AVN to collect usage data, manage charger access, set pricing, and monitor EV charger's performance.

Note that the T-3 Annex parking area will ultimately be impacted by future development proposed in the CAMP and as a result were not evaluated for future EV charging needs.

3.6 Non-AVN Employee Private Vehicles

Parking garages and lots used by non-AVN employees (e.g., airlines and concessions employees) for their private vehicles at PHX include the following:

- T-3 Parking Garage
- T-4 Parking Garage
- West Economy Garage
- 44th Street Airline Employee Parking Lot
- RAC Garage (both AVN and Non-AVN)

The same charging types recommended for the AVN employee private vehicles is recommended for the non-AVN employee private vehicles. This includes a combination of Level 1 and Level 2 chargers, with Level 1 chargers as the primary type of charging (approximately 85% of EV infrastructure) and Level 2 chargers as the secondary type of charging (approximately 15% of EV infrastructure). This assumes that majority of the non-AVN employees could use the Level 1 chargers during work hours and have the time for a slower charge, however Level 2 chargers, with payment required, would be available to employees that need more range or a faster charge. **Level 1 charging (by providing access to a 120-V outlet)** and **networked** and **load managed Level 2 chargers (7.2kW to 11.4kW)** are the recommended charging type for the non-AVN employees. Use of the networked Level 2 chargers would allow for easier promotion of these EV chargers as well as the ability to collect usage data, manage charger access, set pricing, and monitor EV charger's performance. In addition, it is important to note that some networked Level 2 chargers are currently available to the public at the T-3 and T-4 Parking Garages. Introducing networked Level 2 chargers for the non-AVN employees at these locations would provide the flexibility to load manage a cluster of EV chargers (a combination of Level 2 chargers for both the public and for the non-AVN employees) at these locations.

3.7 AVN Light-Duty Fleet Vehicles

AVN light-duty fleet vehicles are currently assigned to the following landside parking lots at PHX:

- AVN Headquarters Building
- Command Center Building
- Operations Building
- F&S Building
- Executive Terminal, Airport Police Bureau
- RAC Garage
- City Hangar
- T4S1
- T3 South

The recommended charging type for the AVN light-duty fleet vehicles are **networked** and **load managed high-output Level 2 chargers with a maximum output at 19.2 kW**. The high-output Level 2 chargers are preferred as the AVN light-duty fleet vehicles typically have limited time to charge. For example, the vehicles may be used during two consecutive shifts with minimal time to charge between shifts. Additionally, networked charging makes it easier to track usage and collect data for these EV chargers, which some grant funding requires for eligibility. For example: the FAA's Airport ZEV and Infrastructure Pilot Program requires that the airport sponsor track and maintain records of ZEV-funded equipment use. The use of load management will help manage the electrical load of the high-output chargers during peak demand periods and thus reduces utility cost. In addition, four **networked** and **load managed DC Fast chargers (150 kW)** are recommended in a location that would be convenient for employees who need the quick charge (e.g., F&S Building Parking Lot). The location should accommodate AVN activities and preferably located in a low-traffic area because EVs may be required to remain parked for several hours at a time and therefore could block the movement of other fleet vehicles. To ensure EV chargers are available only to AVN fleet vehicles, access should be monitored. Factors to consider include key card access, motion detectors, security lighting, tamper alarms, locked enclosures, and fences.

3.8 Shuttle Buses

Two electric shuttle buses have been delivered and are in use at the East Economy Lot at PHX. The recommended charger type for shuttle buses is **networked** and **load managed DC Fast chargers (maximum output at 350 kW)**. There is currently one Level 2 charger and one low-output DC Fast charger, however the current charging is not sufficient. It is recommended that 350 kW output maximum be provided to keep up with the current EV charging needs of the shuttle buses that are running. Similar to the AVN light-duty fleet vehicles, networked chargers for the shuttle buses would provide the ability to easily collect usage data from a cloud-based communication platform. In addition, the use of load management can help manage the electrical load of these high-output DC Fast chargers, ensuring that the maximum power output is not exceeded and can help manage the electrical load during peak demand periods as well.

4.0 AVN Light-Duty Fleet EV Replacement

As part of the City of Phoenix's "Roadmap to 2030", the City has a goal to transition 200 light-duty gas powered vehicles to EVs in the City Fleet. In support of the City's overall efforts, AVN has established a goal to replace all applicable light-duty fleet vehicles with EVs as vehicles become due for replacement and where vehicle utility allows. Light-duty fleet vehicles include those that are less than ½ ton, which is the equivalent of a Ford F-150 truck. Light-duty vehicle types include sedans, Sports Utility Vehicles (SUVs), vans, and ½-ton trucks. There are 178 total light-duty vehicles in the AVN fleet.[2]

4.1 Eligible AVN Fleet Vehicles for EV Replacement

There are 132 AVN light-duty vehicles that are eligible for EV replacement[3] based on available EVs available in the market as of May 2023, and it was determined, after conducting fleet use surveys with all section heads who are currently assigned an AVN fleet vehicle, that an additional 14 AVN fleet vehicles could also be eligible for replacement. **Figure 4-1** illustrates the AVN fleet vehicles that are eligible for EV replacement by division. The additional 14 vehicles are primarily medium-duty vehicles that could be replaced to light-duty fleet vehicles based on the vehicle's usage and function.

4.2 Current Fleet Vehicle Utilization

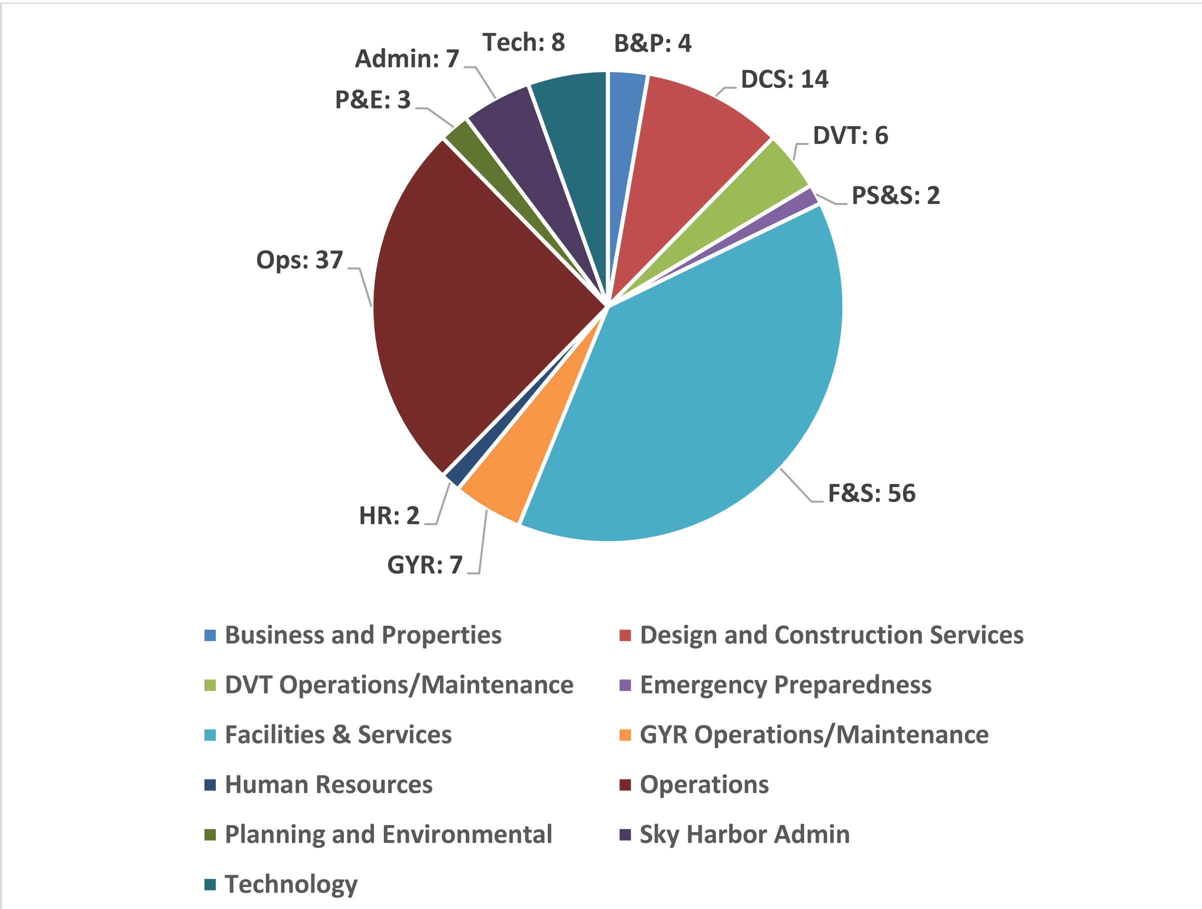
To identify the AVN fleet vehicles that are eligible for EV replacement and to arrive at a near-term, medium-term, and long-term EV replacement target, it was important to first understand how each of the fleet vehicles are currently utilized. To gather this usage information, the staff responsible for fleet vehicles assigned to each section/division were surveyed between March and April of 2022. The following information was gathered during the fleet vehicle use survey. Detailed responses for each fleet vehicle use survey are included in **Appendix C**.

1. Confirmation of number of full-time employees within section/division
2. Confirmation of number of shifts offered within section/division
3. Verification of fleet vehicles assigned to section/division
4. Confirmation of the assigned location(s) of each fleet vehicle assigned to section/division
5. Usage data for each fleet vehicle:
    a. Approximate number of hours used per day
    b. Number of shifts the vehicle is utilized for
    c. Various on-campus parking locations that the vehicle uses (and for how long)
    d. Distance traveled daily
    e. Idle time (high/low)
    f. Towing needs

[2] AVN Facilities & Services Asset Report, dated November 16, 2021, and HNTB analysis.
[3] Based on Fleet vehicle list, Facilities & Services Fleet, July 12, 2022, and HNTB analysis.

g. Typical uses (e.g., transit from Point A to Point B, or transport materials from Point A to Point B, or extensive idle time on airfield for observation/inspection, etc.)

Figure 4-1: AVN Eligible Vehicles for EV Replacement(1)



Source: Fleet vehicle list, Facilities & Services Fleet, July 12, 2022, and HNTB analysis.

Notes:
(1) Note that there are 132 existing AVN light-duty fleet vehicles that are eligible for EV replacement and an additional 14 vehicles that are eligible for replacement after right-sizing based on fleet use surveys conducted with Section Heads. This is based on EVs available in the market as of May 2023.

This process also served as an opportunity to solicit input on the functionality of the existing fleets, identify areas for improvement, and gather recommendations based on past and current experience. Interviews frequently resulted in discussion about the vehicle size and whether it is appropriate for the function that it is serving. **Table 4-1** summarizes the assigned locations (for all landside parking facilities at PHX, DVT, and GYR) for the AVN eligible fleet vehicles for EV replacement, as noted in Figure 4-1.

Note that DVT and GYR do not currently have EV charging infrastructure in place, however replacement of fleet vehicles to EVs is scheduled for FY 22/23 (GYR) and FY

23/24 (DVT) according to the June 2022 EV replacement schedule. The schedule includes four fleet trucks to be replaced with EVs at GYR in FY 22-23 and two trucks to be replaced with EVs at DVT in FY 23-24. Assessment of available capacity at these airports was not within the scope of this study, however charging infrastructure will be needed. Further evaluation of available capacity is needed to determine what level of chargers these parking lots can accommodate.

Table 4-1: Assigned Location of AVN Fleet Vehicles Eligible for EV Replacement

Assigned Location (For All Landside Parking Facilities)	Number of AVN Vehicles Eligible for EV Replacement
AVN Headquarters Building	25
Command Center	1
Design and Construction Services Building	17
Facilities & Services Building	40
Operations Building (*Landside Only*)	22
RCC Employee Parking Lot (Key Shop)	2
DVT Terminal Covered Parking	5
GYR Covered Parking	7
Total	**119**

Source: AVN Ordered EVs Spreadsheet, accessed 12/1/2022, Interviews with Section Heads, and HNTB analysis.

Notes:
(1) Note that this table only accounts for all landside parking facilities at PHX, DVT, and GYR. Airside locations (e.g., at T4N1 for F&S Building Maintenance or Terminal Services, or for Airside Operations) are not accounted for in this table.

4.3 Available Electric Vehicles in the Market (Current and Near Term)

In determining the most feasible EV model to use as replacements within the existing AVN fleet, several factors were considered, including current and near-term market availability. The recommended list of EVs primarily highlights Ford Motor Company and General Motors (GM) vehicles. Historically, the AVN Fleet Section and the Public Works department has preferred these brands when procuring vehicles due to the existing relationship they have established with local dealerships, which provide maintenance, and established warranty terms. It is noted, however, that under the 'Roadmap to 2030' that the City is looking to update fleet vehicle procurement agreements to ensure a wider variety of EV procurement opportunities. **Table 4-2** identifies the EV replacement vehicles currently recommended as EV replacements based on their near-term availability and discussion with the AVN Fleet Section staff.

Table 4-2: Replacement EV in the Market (Current and Near Term)

Existing AVN Fleet Vehicle	Vehicle Type	EV Alternative	Available Date
Chevrolet Malibu/ Toyota Prius	Sedan	Chevrolet Bolt/Bolt EUV	Now
Chevrolet Impala	Sedan	Chevrolet Bolt/Bolt EUV	Now
Chevrolet Equinox/Jeep Liberty	Compact SUV	Chevrolet Equinox EV	2024
Chevrolet Silverado 1500	½ Ton Truck	Ford F-150 Lightning	Now
Chevrolet Silverado 2500	¾ Ton Truck	Ford F-150 Lightning or Ford E-Transit	Now
Chevrolet Tahoe	Truck, SUV, ½ Ton, 4-door	Ford F-150 Lightning / Ford Explorer EV	Now / 2025
Dodge B-250	Van, 1 Ton, Utility Body	Ford E-Transit	Now
Ford F-150	½ Ton Truck	Ford F-150 Lightning	Now
Ford F-250	¾ Ton Truck, Utility Body	Ford F-150 Lightning or Ford E-Transit	Now
Ford F-350	¾ Ton Truck, Utility Body	Ford F-150 Lightning or Ford E-Transit	Now

Source: AVN Ordered EVs Spreadsheet, accessed 12/1/2022, and HNTB analysis.

4.4 Phased Approach to Light-Duty Fleet EV Replacement

The replacement schedule for City vehicles has been every 10 years except for police and operation vehicles (which typically are replaced every 5 years). The City's EV Roadmap to 2030 includes an EV fleet transition purchasing policy that prioritize EV as a first-choice option. A range of short, medium, and long-term targets for replacement of the AVN fleet were initially established for the Study (see **Appendix A**) and have been further refined here. Based on interviews with the responsible parties that are assigned an AVN fleet vehicle, and iterative discussion with the AVN Fleet Section staff, while considering the availability of EVs in the market and the historical AVN light-duty fleet replacement data, a phased approach to implementation is proposed. **Table 4-3** identifies the number of AVN light-duty fleet vehicle replacements over the last five fiscal years. On average, 12 AVN light-duty fleet vehicles were replaced each year.

Table 4-3: Historical AVN Light-Duty Fleet Replacement Data

Fiscal Year	Sedan	Compact SUV	Full-Size SUV	½ Ton Truck	Total
2017-2018	4	0	12	2	**18**
2018-2019	4	1	3	1	**9**
2019-2020	1	1	2	2	**6**
2020-2021	0	1	1	8	**10**
2021-2022	3	3	5	7	**18**

Source: AVN Equipment Procurement Lists, FY17-18, FY18-19, FY19-20, FY20-21, and FY21-22, and HNTB analysis.

The phased implementation would allow time to gradually train vehicle operators and fleet technicians on proper EV operation and maintenance as the fleet is replaced. It is anticipated that the number of AVN light-duty EV fleet replacements in the short-term (in the next 2-3 years) may be lower than the maximum projection due to supply-chain issues and procurement challenges, and it is assumed that 100% of the light-duty fleet EV replacement will occur by the end of the long-term target (by 2030). Refer to **Table 4-4** for a high projection of AVN light-duty fleet vehicles to be replaced with EVs annually between 2023 and 2030.

Table 4-4: High Projection of EV Light-Duty Replacement by Fiscal Year

	2023	2024	2025	2026	2027	2028	2029	2030
Projected Number of AVN Fleet Vehicle EV Replacement	16 (1)	25 (1)	13	18	18	19	19	18

Source: AVN Ordered EVs Spreadsheet, accessed 12/1/2022, and HNTB analysis.

Notes:
(1) The projected number of EV replacements for FY 2023 and FY 2024 is based on best available information as of 12/1/22 and is subject to change due to supply chain issues / procurement challenges. Projections for future years (FY 2025 through 2030) are estimated based on vehicle age, historical light-duty fleet vehicle replacement data, and feasibility for EV replacement resulting from interviews with Section Heads.

Near-, medium-, and long-term targets have been established in coordination with AVN staff for the replacement of their light-duty fleet vehicles to EVs. The targets account for factors such as the availability of vehicles in the market, infrastructure upgrades needed, and vehicle operator training. There are 146 AVN fleet vehicles that are eligible for EV replacement.

4.4.1 Near-Term Target (FY 2023-2025)

The near-term target is to replace 39 to 54 light-duty AVN fleet vehicles with EVs in the next approximately one to three years. A slower replacement with EVs in the near term is expected to be easier to implement, as vehicle operators and technicians become more familiar with the equipment. Note that **Table 4-4** illustrates a high projection of EV replacements at 54 vehicles. This target, however, was established with the understanding that there may continue to be supply chain issues and procurement challenges during this timeframe, as mass-market availability may not occur until 2024.

The intent is to implement the replacement with a phased approach and to select priorities for replacement based on several factors. It is recommended to start with the replacement of fleet vehicles that are not operating 24/7 or are not fully staffed during all three shifts. This will allow more time to maintain vehicles between shifts and/or adjust operations as needed and will also provide flexibility with the charging infrastructure used. Replacement of vehicles with EVs will also be prioritized based on the scale and cost of the electrical infrastructure improvements required for the EV charger installation.

It is proposed to continue pool vehicle replacement first; while AVN continues to evaluate if the vehicles are appropriately sized, or whether some of the vehicles' utilization would allow for smaller vehicles. Initial discussions have identified replacement of ½-ton work trucks (e.g., Ford F-150) that are not in use 24/7 early in the phased implementation, and potentially experiment with DVT and GYR fleet vehicles. However, additional coordination and discussion with the AVN Fleet Section is necessary to identify the divisions/sections that make the most sense to replace in the near term, and to work with F&S Electrical and APS to evaluate the necessary electrical infrastructure.

During this timeframe, a "pilot" phase is recommended for the vehicles that are used 24/7 so that any issues or concerns can be worked out by the medium and long-term target phase (e.g., 100% implementation).

4.4.2 Medium-Term Target (FY 2026-2028)

The medium-term target is to replace 45 to 55 light-duty AVN fleet vehicles with EVs within approximately 3 to 5 years. This target assumes replacement of 100% of light-duty vehicles, including ½-ton work trucks, that are *not* utilized 24/7. It is assumed that within this timeframe, vehicle operators and technicians will be proficient at the use, care, and maintenance of the EVs.

4.4.3 Long-Term Target (FY 2028-2030)

The long-term target is to replace 46 to 56 light-duty AVN fleet vehicles with EVs within approximately 5 to 7 years, by 2030. This target phase will include the replacement of the remaining AVN fleet vehicles that were not previously replaced (except for the police pursuit vehicles). By this point, lessons learned from the pilot phase conducted for vehicles that are used 24/7 during the near- and medium- term will have been resolved, and vehicles operators and technicians will be fully trained in the use, care, and maintenance of the vehicles. The necessary EV chargers will have been implemented for maximum use. During the long-term target timeframe, it is expected that technology will have greatly advanced, and any supply chain issues related to procuring vehicles will have been resolved.

5.0 Analysis of Existing Electrical Infrastructure

5.1 Review of Local Infrastructure (Panels, Switchboards, SES)

5.1.1 Study Approach

The record drawings for the target locations around the PHX passenger terminals, maintenance facilities, offices, and all other facilities were reviewed, and potentially viable panels, switchboards, and Service Entrance Sections (SESs) were identified and verified in the field. AVN F&S Electrical and Energy Systems staff were also engaged for input during field investigation efforts. Once the existing infrastructure was field verified, the metering and escort services of C3 Engineering and H&B Electric were used to arrange 30-day metering on viable panels to meet the 30-day load study requirements of National Electrical Code (NEC) 220.87. Following the metering data, the maximum number of chargers that can be fed by the existing electrical infrastructure with and without the implementation of load management was determined.

5.1.2 Preliminary Findings from As-Built Drawings

The study was initiated by reviewing as-built drawings at each target location to determine the names of all existing panels, switchboards, and SESs that are located adjacent to or within the parking lots at each location. After the viable existing electrical panels, switchboards, and SESs were determined, the as-built one-line diagrams and panel schedules were consulted to determine which candidates had the highest number of spare breakers and breaker space that could be used to provide power to new EV chargers.

However, because as-built drawings can be inaccurate or outdated, field investigations and metering on the panels was required to verify whether the indicated panels, switchboards, and SESs were viable candidates for providing power to new EV chargers. For example, it is important to determine whether the indicated panels have adequate spare capacity, spare breakers, and breaker space.

5.1.3 Additional Findings from Field Investigation

Site investigations were conducted at every panel identified during the as-built review as viable and with close proximity to the nearby parking lots. During the field investigation, roughly 40% of the panels identified in the as-builts were determined not to be viable due to lack of breaker space, insufficient quantity of spare breakers, equipment in poor condition, or equipment that had been demolished since the time of construction.

For the panels that were found to be viable during the field investigation, the quantity of spare breakers and amount of breaker spaces on each panel, switchboard, and SES were documented. Panel name, ratings, and condition were also verified in the field.

When field investigations indicated that all existing equipment identified during the as-built review was not viable, AVN F&S Electrical section staff was consulted in the field to help determine on-site which other panels, switchboards, or SESs would be viable for usage. For locations where no alternative viable equipment could be identified, AVN F&S Electrical section staff indicated that none of the panels, switchboards, or SESs identified in the as-builts were viable and that a new SES would be required to provide EV chargers with power at the indicated location.

5.1.4 Load Study Locations and Approach

After gathering all the required data for the panels, switchboards, and SESs at each target location, a load study was conducted to determine the spare electrical capacity on each piece of equipment. The following data was used to conduct the load study:

- Panel Ampere rating
- Panel Voltage rating
- A minimum of 30-days of NEC 220.87 compliant metering data
- Main breaker ratings and trip settings

The equipment included in the study falls into one of two categories:

1. Local Equipment: Panels, switchboards, or SESs that are directly feeding new EV chargers or new infrastructure dedicated to feeding multiple EV chargers.
2. Upstream Equipment: These are panels, switchboards, or SESs that provide power to the Local Equipment. These pieces of equipment were also studied to confirm that all Upstream Equipment is also capable of supporting the EV charger load projected to be installed on the Local Equipment.

To determine the spare electrical capacity on a panel, switchboard, or SES, the amperage rating of the panel was first taken to determine the maximum amount of current the equipment is capable of providing to the connected loads. The load study assumes that, per NEC 210.20(A), the equipment evaluated by the load study currently supports and can continue to support continuous loads. The demand of the continuous loads equals 125% the value of the connected load. Thus, 80% of the panel ratings were used for the load study.

The existing load on the equipment was determined using the NEC 220.87 compliant metering data. The voltage, current, and power factor on each phase was measured at 15-minute intervals for a period of at least 30-days. Real and apparent power readings were also taken. If 365 days of metering was available for a piece of equipment, then the assumed existing load was calculated at 125% of the metered maximum demand. If 30 days of metering was conducted due to 365-day metering not being available, then 125% of the metered maximum demand on the highest metered phase was used.

Thus, the available electrical capacity was determined by subtracting 125% of the metered peak demand from 80% of the equipment ratings. Refer to **Table 5-1** for the areas considered during the load study.

5.1.5 Results (Load Limitations on Local Infrastructure)

The load study provided critically useful insight into the available electrical capacity on the panels, switchboards, and SESs first identified in the review of the as-built drawings. Additionally, it identified equipment that, while abundant in spare breakers and breaker space, have limited spare electrical capacity and aren't recommended for the installation of EV chargers. Examples of these pieces of equipment are the Panel 44-PL-H2 located at the 44th Street Airline Employee Parking Lot and Switchboard GH3 at the T-3 Parking Garage.

Table 5-1: PHX Existing Infrastructure Load Study Results

Location	Local or Downstream Equipment	Equipment Label (Panel, Switchboard, or SES)	Ratings (80% Ratings) (Amps)	Metered Peak Demand (Amps)	Available Electrical Capacity (Amps)
East Economy Garage B	Local	Switchboard DB1	600 (480)	15.0	465.0
	Upstream	SES-A	1600 (1280)	95.6	1184.4
East Economy Lot	NEW SES RECOMMENDED (EXISTING EQUIPMENT TOO FAR AWAY)				
44th Street Airline Employee Lot	Local	Panel 44-PL-H1	400 (320)	137.9	183.1
	Upstream	Panel 44-PL-H2	200 (160)	130.1	24.8
T-4 Parking Garage	Local	SES-TB3A	3000 (2400)	507	1893
T-3 Parking Garage	Local	Switchboard GH3	225 (180)	108.2	71.8
	Local or Upstream	Switchboard GHDB1	800 (640)	151.3	488.8
	Upstream	SES-A1	3000 (2400)	763.3	1636.8
Operations Building	NEW SES RECOMMENDED (EXISTING SESs HAVE NO BREAKER SPACE/SPARE BREAKERS)				
West Economy Garage	Local	Panel LD	250 (200)	4.4	195.6
	Upstream	SES T2GSES	800 (640)	202.6	437.4
West Economy Park and Walk	Local/Upstream	SES-TEMP 400A	400 (320)	109.6	210.4
West GT Lot	NO BREAKER SPACE OR SPARE BREAKERS ON EXISTING INFRASTRUCTURE				
Command Center	Local	COPS-HDP1	600 (480)	306	174
	Upstream	SES N-SG1	600 (480)	199	281
AVN Headquarters Building	Local	Switchboard DSCCB1	800 (640)	170.4	640
	Upstream	SES-CCB1	2000	585.3	1014.7

Location	Local or Downstream Equipment	Equipment Label (Panel, Switchboard, or SES)	Ratings (80% Ratings) (Amps)	Metered Peak Demand (Amps)	Available Electrical Capacity (Amps)
			(1600)		
24TH Street Express Pay Parking	AS-BUILT DRAWINGS ARE CURRENT AND INDICATE UPSTREAM CAPACITY IS EXHAUSTED				
DCS Building	NO BREAKER SPACE OR SPARE BREAKERS ON EXISTING SES				
Executive Terminal	Local	NEW SES	600 (480)	163	317
RAC Garage	USE EXISTING SES-AWT-1 OR SES-AWT-2 IF VOLTAGE DROP IS NOT EXCESSIVE. PROVIDE NEW SES IF VOLTAGE DROP IS EXCESSIVE				
RCC Employee Parking Lot	Local	Panel HCPA	225 (180)	32.5	117.2
Facilities & Services Building	Local	2515 E. Buckeye SES	2000 (1600)	233.5	1366.5
	Local	Relocated 800A SES	800 (640)	13.7	626.3

Source: HNTB analysis, 2022-2023.

Refer to **Appendix D** for the full Electrical Infrastructure Analysis Summary Table, which summarized the as-built calculated capacity, Load Study Metering results, quantity of spare breakers and breaker space, and the quantity of EV chargers that can be supported by the indicated infrastructure based on the load study, spare breakers, and breaker space.

5.2 Review of Upstream Infrastructure (APS Feeders)

5.2.1 Coordination With Arizona Public Service (APS)

The results of the load study conducted in April 2022 represent a portion of the data required to determine the maximum number of EV chargers which can be installed across all PHX parking garages, parking lots, and facilities. The infrastructure PHX owns, operates, and maintains extends up to the SESs, essentially limited to the 480V infrastructure downstream from the SESs. APS distributes power at 12kV to the various SESs around PHX.

It is critical to ensure that the APS-owned distribution will not exceed capacity if AVN installs the quantity of EV chargers that can be theoretically installed across the airport based on the load study. For this reason, APS was also engaged throughout the study to determine whether any capacity-related bottlenecks exist in the APS circuits feeding the PHX infrastructure. Note that available capacity identified in this study is as of April 2022, APS will need to review and update capacity availability as refined site planning occurs closer to the date of implementation.

5.2.2 Study Approach

While the metering for the load study was being conducted, APS was presented with the EV charging stall implementation targets for all pertinent locations across the PHX airport campus. The targets were also presented in terms of total input power requirements for the various locations, which assumed a ratio of 75% Level 1 chargers (2 kW) and 25% Level 2 chargers (6.5 kW) for majority of the locations presented to APS.

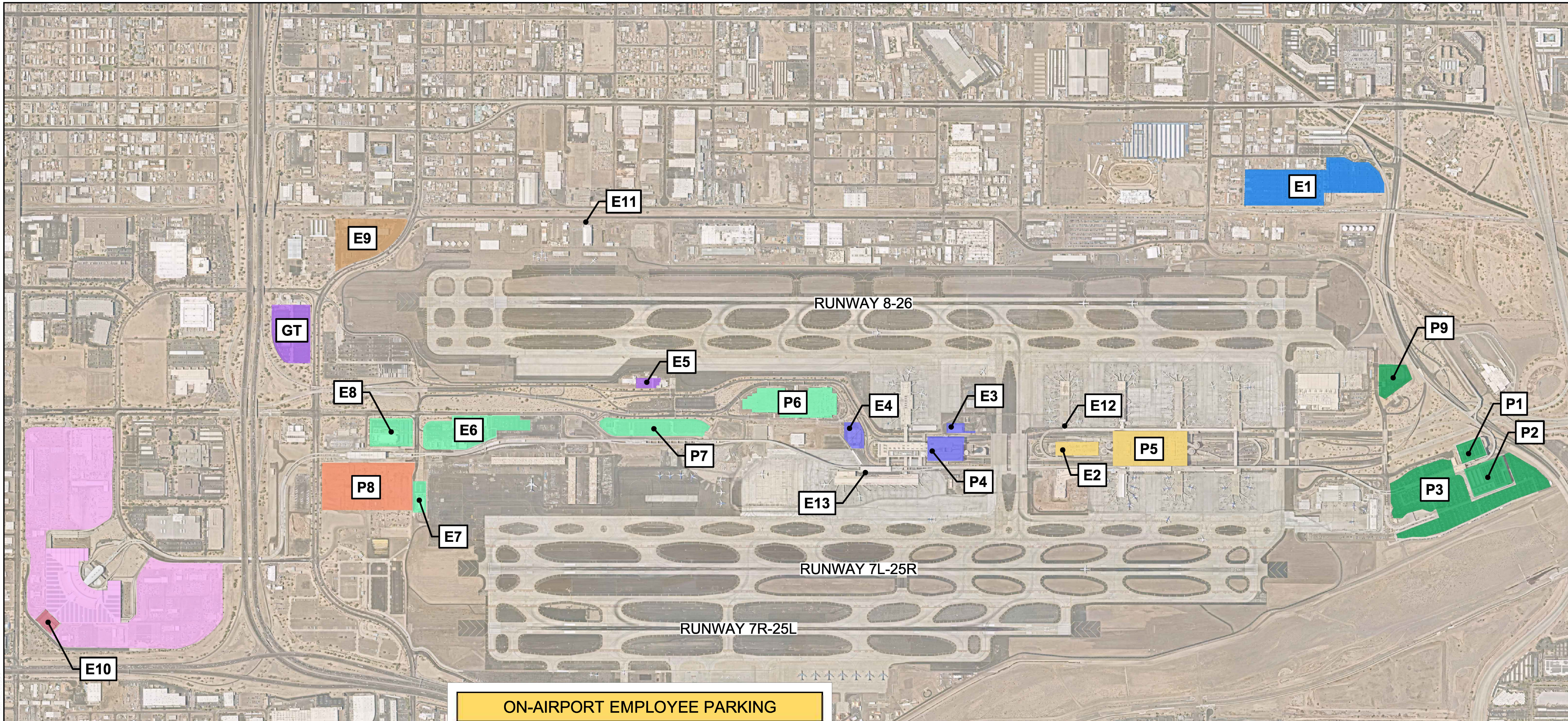
APS compared the locations to the APS 12kV circuits feeding the locations. The circuits feeding the various locations were given source labels, ranging from A-K. **Figure 5-1** illustrates the feeder source for each of the potential locations for future EV chargers at PHX. The projected EV charger demand was then compared to the available electrical capacity on each circuit to identify, for each location, the EV charger installation thresholds that can be achieved without overloading APS circuits. See **Appendix E** for the results of this coordination. The result is also depicted graphically in **Figure 5-2**. It is important to note that for circuits that support multiple locations, the ability to serve the projected quantity of EV charger demand is based on a single location. i.e., Circuit B can support either of the high targets for the East Economy Garages A and B, but not both simultaneously. Also note that there are three existing locations with light duty fleet vehicle parking (City Hangar, Terminal 4 South 1 [T4S1], and Terminal 3 South [T3 South]) that have not yet been assessed for available capacity. Further evaluation of available capacity is needed to determine the infrastructure required to support Level 2 chargers at these locations.

5.2.3 Results (APS Feeders Limitations)

The results shown in **Appendix E** indicate that most APS 12kV circuits have adequate spare capacity to support the projected EV targets. The exceptions to this are the East Economy Garages and Surface Lot, as well as the Operations Building.

APS circuit B can support up to 492kVA of additional electrical load before reaching capacity. This 492kVA would be spread between one to three of the indicated locations but is well short of what the local SES infrastructure is capable of providing. Thus, if aggressive EV charger implementation is a target at this location, new APS circuits will need to be provided to these locations.

APS circuit H is nearly overloaded and is not a suitable candidate for supporting downstream infrastructure for new EV chargers at the Operations Building. Thus, to provide the Operations Building with EV chargers, PHX will need to coordinate with APS to provide a new 12kV circuit to support a new SES for the new EV chargers.



ON-AIRPORT EMPLOYEE PARKING
E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING[1]
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU[1]
E6 - FACILITIES & SERVICES BUILDING[1]
E7 - COMMAND CENTER BUILDING[1]
E8 - AVIATION HEADQUARTERS BUILDING[1]
E9 - DESIGN & CONSTRUCTION SERVICES BUILDING EMPLOYEE PARKING LOT[1]
E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT[1]
E11 - CITY HANGAR[1]
E12 - TERMINAL 4 SOUTH 1[1]
E13 - TERMINAL 3 SOUTH[1]

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE
P5 - TERMINAL 4 PARKING GARAGE
P6 - WEST ECONOMY GARAGE
P7 - WEST ECONOMY PARK AND WALK
P8 - FUTURE 24TH ST. STATION
P9 - EAST CELL PHONE LOT
P10 - WEST CELL PHONE LOT

1) THESE FACILITIES INCLUDE PARKING FOR AVN FLEET VEHICLES.

DRAWING LEGEND
FEEDER SOURCE A
FEEDER SOURCE B
FEEDER SOURCE C
FEEDER SOURCE D
FEEDER SOURCE E
FEEDER SOURCE F
FEEDER SOURCE G
FEEDER SOURCE H
FEEDER SOURCE I
FEEDER SOURCE K

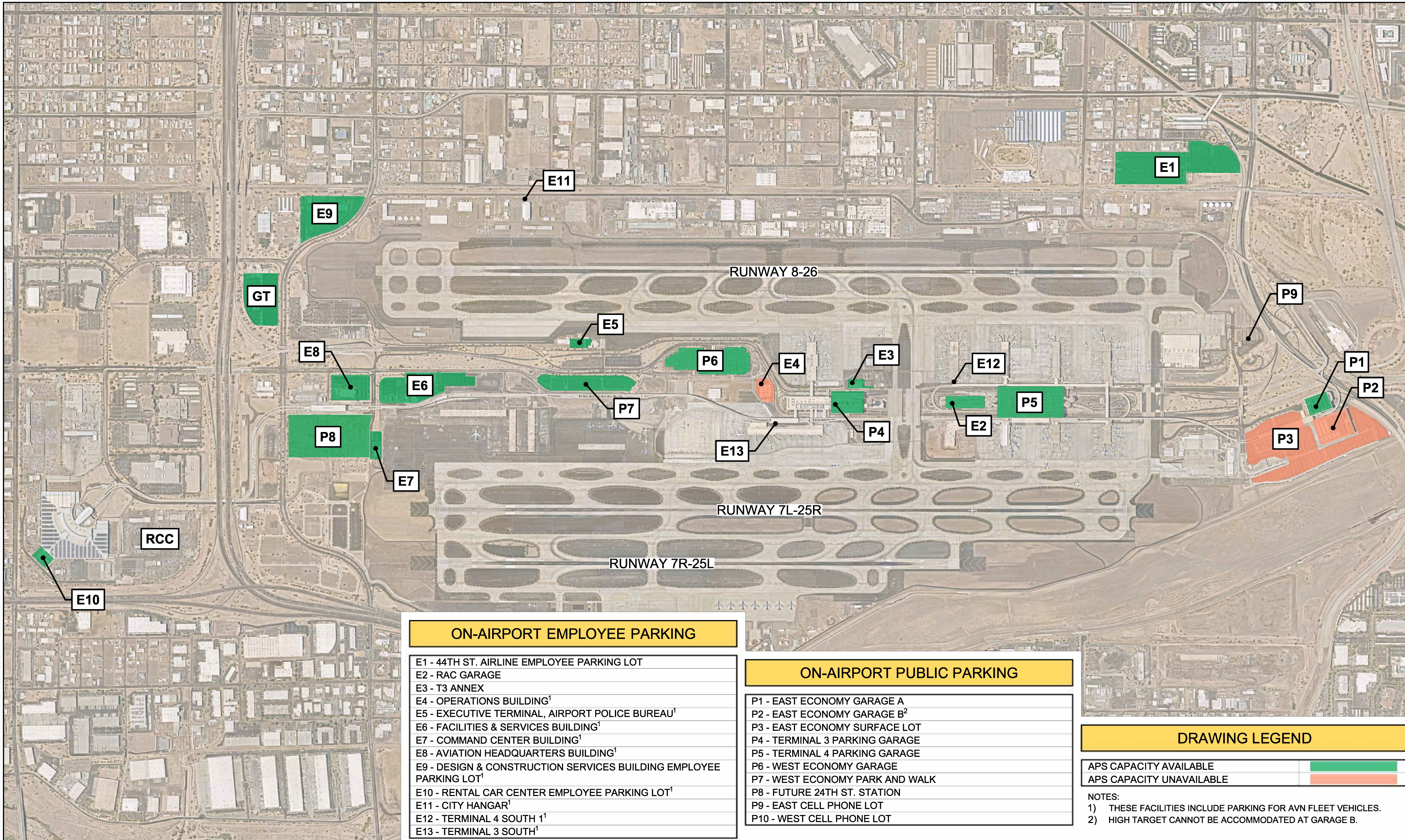
PHX City of Phoenix

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N
0 1,300' 2,600'

FIGURE 5-1 MAY 2023

FEEDER SOURCES AT POTENTIAL LOCATIONS FOR FUTURE EV CHARGERS



ON-AIRPORT EMPLOYEE PARKING
E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING[1]
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU[1]
E6 - FACILITIES & SERVICES BUILDING[1]
E7 - COMMAND CENTER BUILDING[1]
E8 - AVIATION HEADQUARTERS BUILDING[1]
E9 - DESIGN & CONSTRUCTION SERVICES BUILDING EMPLOYEE PARKING LOT[1]
E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT[1]
E11 - CITY HANGAR[1]
E12 - TERMINAL 4 SOUTH 1[1]
E13 - TERMINAL 3 SOUTH[1]

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B[2]
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE
P5 - TERMINAL 4 PARKING GARAGE
P6 - WEST ECONOMY GARAGE
P7 - WEST ECONOMY PARK AND WALK
P8 - FUTURE 24TH ST. STATION
P9 - EAST CELL PHONE LOT
P10 - WEST CELL PHONE LOT

DRAWING LEGEND
APS CAPACITY AVAILABLE
APS CAPACITY UNAVAILABLE

NOTES:
1) THESE FACILITIES INCLUDE PARKING FOR AVN FLEET VEHICLES.
2) HIGH TARGET CANNOT BE ACCOMMODATED AT GARAGE B.

PHX City of Phoenix

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N
0 1,300' 2,600'

FIGURE 5-2 MAY 2023

APS CAPACITY TO SERVE AT POTENTIAL LOCATIONS FOR FUTURE EV CHARGERS

6.0 Proposed Distribution Approach and Estimated Cost

The proposed distribution approach and the associated Rough Order of Magnitude (ROM) cost estimate for implementing EV chargers at the following PHX parking facilities are presented in this chapter:

- T-3 Parking Garage
- T-4 Parking Garage
- East Economy Garage A
- East Economy Garage B
- East Economy Surface Lot
- West Economy Garage
- West Ground Transportation (GT) Lot
- 24th Street Express Pay Parking
- West Economy Park & Walk
- Operations Building Parking Lot
- Facilities & Services Building Parking Lot
- AVN Headquarters Parking Lot
- Command Center Parking Lot
- Design & Construction Services (DCS) Building Parking Lot
- 44th Street Airline Employee Parking Lot
- RAC Garage
- Executive Terminal
- Rental Car Center (RCC) Employee Parking Lot
- East Cell Phone Lot

The ROM cost estimate accounts for the EV chargers and any associated installation and network service cost (where applicable). Any additional infrastructure needed to support the recommended number of EV stalls (e.g., new SES, new panels, new APS circuits and infrastructure) are also accounted for in the ROM cost estimate. Note that these are hard construction costs and do not include any soft costs. The ROM also does not include any potential offsite upgrades that may be required. A split between single and dual port EV charging pedestals was assumed for cost purposes. To be conservative wall mounted chargers and those in tight spaces were assumed to be single port with dual port pedestals assumed where more space is available as they tend to have a larger footprint. The actual distribution of single and dual port chargers will need to be determined during the design process.

Additionally, the upfront costs can vary if AVN elects an EV charger program vendor to install, operate, and maintain the EV chargers. As an example, **Table 6-1** presents the cost and revenue breakdown for the four business models offered by a third-party vendor in deploying EV chargers. Data from Blink, the current vendor at PHX, is shown as an example to share an actual cost structure; however future installations/ contracts could be with any available vendor. Note that the first three options ("Host Owned", "Hybrid Owned", and "Blink as a Service") require that the host (AVN) be responsible for making the site "make-ready", which means that all necessary electrical infrastructure to operate the chargers, all conduit and wire is pulled to the location of the chargers, all concrete work is completed properly so that the chargers can be mounted and any cellular repeaters are installed if required.

Table 6-1: Business Model for Current Third Party Vendor

	Host Owned Equipment Purchase Model		Hybrid Owned Revenue Shared Model		Blink as a Service Monthly Subscription		Blink Owned Turn-Key Solution	
	Host	Blink	Host	Blink	Host	Blink	Host	Blink
Site Preparation	•		•		•			•
Equipment Cost	•			•		•		•
Charger Installation	•			•		•		•
Electricity	•			•	•			•
Maintenance	•			•		•		•
Network Connectivity Fee	$12-18/month[1]		$12-18/month[1]		Included		$12-18/month[1]	
Subscription Fee					$79–189/month[2]			
Charging Revenue Share	100%	0%	40%	60%	100%	0%	5%	95%

Source: Blink, December 2022. Note that Blink is used as a third-party vendor example due to their current contract with the City, however future contracts could be with any available vendor.

Notes:
(1) Varies depending on charger type. For Hybrid, Blink Owned, Blink as a Service Network fees are deducted from charging revenue monthly. Host Owned Network fees paid annually.
(2) Varies depending on charger type.

6.1 T-3 Parking Garage

6.1.1 Distribution Approach

The electrical load in the T-3 Parking Garage was recently increased as a result of the replacement of the antiquated garage luminaires with more efficient LED alternatives. This has left the panels and distribution boards on each floor of the garage more lightly loaded and thus capable of providing EV chargers with power. There are smaller panels with space and spare breakers on each floor of the garage, such as Panel GH3, that could be used to efficiently provide power to new EV charger dedicated panels on each floor. A more conservative approach would be to use spare breakers and breaker space on Panel GHDB1 to subpanels on each floor, following the same conduit routing between GHDB1 and the GH panels. The condition of the GH3 panel indicates that it might require replacing in the near future, thus it is recommended that GHDB1 be used. Power feeders would be distributed from the new panels installed on the floors housing EV chargers to the chargers on the garage ceiling and across the walls.

6.1.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the T-3 Parking Garage are presented below for option with and without load management, respectively. Note that the option with load management corresponds to the *low target* established from the study (See **Appendix A**). Any additional EV chargers would require significant infrastructure upgrades in this area.

Implementation Cost (No Load Management):

- Charger Quantities: 31 Level 2 Single Pedestals, 15 Level 2 Dual Pedestal
- **Total Quantity of EV-Installed Stalls Provided: 61**
- Cost of Infrastructure (Distribution Board 'GHDB1' to New Panels to EV Chargers): $753,000
- Cost of EV Charger Installation: $415,000
- **Total Cost: $1,168,000**

Implementation Cost (With Load Management):

- Charger Quantities: 62 Level 2 Single Pedestal, 30 Level 2 Dual Pedestal
- **Total Quantity of EV-Installed Stalls Provided: 122**
- Cost of Infrastructure (Distribution Board 'GHDB1' to New Panels to EV Chargers): $891,000
- Cost of EV Charger Installation: $831,000
- **Total Cost: $1,722,000**

6.2 T-4 Parking Garage

6.2.1 Distribution Approach

The existing PHX panels and switchboards in the T-4 Parking Garage are deficient in space and antiquated. It is recommended that the local SES-TB3A is used to provide power feeders to new panels located on one or more floors of the T-4 Parking Garage. SES-TB3A has provisions for new breakers to be installed that range from 60 amps to 400 amps. The feeds would be routed up the exterior of the parking garage structure or the interior through drilled holes in the floor of the garage to the floors the EV chargers will be installed on. Existing parking stalls would be repurposed to accommodate installation of EV charger dedicated panels in fenced-off areas. The new panels would distribute power to the chargers throughout the T-4 Parking Garage, as required.

6.2.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the T-4 Parking Garage are presented below for option with and without load management, respectively.

Note that the option with load management corresponds to 2.4% of the total number of parking stalls at the T-4 garage, which is *below the low target* (5% of total number of parking stalls) established (see **Appendix A**). However, providing any additional EV chargers at this location would require significant infrastructure upgrades.

Implementation Cost (No Load Management):

- Charger Quantities: 50 Level 2 Single Pedestals, 16 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 82**
- Cost of Infrastructure (SES-TB3A to New Panels to EV Chargers): $1,320,000
- Cost of EV Charger Installation: $575,000
- **Total Cost: $1,895,000**

Implementation Cost (With Load Management):

- Charger Quantities: 100 Level 2 Single Pedestals, 32 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 164**
- Cost of Infrastructure (SES-TB3A to New Panels to EV Chargers): $1,278,000
- Cost of EV Charger Installation: $1,150,000
- **Total Cost: $2,428,000**

6.3 East Economy Garage A

6.3.1 Distribution Approach

The existing panels and switchboards within the East Economy A Garage mainly support lighting loads and were sized accordingly during construction. Thus, using them to feed new EV chargers would not be an optimal solution. It is recommended that new EV charger dedicated panels be fed from SES-C or a new SES supported by a new line extension, likely served by APS from an existing distribution circuit. The existing APS circuit feeding SES-C has limited capacity. It is recommended that a new APS circuit feeding a new SES be provided if the high target level of EV chargers is implemented at the East Economy Garages. Both solutions involve routing new conduits on the exterior of the garage up support columns or drilling conduit entries up through the floors on the interior side of the garage to the floors where EV chargers are installed. Existing parking stalls would be repurposed to accommodate installation of EV charger dedicated panels in fenced-off areas. The new panels would distribute power to the chargers throughout the East Economy Garage A, as required.

Additionally, it is important to note that EV charging introduced at both the East Economy Garages A and B can be consolidated at one of the East Economy garages to lower the cost of infrastructure upgrades and for easier wayfinding for EV's owners as well. The evaluation of the existing electrical infrastructure reveals that Garage B is a better candidate as it can support a high number of chargers at a lower implementation cost in comparison to Garage A.

6.3.2 ROM Cost Estimate

ROM cost estimates for implementing EV chargers at the East Economy Garage A are presented below for options with and without load management, respectively. Note that two types of charging are presented for long-term public parking: (1) provide Level 2 chargers at full charging output at all times regardless of operating condition; (2) tying multiple load managed Level 2 chargers to a single breaker, with charging infrastructure sized at Level 1 output levels.

Note that EV charging introduced at both the East Economy Garages A and B can be consolidated at East Economy Garage B. Not only is it important to provide one location for EV parkers to be easily directed to, but the consolidation will also lower the cost of infrastructure upgrades. Garage B is the preferred garage for consolidating the locations following the results of the existing electrical infrastructure evaluation.

Implementation Cost (No Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 245 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 245**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $3,690,000
- Cost of EV Charger Installation: $1,907,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $8,276,000**

Implementation Cost (With Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 469 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 469**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $4,215,000
- Cost of EV Charger Installation: $3,650,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $10,544,000**

Implementation Cost (No Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 245 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 245**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $733,000
- Cost of EV Charger Installation: $1,556,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $4,968,000**

Implementation Cost (With Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 469 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 469**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $827,000
- Cost of EV Charger Installation: $2,978,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $6,484,000**

6.4 East Economy Garage B

6.4.1 Distribution Approach

East Economy Garage B houses existing equipment with ratings such that new EV chargers can be supported by existing infrastructure. The most ideal candidate is existing Switchboard DB1. While this panel is ideal, the existing APS circuit feeding the upstream SES-A has limited capacity. It is recommended that Garage B be outfitted with EV chargers between Low and Medium target levels, depending on the implementation of Load Management. This will enable PHX to install EV chargers using existing infrastructure without overloading the existing APS circuit feeding the East Economy Garages and Surface Lot. If additional chargers are desired at this location, a new SES fed by a new line extension, likely served by APS from an existing distribution circuit, can be provided for any of the three locations to hit High target levels, albeit at a higher cost. This solution would involve routing new conduits on the exterior of the garage up support columns or drilling conduit entries up through the floors on the interior side of the garage to the floor where the EV chargers are installed. Existing parking stalls would be repurposed to accommodate installation of EV charger dedicated panels in fenced-off areas. The new panels would distribute power to the chargers throughout the East Economy Garage B, as required. As noted previously, the evaluation of the existing electrical infrastructure reveals that Garage B is a better candidate as it can support a high number of chargers at a lower implementation cost in comparison to Garage A.

6.4.2 ROM Cost Estimate

ROM cost estimates for implementing EV chargers at the East Economy Garage B are presented below for option with and without load management, respectively. Note that two types of charging are presented for long-term public parking: (1) provide Level 2 chargers at full charging output at all times regardless of operating condition; (2) tying multiple load managed Level 2 chargers to a single breaker, with charging infrastructure sized at Level 1 output levels.

Note that the option with load management corresponds to 2% of the total number of parking stalls at the East Economy Garages A and B combined, which is *below the low target* (5% of total number of parking stalls) established in this Study (See **Appendix A**). However, providing any additional EV chargers at this location would require significant infrastructure upgrades including the APS feeders.

Implementation Cost (No Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 59 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 59**
- Cost of Infrastructure (Switchboard 'DB1' to New Panels to EV Chargers): $872,000
- Cost of EV Charger Installation: $459,000
- **Total Cost: $1,331,000**

Implementation Cost (With Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 118 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 118**
- Cost of Infrastructure (Switchboard 'DB1' to New Panels to EV Chargers): $1,227,000
- Cost of EV Charger Installation: $918,000
- **Total Cost: $2,145,000**

Implementation Cost (No Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 59 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 59**
- Cost of Infrastructure (Switchboard 'DB1' to New Panels to EV Chargers): $221,000
- Cost of EV Charger Installation: $375,000
- **Total Cost: $596,000**

Implementation Cost (With Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 118 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 118**
- Cost of Infrastructure (Switchboard 'DB1' to New Panels to EV Chargers): $317,000
- Cost of EV Charger Installation: $749,000
- **Total Cost: $1,066,000**

6.5 East Economy Lot

6.5.1 Distribution Approach

The existing panels, switchboards, and SESs near the East Economy Surface Lot are not viable options due to equipment ratings or proximity to the parking lot. It is recommended that new EV charger be provided using dedicated panels from a new SES supported by a new APS circuit. The existing nearby APS circuit, which also feeds SES-A and SES-C has limited capacity. It is recommended that a new line extension, likely served by APS from an existing distribution APS circuit feeding a new SES, be provided if the high target level of EV chargers is implemented at the East Economy Garages or Surface Lot. The new SES would route new power feeders out to panels near the EV charger clusters throughout the East Economy Surface Lot. This would either supplement or replace the quantity of chargers installed at the East Economy Garages, nearby. This, low to medium target levels are assumed for this area.

6.5.2 ROM Cost Estimate

ROM cost estimates for implementing EV chargers at the East Economy Lot are presented below for option with and without load management, respectively. Note that two types of charging are presented for long-term public parking: (1) provide Level 2 chargers at full charging output at all times regardless of operating condition;

(2) tying multiple load managed Level 2 chargers to a single breaker, with charging infrastructure sized at Level 1 output levels.

Note that the option with load management (and at Level 1 output levels) corresponds to *the medium target* (10% of total number of parking stalls) established in the Study (see **Appendix A**). Any additional EV chargers implemented at this location would require additional infrastructure upgrades and a substantially higher capital cost expense, as the currently recommended distribution approach at the East Economy Lot already includes a new 3000A SES with a new line extension, likely served by APS from an existing distribution, circuit and associated infrastructure.

Implementation Cost (No Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 181 Level 2 Single Pedestals and 2 350kW DCFCs
- **Total Quantity of EV Charging Stalls Provided: 183**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $2,351,000
- Cost of EV Charger Installation: $1,559,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $6,589,000**

Implementation Cost (With Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 364 Level 2 Single Pedestals and 2 350kW DCFCs
- **Total Quantity of EV Charging Stalls Provided: 366**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $2,867,000
- Cost of EV Charger Installation: $2,983,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $8,529,000**

Implementation Cost (No Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 181 Level 2 Single Pedestals and 2 DCFCs
- **Total Quantity of EV Charging Stalls Provided: 183**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $592,000
- Cost of EV Charger Installation: $1,429,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $4,700,000**

Implementation Cost (With Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 364 Level 2 Single Pedestals and 2 DCFCs
- **Total Quantity of EV Charging Stalls Provided: 366**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $743,000
- Cost of EV Charger Installation: $2,591,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $6,013,000**

6.6 West Economy Garage

6.6.1 Distribution Approach

The existing electrical equipment at the West Economy Garage includes a panel that previously fed EV chargers that have since been removed, in addition to other panels that are lightly loaded and with an adequate quantity of spare breakers and breaker space. The best candidate of the existing panels is existing panel LD, fed by the T2GSES. It is recommended that if the West Economy Garage has EV chargers implemented on the existing stalls, panel LD should be used to provide power to new panels dedicated to new EV chargers. Power feeders would be run from the electrical room where LD is currently housed, along the ceiling and/or through new trenching in the garage to the new panels and charger locations.

6.6.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the West Economy Garage is presented below for option without load management. Note that the bulk of the chargers recommended for the West Economy Garage are simply 120-V receptacles, which do not provide any load management capabilities.

Note that the option below corresponds to 3.1% of the total number of parking stalls at the West Economy Garage, which is *below the low target* (5% of total number of parking stalls) established in this Study (see **Appendix A**). However, providing any additional EV chargers at this location would require significant infrastructure upgrades.

Implementation Cost (No Load Management):

- Charger Quantities: 58 Level 1 Receptacles, 7 Level 2 Single Pedestals, 5 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 75**
- Cost of Infrastructure (Panel LD to New Panels to EV Chargers): $432,000
- Cost of EV Charger Installation: $142,000
- **Total Cost: $574,000**

6.7 West Ground Transportation (GT) Lot

6.7.1 Distribution Approach

The existing electrical infrastructure at the West GT Lot is inadequate in both size and abundance of spare breakers and breaker space to support the installation of DC Fast chargers. Due to these limitations and the fact that the West GT Lot will be used for fast charging for taxis and TNCs, it is recommended that AVN coordinate with APS to determine how to serve a new SES that can support multiple DC Fast chargers. The ROM Cost Estimate with load management assumes eight 150kW DC Fast chargers. Alternatively, 250kW DC Fast chargers could be installed to reduce the amount of charging time needed.

6.7.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the West GT Lot is presented below for option without load management.

Implementation Cost (No Load Management)

- Charger Quantities: 8 80kW Single pedestal DC Fast Chargers
- **Total Quantity of EV Charging Stalls Provided: 8**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $347,000
- Cost of EV Charger Installation: $224,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $3,250,000**

Implementation Cost (With Load Management):

- Charger Quantities: 8 150kW Single pedestal DC Fast Chargers
- **Total Quantity of EV Charging Stalls Provided: 8**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $529,000
- Cost of EV Charger Installation: $600,000
- Cost of New 3000A SES: $1,527,000
- Cost of New APS Circuit & Infrastructure: $1,152,000
- **Total Cost: $3,808,000**

6.8 24th Street Express Pay Parking

6.8.1 Distribution Approach

The existing panels and switchboards at the 24th Street Express Pay Parking lot have been loaded near their ratings, as indicated on recent as-built drawings. The main 24th Street Station panels, 24-SDH1, is fed from 24-MSB-1, which could not be field verified. 24-MSB-1 could be used to provide a new power feed if spare capacity on the switchboard is available or a new SES could be provided at the lot, dedicated to the proposed EV chargers. This would feed new EV charger dedicated panels near the EV charger clusters.

6.8.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the 24th Street Express Pay Parking lot is presented below for option without load management. Note that two types of charging are presented for long-term public parking: (1) provide Level 2 chargers at full charging output at all times regardless of operating condition; (2) tying multiple load managed Level 2 chargers to a single breaker, with charging infrastructure sized at Level 1 output levels.

Note that the option with load management (and at Level 1 output levels) corresponds to *the medium target* (10% of total number of parking stalls) established in this Study (see **Appendix A**). Any additional EV chargers implemented at this location would require additional infrastructure upgrades and a substantially higher capital cost expense, as the currently recommended distribution approach at the 24th Street Express Pay Parking Lot already requires a new service.

Implementation Cost, New Service not Included (No Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 53 Level 2 Single Pedestals, 15 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 83**
- Cost of Infrastructure (New Service to New Panels to EV Chargers): $1,068,000
- Cost of EV Charger Installation: $587,000
- **Total Cost: $1,655,000**

Implementation Cost, New Service not Included (With Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 105 Level 2 Single Pedestals, 30 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 165**
- Cost of Infrastructure (New Service to New Panels to EV Chargers): $1,265,000
- Cost of EV Charger Installation: $1,165,000
- **Total Cost: $2,430,000**

Implementation Cost, New Service not Included (No Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 53 Level 2 Single Pedestals, 15 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 83**
- Cost of Infrastructure (New Service to New Panels to EV Chargers): $237,000
- Cost of EV Charger Installation: $527,000
- **Total Cost: $764,000**

Implementation Cost, New Service not Included (With Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 105 Level 2 Single Pedestals, 30 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 165**
- Cost of Infrastructure (New Service to New Panels to EV Chargers): $304,000
- Cost of EV Charger Installation: $1,048,000
- **Total Cost: $1,352,000**

6.9 West Economy Park & Walk

6.9.1 Distribution Approach

The only existing electrical equipment at the West Economy Park & Walk is the existing TEMP 400A SES and some existing lighting panels that are not suitable for EV charging. The 400A SES has a space provision for a three-phase, 208 Volt, 225 Amp circuit breaker. This could provide a new feed directly to an EV charger dedicated panel at the parking lot. Therefore, it is recommended that the existing TEMP 400A SES be used to provide new power feeders to EV chargers unless the medium or high target levels are desired at this location.

6.9.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the West Economy Park & Walk is presented below for option without load management. Note that two types of charging are presented for long-term public parking: (1) provide Level 2 chargers at full charging output at all times regardless of operating condition; (2) tying multiple load managed Level 2 chargers to a single breaker, with charging infrastructure sized at Level 1 output levels.

Note that the option with load management (and at Level 1 output levels) corresponds to 2% of the total number of parking stalls at the West Economy Park & Walk, which is *below the low target* (5% of total number of parking stalls) established in this Study (see **Appendix A**). However, providing any additional EV chargers at this location would require significant infrastructure upgrades. Additionally, it is important to note that there are plans to demolish the West Economy Park & Walk in the future.

Implementation Cost (No Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 10 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 10**
- Cost of Infrastructure (TEMP 400A SES to New Panels to EV Chargers): $196,000
- Cost of EV Charger Installation: $78,000
- **Total Cost: $274,000**

Implementation Cost (With Load Management) – Level 2 at Full Charging Output:

- Charger Quantities: 20 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 20**
- Cost of Infrastructure (TEMP 400A SES to New Panels to EV Chargers): $225,000
- Cost of EV Charger Installation: $156,000
- **Total Cost: $381,000**

Implementation Cost (No Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 10 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 10**
- Cost of Infrastructure (TEMP 400A SES to New Panels to EV Chargers): $92,000
- Cost of EV Charger Installation: $64,000
- **Total Cost: $156,000**

Implementation Cost (With Load Management) – Sized at Level 1 Output Levels:

- Charger Quantities: 20 Level 2 Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 20**
- Cost of Infrastructure (TEMP 400A SES to New Panels to EV Chargers): $100,000
- Cost of EV Charger Installation: $127,000
- **Total Cost: $227,000**

6.10 Operations Building Parking Lot

6.10.1 Distribution Approach

During the field investigations and coordination with APS, it was determined that the existing two SESs at the Operations Building and the APS circuit feeding both of them were not viable for additional EV chargers due to a lack of breaker space, spare breakers, and APS circuit capacity. Thus, if the Operations Building would need to be equipped with EV chargers such that the low to high EV charger targets are met, it is recommended that a new line extension, likely served by APS from an existing distribution circuit, and SES be provided at the Operations Building. This would provide power feeders to new EV charger dedicated panels near the clusters of EV chargers through new trenching in the parking lot.

6.10.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the Operations Building Parking Lot is presented below for option without load management.

Note that both options address the need to charge AVN light-duty fleet vehicles that are currently assigned to the landside of the Operations Building Parking Lot (as these fleet vehicles begin to replace with EV).

Implementation Cost (No Load Management):

- Charger Quantities: 22 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 22**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $413,000
- Cost of EV Charger Installation: $255,000
- Cost of New 600A SES: $306,000
- Cost of New APS Circuit Extension & Infrastructure: $497,000
- **Total Cost: $1,471,000**

Implementation Cost (With Load Management):

- Charger Quantities: 22 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 22**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $243,000
- Cost of EV Charger Installation: $255,000
- Cost of New 600A SES: $306,000
- Cost of New APS Circuit & Infrastructure: $497,000
- **Total Cost: $1,301,000**

6.11 Facilities & Services Building Parking Lot

6.11.1 Distribution Approach

The existing panels and switchboards within the Facilities and Services Building do not have adequate capacity or are located deep within the building and would require challenging modifications to the building to route a new circuit out to the parking lot. It is recommended that the SES serving the Facilities & Services Building, identified as the 2515 E. Buckeye SES, be used to provide power feeders to new panels located at the parking lots around the Facilities & Services building that would provide power to the employee and fleet EV chargers. Power feeders would be routed through ground in new trenches to panels located near the projected location of the EV charger clusters. Chargers can have power distributed through the ground to the chargers or along the supports of parking cover structures where available. As there are only six breaker provisions available on the SES, panel space on the 208V panels is the bottleneck on the quantity of EV chargers that can be provided.

6.11.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the Facilities & Services Building Parking Lot is presented below for option without load management. Note that only a minimal number of DC Fast chargers can be accommodated when considering load management options with the existing infrastructure. The ROM cost estimates below also illustrates additional cost incurred by introducing a new SES for additional DC Fast chargers. Power to the new SES would be provided by extending the existing nearby APS circuit to the location of the new 1200A SES, rather than providing an entirely new, separate APS circuit.

Note that all options address the need to charge AVN light-duty fleet vehicles that are currently assigned to the Facilities & Services Building Parking Lot (as these fleet vehicles begin to replace with EV). In addition, the option with a new 1200A SES provides the capability for AVN to put in 4 DCFCs for immediately fleet charging needs (if a fleet vehicle user requires a quick charge).

Implementation Cost (No Load Management) – Existing Infrastructure:

- Charger Quantities: 36 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 36**
- Cost of Infrastructure (2515 E. Buckeye SES to New Panels to EV Chargers): $634,000
- Cost of EV Charger Installation: $418,000
- **Total Cost: $1,052,000**

Implementation Cost (With Load Management) – Existing Infrastructure:

- Charger Quantities: 40 Level 2 High Output Single Pedestals, 2 150kW DC Fast Charger
- **Total Quantity of EV Charging Stalls Provided: 42**
- Cost of Infrastructure (2515 E. Buckeye SES to New Panels to EV Chargers): $653,000
- Cost of EV Charger Installation: $614,000
- **Total Cost: $1,267,000**

Implementation Cost (With Load Management) – With New 1200A SES:

- Charger Quantities: 40 Level 2 High Output Single Pedestals, 4 150kW DC Fast Charger
- **Total Quantity of EV Charging Stalls Provided: 44**
- Cost of Infrastructure (2515 E. Buckeye SES and New SES to New Panels to EV Chargers): $597,000
- Cost of EV Charger Installation: $934,000
- Cost of New 1200A SES: $611,000
- Cost of New APS Circuit Extension & Infrastructure: $214,000
- **Total Cost: $2,356,000**

6.12 AVN Headquarters Parking Lot

6.12.1 Distribution Approach

The Aviation Headquarters Building is a newer facility that is equipped with more robust panels and switchboards. There are multiple panels and switchboards that are viable for providing new EV chargers with power, but the most ideal is switchboard DSCCB1, fed by SES-CCB1. Both have adequate capacity and adequate space to support the new electrical infrastructure required. The switchboard would be used to feed new panels that distribute power near the new EV clusters in the parking lot. New power feeders would be routed from the room the switchboard is located in out to the parking garage through new conduits installed in the floor and through new trenches in the parking lot.

6.12.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the AVN Headquarters Building Parking Lot is presented below for option without load management.

Note that all options address the need to charge AVN light-duty fleet vehicles that are currently assigned to the AVN Headquarters Parking Lot (as these fleet vehicles begin to replace with EV). In addition, the option with load management (along with the existing Level 1 chargers in place today) corresponds to *high target* at the AVN Headquarters parking lot for AVN employees’ charging (20% of the total number of parking stalls).

Implementation Cost (No Load Management):

- Charger Quantities: 15 Level 1 Receptacles, 5 Level 2 Single Pedestals, 25 Level 2 High Output Single Pedestals

- **Total Quantity of EV Charging Stalls Provided: 45**
- Cost of Infrastructure (Switchboard 'DSCCB1' to New Panels to EV Chargers): $624,000
- Cost of EV Charger Installation: $336,000
- **Total Cost: $960,000**

Implementation Cost (With Load Management):

- Charger Quantities: 30 Level 1 Receptacles, 5 Level 2 Single Pedestals, 25 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 60**
- Cost of Infrastructure (Switchboard 'DSCCB1' to New Panels to EV Chargers): $462,000
- Cost of EV Charger Installation: $344,000
- **Total Cost: $806,000**

6.13 Command Center Parking Lot

6.13.1 Distribution Approach

The Command Center currently houses electrical panels and switchboards with adequate capacity, spare breakers, and breaker space such that they are viable candidates to provide power to new EV chargers. While using the existing infrastructure would be a cost-effective method to providing power to new EV chargers, there are additional design considerations that would need to be considered when using the existing electrical equipment. All viable Command Center panels and switchboards are backed-up by a backup generator, meaning all supported EV charger load would be placed on the backup generator, which is not ideal. Additional control schematics would need to be implemented to ensure, either internally to the EV charger controls or through the building management system, that the EV chargers would not be operational while the backup generator is being used.

Assuming these additional design considerations are taken into account during charger installation and design, the existing panel COPS3-HDP1 would provide a new EV charger dedicated panels from both of the available 225 Amp spare breakers. Power would be routed through the building to the parking lot, through new trenching where required, where the new EV charger dedicated panels would be located.

6.13.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the Command Center Parking Lot is presented below for option without load management.

Note that all options address the need to charge AVN light-duty fleet vehicles that are currently assigned to the Command Center Parking Lot (as these fleet vehicles begin to replace with EV). In addition, it was discussed with the F&S division that there may potentially be additional fleet vehicles that will be assigned to this location in the future. Thus, additional high-output Level 2 chargers are recommended at this location and are capped based on the limits of the existing local infrastructure.

Implementation Cost (No Load Management):

- Charger Quantities: 15 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 15**
- Cost of Infrastructure (Panel 'COPS3-HDP1' to New Panels to EV Chargers): $304,000
- Cost of EV Charger Installation: $174,000
- **Total Cost: $478,000**

Implementation Cost (With Load Management):

- Charger Quantities: 15 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 15**
- Cost of Infrastructure (Panel 'COPS3-HDP1' to New Panels to EV Chargers): $219,000
- Cost of EV Charger Installation: $174,000
- **Total Cost: $393,000**

6.14 Design & Construction Services Building Parking Lot

6.14.1 Distribution Approach

The existing SES at the DCS Building Parking Lot has no breaker space, no spare breakers, and is an antiquated unit. Thus, it is recommended that, if EV chargers are desired at this location, AVN shall coordinate with APS to determine how to serve a new SES at this location, dedicated to providing EV chargers with power. The SES would feed new panels near the EV charger clusters through power feeders installed in trenching through the parking lots, as required.

6.14.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the DCS Building Parking Lot is presented below for option without load management.

Note that all options address the need to charge AVN light-duty fleet vehicles that are currently assigned to the DCS Building Parking Lot (as these fleet vehicles begin to replace with EV). In addition, both options below correspond to the *high target* at the DCS Building Parking Lot for AVN employees' charging (20% of the total number of parking stalls) – the number of EV chargers are maximized at this location as it already requires a new SES to accommodate fleet charging that will be assigned to this location.

Implementation Cost (No Load Management):

- Charger Quantities: 40 Level 1 Receptacles, 7 Level 2 Single Pedestals, 17 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 64**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $536,000
- Cost of EV Charger Installation: $272,000
- Cost of New 1200A SES: $611,000
- Cost of New APS Infrastructure: $214,000
- **Total Cost: $1,633,000**

Implementation Cost (With Load Management):

- Charger Quantities: 40 Level 1 Receptacles, 7 Level 2 Single Pedestals, 17 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 64**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $364,000
- Cost of EV Charger Installation: $272,000
- Cost of New 1200A SES: $611,000
- Cost of New APS Infrastructure: $214,000
- **Total Cost: $1,461,000**

6.15 44th Street Airline Employee Parking Lot

6.15.1 Distribution Approach

The existing electrical panels in the 44th Street Airline Employee Parking Lot have limited available electrical capacity due to panel size, available breakers and breaker space, and already having been equipped with EV chargers. Thus, if a meaningful quantity of EV chargers is desired at this location by AVN, it is recommended that AVN coordinate with APS to determine how to serve a new SES to sub-feed new electrical equipment dedicated to EV chargers. The new panels provided would feed the chargers through power feeders installed in trenches through the parking lot to the EV clusters, similar to the strategy implemented for the existing chargers at this location. The nearby 44th Street PHX Sky Train Station Cell Phone Lot could be equipped with single 100kW DCFC, if deemed appropriate by PHX with the existing infrastructure, however it would exhaust all remaining available electrical capacity on the existing 44-PL-H1 panel, meaning no other L1 or L2 chargers could be installed in the lot. More DCFC chargers could be provided if a new SES was provided from a new or extended APS circuit.

6.15.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the 44th Street Airline Employee Parking Lot is presented below for option without load management.

Note that the option with load management corresponds to *the high target* (20% of total number of parking stalls) established in this Study (see **Appendix A**). The number of EV chargers are maximized at this location as it already requires a new 3000A SES and associated APS infrastructure upgrades in order to accommodate additional employees' charging at this location.

Implementation Cost (No Load Management):

- Charger Quantities: 168 Level 1 Receptacles, 28 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 224**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $1,011,000
- Cost of EV Charger Installation: $409,000
- Cost of New 3000A SES: $1,528,000
- Cost of New APS Infrastructure: $285,000
- **Total Cost: $3,233,000**

Implementation Cost (With Load Management):

- Charger Quantities: 337 Level 1 Receptacles, 56 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 449**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $1,245,000
- Cost of EV Charger Installation: $818,000
- Cost of New 3000A SES: $1,528,000
- Cost of New APS Infrastructure: $285,000
- **Total Cost: $3,876,000**

6.16 RAC Garage

6.16.1 Distribution Approach

The RAC garage infrastructure is not ideal for supporting new EV charging infrastructure, and the nearest suitable SES is SES-TB3A, which is already being targeted by the T-4 Parking Garage as a source of power for EV chargers at that location. SES-AWT-1 and SES-AWT-2, on the East end of the T-4 Parking Garage, which are located considerably far away from the RAC garage and on the other side of a considerable amount of obstacles. It is recommended that AVN coordinate with APS to determine how to serve a new SES at the RAC if EV chargers are to be implemented at this location. This solution would involve routing new conduits on the exterior of the garage up support columns or drilling conduit entries up through the floors on the interior side of the garage to the floors where EV chargers are installed. Existing parking stalls would be repurposed to accommodate installation of EV charger dedicated panels in fenced-off areas. The new panels would distribute power to the chargers throughout the RAC Garage, as required.

6.16.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the RAC Garage is presented below for option without load management.

Note that the option with load management corresponds to *the high target* (20% of total number of parking stalls) established in this Study (see **Appendix A**). The number of EV chargers are maximized at this location as it already requires a new 1200A SES and associated APS infrastructure upgrades in order to accommodate additional employees' charging at this location.

Implementation Cost (No Load Management):

- Charger Quantities: 41 Level 1 Receptacles, 7 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 55**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $314,000
- Cost of EV Charger Installation: $102,000
- Cost of New 1200A SES: $611,000
- Cost of New APS Infrastructure: $214,000
- **Total Cost: $1,241,000**

Implementation Cost (With Load Management):

- Charger Quantities: 83 Level 1 Receptacles, 14 Level 2 Dual Pedestals
- **Total Quantity of EV Charging Stalls Provided: 111**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $372,000
- Cost of EV Charger Installation: $204,000
- Cost of New 1200A SES: $611,000
- Cost of New APS Infrastructure: $214,000
- **Total Cost: $1,401,000**

6.17 Executive Terminal

6.17.1 Distribution Approach

The existing 600 Amp, 208 Volt SES feeding the Executive Terminal has one three-phase, 60 Amp circuit breaker available. Due to the voltage being lower than other SESs and only having a single breaker available, the existing SES can support no more than one Level 2 charger. It is recommended that a AVN coordinate with APS to determine how to serve a new SES at the Executive Terminal to meet the EV charger target levels provided. The new SES would feed EV charger dedicated panels located near the chargers at the Executive Terminal, with power conduits routed through the parking lot via trenches to the panels and chargers.

6.17.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the Executive Terminal is presented below for option without load management. The cost per charger is very high at this location – it is important to note that additional EV chargers (beyond the high targets established in this Study [see **Appendix A**]) can be provided at this location to make efficient use of the new SES implemented at this location. Note that police pursuit vehicles are not included in the City's fleet EV replacement plan at this time. However, this infrastructure upgrade will pave the way for additional fleet charging needs (e.g., police pursuit EVs) at this location in the future.

Implementation Cost (No Load Management):

- Charger Quantities: 5 Level 1 Receptacles, 1 Level 2 Single Pedestal
- **Total Quantity of EV Charging Stalls Provided: 6**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $91,000
- Cost of EV Charger Installation: $10,000
- Cost of New 600A SES: $306,000
- Cost of New APS Infrastructure: $176,000
- **Total Cost: $583,000**

Implementation Cost (With Load Management):

- Charger Quantities: 10 Level 1 Receptacles, 1 Level 2 Dual Pedestal
- **Total Quantity of EV Charging Stalls Provided: 12**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $95,000
- Cost of EV Charger Installation: $17,000
- Cost of New 600A SES: $306,000
- Cost of New APS Infrastructure: $176,000
- **Total Cost: $594,000**

6.18 Rental Car Center Employee Parking

6.18.1 Distribution Approach

Due to the low quantity of chargers being suggested by the Low to High EV charging targets provided by this report, it was concluded that the existing building electrical equipment located adjacent to the parking stalls present a suitable and cost-efficient solution for providing new EV chargers with power. The building 480V electrical panel HCPA has spare electrical capacity and four spaces for three phase, 100A circuit breakers that could be used to feed an EV charger dedicated panel on the exterior of the building to feed the new EV chargers using new power feeders through new trenching in the parking lot.

6.18.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the RCC Employee Parking Lot is presented below for option without load management.

Note that all options address the need to charge AVN light-duty fleet vehicles that are currently assigned to the RCC Employee Parking Lot (as these fleet vehicles begin to replace with EV).

Implementation Cost (No Load Management):

- Charger Quantities: 2 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 2**
- Cost of Infrastructure (Panel 'HCPA' to New Panels to EV Chargers): $91,000
- Cost of EV Charger Installation: $23,000
- **Total Cost: $114,000**

Implementation Cost (With Load Management):

- Charger Quantities: 2 Level 2 High Output Single Pedestals
- **Total Quantity of EV Charging Stalls Provided: 2**
- Cost of Infrastructure (Panel 'HCPA' to New Panels to EV Chargers): $91,000
- Cost of EV Charger Installation: $23,000
- **Total Cost: $114,000**

6.19 East Cell Phone Lot

6.19.1 Distribution Approach

Per APS input, the existing electrical infrastructure at the East Cell Phone Lot is inadequate to support DC fast chargers. Thus, it was not considered during the infrastructure evaluation, and it shall be assumed that new infrastructure is required to support the installation of DC fast chargers. It is recommended that AVN coordinate with APS to determine how to serve a new SES at this location that is capable of supporting multiple DC Fast chargers.

6.19.2 ROM Cost Estimate

ROM cost estimate for implementing EV chargers at the East Cell Phone Lot is presented below for option without load management.

Implementation Cost (No Load Management)

- Charger Quantities: 2 150kW DC Fast Chargers
- **Total Quantity of EV Charging Stalls Provided: 2**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $179,000
- Cost of EV Charger Installation: $150,000
- Cost of New 600A SES: $306,000
- Cost of New APS Circuit & Infrastructure: $176,000
- **Total Cost: $811,000**

Implementation Cost (With Load Management):

- Charger Quantities: 2 150kW DC Fast Chargers
- **Total Quantity of EV Charging Stalls Provided: 2**
- Cost of Infrastructure (New SES to New Panels to EV Chargers): $179,000
- Cost of EV Charger Installation: $150,000
- Cost of New 600A SES: $306,000
- Cost of New APS Circuit & Infrastructure: $176,000
- **Total Cost: $811,000**

6.20 Summary

Table 6-2 summarizes the total quantity of EV charging stalls and the associated ROM cost estimate with and without load management for each of the opportunity sites identified in the prior sections. The ROM costs include the EV chargers, as well as the additional infrastructure needed to support the recommended number of EV stalls (e.g., new SES, new panels, new APS circuits and infrastructure). Note that these are hard construction costs and do not include any soft costs.

Table 6-2: Summary of ROM EV Chargers Maximum Implementation Cost

Facility	User Group (1)	No Load Management			With Load Management		
		Type of EV Chargers	Max Number of EV-Installed Stalls	ROM Total Cost (2)	Type of EV Chargers	Max Number of EV-Installed Stalls	ROM Total Cost (2)
T3 Parking Garage	• Short-term Public	• Level 2 (7.2kW to 11.4kW)	61	$1,168,000	• Level 2 (7.2kW to 11.4kW)	122	$1,722,000
T4 Parking Garage	• Short-term Public	• Level 2 (7.2kW to 11.4kW)	82	$1,895,000	• Level 2 (7.2kW to 11.4kW)	164	$2,428,000
East Economy Garage A (3)	• Long-term Public	• Level 2 (Reduced Power Output)	245	$4,968,000	• Level 2 (Reduced Power Output)	469	$6,484,000
East Economy Garage B	• Long-term Public	• Level 2 (Reduced Power Output)	59	$596,000	• Level 2 (Reduced Power Output)	118	$1,066,000
East Economy Lot	• Long-term Public • Shuttle Buses	• Level 2 (Reduced Power Output) • 350kW DCFC	181 Level 2 2 DCFC	$4,700,000	• Level 2 (Reduced Power Output) • 350kW DCFC	364 Level 2 2 DCFC	$6,013,000
West Economy Garage	• Non-AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	58 Level 1 17 Level 2	$574,000	N/A (4)		
West GT Lot	• Ground Transport	• 80kW DCFC	8	$3,250,000	• 150kW DCFC(6)	8	$3,808,000
24th Street Express Pay Parking	• Long-term Public	• Level 2 (Reduced Power Output)	83	$764,000	• Level 2 (Reduced Power Output)	165	$1,352,000
West Economy Park & Walk	• Long-term Public	• Level 2 (Reduced Power Output)	10	$156,000	• Level 2 (Reduced Power Output)	20	$227,000

Facility	User Group (1)	No Load Management			With Load Management		
		Type of EV Chargers	Max Number of EV-Installed Stalls	ROM Total Cost (2)	Type of EV Chargers	Max Number of EV-Installed Stalls	ROM Total Cost (2)
Operations Building Parking Lot	• AVN Fleet	• High Output Level 2 (Up to 19.2kW)	22	$1,471,000	• High Output Level 2 (Up to 19.2kW)	22	$1,301,000
Facilities & Services Building Parking Lot	• AVN Fleet	• High Output Level 2 (Up to 19.2kW)	36	$1,052,000	• High Output Level 2 (Up to 19.2kW) • 150kW DCFC	40 Level 2 4 DCFC	$2,356,000
AVN HQ Parking Lot	• AVN Fleet • AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW) • High Output Level 2 (Up to 19.2kW)	• 15 Level 1 • 5 Level 2 • 25 High-Output Level 2	$960,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW) • High Output Level 2 (Up to 19.2kW)	• 30 Level 1 • 5 Level 2 • 25 High-Output Level 2	$806,000
Command Center Parking Lot	• AVN Fleet	• High Output Level 2 (Up to 19.2kW)	15	$478,000	• High Output Level 2 (Up to 19.2kW)	15	$393,000
DCS Building Parking Lot	• AVN Fleet • AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW) • High Output Level 2 (Up to 19.2kW)	• 40 Level 1 • 7 Level 2 • 17 High-Output Level 2	$1,633,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW) • High Output Level 2 (Up to 19.2kW)	• 40 Level 1 • 7 Level 2 • 17 High-Output Level 2	$1,461,000
44th Street Airline Employee Parking Lot	• Non-AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	168 Level 1 56 Level 2	$3,233,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	337 Level 1 112 Level 2	$3,876,000
RAC Garage	• Non-AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	41 Level 1 14 Level 2	$1,241,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	83 Level 1 28 Level 2	$1,401,000

Facility	User Group (1)	No Load Management			With Load Management		
		Type of EV Chargers	Max Number of EV-Installed Stalls	ROM Total Cost (2)	Type of EV Chargers	Max Number of EV-Installed Stalls	ROM Total Cost (2)
Executive Terminal	• AVN Employees	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	5 Level 1 1 Level 2	$583,000	• Level 1 Receptacles • Level 2 (7.2 kW to 11.4 kW)	10 Level 1 2 Level 2	$594,000
Rental Car Center Employee Parking	• AVN Fleet	• High Output Level 2 (Up to 19.2kW)	2	$114,000	• High Output Level 2 (Up to 19.2kW)	2	$114,000
East Cell Phone Lot	• Short-term Public	• 2 150kW DC Fast Chargers	2	$811,000	• 2 150kW DC Fast Chargers	2	$811,000
	Total	**$29,647,000**			**$36,787,000 (5)**		

Source: HNTB analysis, 2022-2023.

Notes:
(1) The user group(s) identified in this column classify users that have future chargers assigned to them in the implementation plan (based on limitations due to existing infrastructure), and do not represent all users that are currently parking at that facility.
(2) The ROM total costs are hard construction costs and do not include any soft costs.
(3) The evaluation of the existing electrical infrastructure reveals that East Economy Garage B is a better candidate for implementing EV chargers between East Economy Garages A and B as it can support a high number of chargers at a lower implementation cost in comparison to Garage A. The ROM cost and number of EV-installed stalls are included for illustration purposes.
(4) Note that the bulk of the chargers recommended for the West Economy Garage are Level 1 chargers (120-V receptacles), which do not provide any load management capabilities.
(5) Note that this ROM total cost accounts for West Economy Garage (without load management).
(6) As an alternative, fewer 250kW chargers could be used in place of the 150 kW chargers for faster charging.

7.0 Phased Implementation Plan

7.1 Implementation Priorities

Section 6.0*, Proposed Distribution Approach,* identifies the distribution approaches (with and without load management) for all parking facilities for the maximum number of EV-installed parking stalls that can be provided. It is recommended that the existing electrical infrastructure be upgraded and available for use to the maximum number of recommended EV-installed parking stalls during the initial installation. However, the it is recommended that EV chargers be installed through a phased approach – starting with an initial number of EV-installed parking stalls (maximum: 50 EV-installed parking stalls), and steadily increasing to the maximum number of EV-installed parking stalls at each of the parking facilities. The lower-scale initial installations will not remove a significant number of parking spaces all at once and will help balance the parking needs for both EV and non-EV users in the near-term. Regardless of implementation strategy, AVN should monitor usage regularly, re-evaluate, and further increase the number of EV-installed parking stalls accordingly as needed. With the existing electrical infrastructure upgraded with the initial installation, additional EV-installed parking stalls can be readily provided in the future.

This phased implementation plan recommends assignment of priorities (Priority Groups 1 through 3 with Priority 1 as the most critical need) for each of those locations and the preferred distribution approach, which considers the most critical needs, potential implementation costs, and the feasibility to implement. Through this effort, it is important to have an equitable approach to distribution of resources to ensure that future EV charging needs for each user group is addressed accordingly. In addition, the disparity between the number of EV chargers offered at each parking facility should be considered to the extent practicable. The intent of creating priority groups is to enable AVN to implement additional projects/infrastructure upgrades in any given year should there be additional funding available and/or if the parking facility is undergoing major alterations. It is also important to review the collected usage data, re-evaluate and further develop the EV charging adoption targets for each of the parking facilities on an annual basis.

In addition to implementing new EV chargers in these Priority Groups, it is noted that there are currently EV chargers in locations (e.g. T-3 Parking Garage) that are currently underutilized. It is recommended that in addition to planning for new infrastructure and EV chargers, the AVN should increase visibility of signage and enhance wayfinding to all existing and future EV charging facilities.

7.1.1 Priority Group 1

Priority Group 1 includes the parking facilities with the highest priority for EV charger implementation, which includes the following:

- F&S Building Parking Lot
- Operations Building Parking Lot
- T-4 Parking Garage
- East Economy Garage B
- 44th Street Airline Employee Parking Lot
- West GT Lot
- GYR Covered Parking
- DVT Terminal Covered Parking

Table 7-1 identifies the initial and maximum number of EV-Installed parking spaces that can be accommodated at each of the parking facilities above and the corresponding ROM cost estimate for each. The parking facilities assigned under Priority Group 1 are also illustrated graphically in **Figure 7-1**.

It is recommended that AVN prioritizes the implementation of fleet dedicated EV charging clusters. As AVN fleet vehicles are replaced on a planned schedule, it is important for the EV chargers to be in place prior to replacement with an EV alternative. The fleet replacement schedule will help determine which locations require EV charger installation first. In discussion with the F&S Fleet section, it was noted that the near-term fleet EV replacements are slated for AVN light-duty fleet vehicles that are assigned to both the F&S Building and Operations Building Parking Lots. Therefore, it is important to ensure that the high-output Level 2 chargers are in place at these two locations prior to deploying these AVN light-duty EV fleet.

Along with implementation of fleet dedicated EV chargers, it is recommended that AVN prioritize, and balance distribution of, EV chargers available for public use. It is recommended to focus initially on increasing the number of EV-installed parking stalls available within the T-4 Parking Garage and the East Economy Garage B. These locations typically serve short term and long-term public vehicles, respectively, and would allow AVN to provide EV chargers to varying user types. The T-4 Parking Garage has a deficit of chargers for public use, particularly when compared to the T-3 Parking Garage. There are currently two EV-installed parking stalls for the approximately 8,000 parking spaces in the T-4 Parking Garage and notable demand for additional charging capabilities in the near term. For comparison, the T-3 Parking Garage has 16 Level 2 EV-installed parking stalls. While T-4 and the East Economy Garage B both serve public users, the East Economy Garages serve a different type of parker, typically staying for longer periods of time, than the T-3 and T-4 Parking Garages. The East Economy Lot does not have any EV charging stalls currently and Garage B could serve as a consolidated location for EV charging stalls with the East Economy Lot making it easier for an EV user to find a space and quickly know if any are available (rather than driving to multiple locations to check availability if spaces in one area are occupied).

The existing charging infrastructure in the 44th Street Airline Employee Parking Lot is outdated and not up to current standards. The six Level 2 EV-installed parking stalls in this parking lot are in high demand by airport employees and there have been consistent requests for additional EV chargers and/or for updates to the outdated Level 2 output EV chargers.

DC Fast chargers are recommended at the West GT Lot as users will need to use the EV chargers to quickly charge ground transportation vehicles in a short period of time. While APS has indicated there is overall capacity to serve the existing electrical infrastructure at this lot, it will need to be upgraded to support the recommended DC Fast charging infrastructure and additional breaker space will be needed to support additional charging infrastructure. Thus, upgrades are recommended at this facility and the costs of a new SES and associated APS circuit and infrastructure upgrades have been included in the ROM costs. ROM estimates do not account for any potential off-site infrastructure costs.

Table 7-1: EV-Installed Parking Spaces Implementation (Priority 1)

Location	User Group	Initial Number of EV-Installed Stalls	Maximum Number of EV-Installed Stalls	Load Managed (Y/N)	Initial ROM Cost (if applicable)	Total ROM Cost (Maximum)
F&S Building Parking Lot	AVN Fleet	40 High-Output Networked Level 2 4 Networked 150kW DCFC	40 High-Output Networked Level 2 4 Networked 150kW DCFC	Y	$2,356,000	$2,356,000
Operations Building Parking Lot	AVN Fleet	22 High-Output Networked Level 2	22 High-Output Networked Level 2	Y	$1,301,000	$1,301,000
T-4 Parking Garage	Short-term Public (Revenue)	50 Networked Level 2	164 Networked Level 2	Y	$1,636,000	$2,428,000
East Economy Garage B	Long-term Public (Revenue)	50 Networked Level 2 (Reduced Power Output)	118 Networked Level 2 (Reduced Power Output)	Y	$635,000	$1,066,000
44^{th} Street Airline Employee Parking Lot	Non-AVN Employee Private Vehicles	50 Level 1 (120-V Receptacles) 9 Networked Level 2	337 Level 1 (120-V Receptacles) 112 Networked Level 2(1)	Y	$3,083,000	$3,876,000
West GT Lot	Ground Transportation	8 Networked 150kW DCFC	8 Networked 150kW DCFC(2)	Y	$3,808,000	$3,808,000
GYR Covered Parking Lot	AVN Fleet	To be determined; separate load study needed at GYR to determine electrical capacity and ROM Costs.				
DVT Terminal Covered Parking Lot	AVN Fleet	To be determined; separate load study needed at DVT to determine electrical capacity and ROM Costs.				
				Total	**$12,819,000**	**$14,835,000**

Source: HNTB analysis, 2022-2023.

Notes:

(1) Note that the maximum number of EV-Installed parking stalls at the 44th Street Airline Employee Parking Lot corresponds to the high target (20% of total number of parking stalls) established by the Study (see Appendix A). The number of EV chargers are maximized at this location as it already requires a new 3000A SES and associated APS infrastructure upgrades to accommodate additional employees' charging at this location.

(2) As an alternative, fewer 250kW chargers could be used in place of the 150 kW chargers for faster charging.

7.1.2 Priority Group 2

Priority Group 2 consists of the next group of parking facilities with priority for EV charger implementation, which includes the following:

- AVN Headquarters Parking Lot
- Command Center Parking Lot
- DCS Building Parking Lot
- East Cell Phone Lot

Table 7-2 identifies the maximum number of EV-Installed parking spaces for each of the parking facilities listed above and the corresponding ROM cost estimate for each. The parking facilities assigned under Priority Group 2 are also illustrated graphically in **Figure 7-2**.

Table 7-2: EV-Installed Parking Spaces Implementation (Priority 2)

Location	User Group	Maximum Number of EV-Installed Stalls (1)	Load Managed (Y/N)	Total ROM Cost (Maximum)
AVN Headquarters Parking Lot	AVN Fleet and AVN Employee Private Vehicles	30 Level 1 (120-V Receptacles) 5 Networked Level 2 25 High-Output Networked Level 2	Y	$806,000
Command Center Parking Lot	AVN Fleet and AVN Employee Private Vehicles	15 High-Output Networked Level 2	Y	$393,000
DCS Building Parking Lot	AVN Fleet and AVN Employee Private Vehicles	40 Level 1 (120-V Receptacles) 7 Networked Level 2 17 High-Output Networked Level 2	Y	$1,461,000
East Cell Phone Lot	Public (Non-Revenue)	2 Networked 150kW DCFC	Y	$811,000
			Total	**$3,471,000**

Source: HNTB analysis, 2022-2023.

Notes:
(1) The recommendation for initial installation and maximum installation are the same for Priority 2 because the recommended number of chargers is fewer than 50 at each of the locations, as discussed in *Section 7.1, Implementation Priorities*.

It is recommended that the second priority group focuses on adding EV chargers to AVN employee parking lots and for AVN fleet vehicles' charging needs. The AVN Headquarters Parking Lot and Command Center Parking Lots both accommodate parking for AVN light-duty vehicles and AVN employee parking. They also have fleet vehicles that staff has indicated could be replaced with EV. These lots both have Level 1 chargers currently, as well as adequate electrical infrastructure to accommodate additional EV chargers.

DC Fast chargers are recommended at the East Cell Phone Lot as users will need to use the EV chargers to quickly charge vehicles in a short period of time. The existing electrical infrastructure at this lot is inadequate to support the recommended DC Fast charging infrastructure. Thus, upgrades are recommended at this facility and the costs of a new SES and associated APS circuit and infrastructure upgrades have been included in the ROM costs. ROM estimates do not account for any potential off-site infrastructure costs.

The remainder of the parking facilities in this priority group will require coordination between AVN and APS to support new or upgraded electrical infrastructure to accommodate the recommended charging types. As projects near implementation, updates to data, needs, and cost may be necessary. The DCS Building Parking Lot is used for AVN employee parking and has one Level 1 charger. Incorporated into the cost is a new SES that will be needed at this location, dedicated to providing EV chargers with power since there is currently no capacity for any additional EV chargers at this location.

7.1.3 Priority Group 3

Priority Group 3 consists of the remaining parking facilities for EV charger implementation, which includes the following:

- T-3 Parking Garage
- 24th Street Express Pay Parking Lot
- East Economy Surface Lot
- RAC Garage
- RCC Employee Parking Lot

Table 7-3 identifies the initial and maximum number of EV-Installed parking spaces for each of the parking facilities listed above and the corresponding ROM cost estimate for each. The parking facilities assigned under Priority Group 3 are also illustrated graphically in **Figure 7-3**.

The RCC Employee Parking Lot has minimal EV charging stalls proposed and therefore takes less priority than many other facilities. The RAC Garage infrastructure is not ideal for supporting new EV charging infrastructure, and the nearest suitable SES is SES-TB3A, which is already being targeted by the T-4 Parking Garage as a source of power for EV chargers at that location. SES-AWT-1 and SES-AWT-2, on the East end of the T-4 Parking Garage, which are located considerably far away from the RAC Garage. As a result, it is recommended that AVN coordinate with APS to determine how to serve a new SES at the RAC Garage. Similarly, a new SES will be needed at both the East Economy Lot and the 24th Street Express Pay Parking Lot. Note that a new SES and the associated APS feeder upgrades are significant infrastructure upgrades and will require additional coordination with APS as well as additional time for permitting, design, and construction. For these reasons, these locations are also placed lower in the priority listing.

Table 7-3: EV-Installed Parking Spaces Implementation (Priority 3)

Location	User Group	Initial Number of EV-Installed Stalls	Maximum Number of EV-Installed Stalls	Load Managed (Y/N)	Initial ROM Cost (if applicable)	Total ROM Cost (Maximum)
T-3 Parking Garage	Short-term Public (Revenue)	50 Networked Level 2	122 Networked Level 2	Y	$1,233,000	$1,722,000
24th Street Express Pay Parking Lot	Long-term Public (Revenue)	50 Networked Level 2 (Reduced Power Output)	165 Networked Level 2 (Reduced Power Output)	Y	$529,000	$1,352,000
East Economy Lot	Long-term Public (Revenue)	50 Networked Level 2 (Reduced Power Output) 2 Networked 350kW DCFC	364 Networked Level 2 (Reduced Power Output) 2 Networked 350kW DCFC(1)	Y	$4,019,000	$6,013,000
RAC Garage	Non-AVN and AVN Employee Private Vehicles	50 Level 1 (120-V Receptacles) 9 Networked Level 2	83 Level 1 (120-V Receptacles) 28 Networked Level 2(1)	Y	$1,280,000	$1,401,000
RCC Employee Parking Lot	AVN Fleet and AVN Employee Private Vehicles	2 High-Output Networked Level 2	2 High-Output Networked Level 2	Y	$114,000	$114,000
				Total	**$7,175,000**	**$10,602,000**

Source: HNTB analysis, 2022-2023.

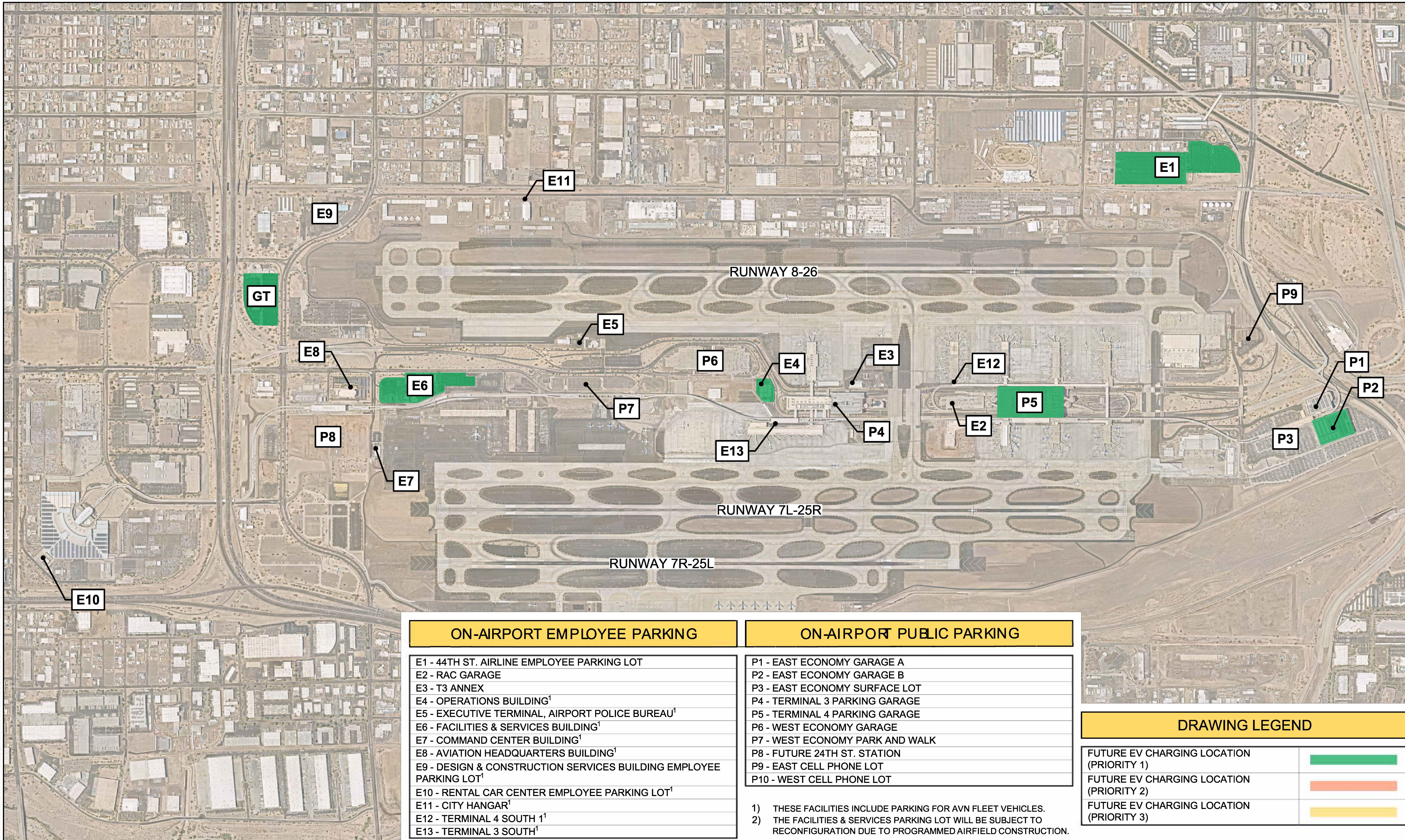
Notes:

(1) Note that the maximum number of EV-Installed parking stalls at the East Economy Surface Lot and RAC Garage corresponds to *the high target* (20% of total number of parking stalls) established by the Study (see Appendix A). The number of EV chargers are maximized at this location as it already requires major infrastructure upgrades (including new SES and associated APS infrastructure upgrades) to provide additional chargers at this location.

Figure 7-4 illustrates all three priority groups on the same figure. Note that the appropriate priority group for the City Hangar, T4S1, T3 South parking locations have not yet been identified. These locations typically house three or fewer vehicles, therefore the appropriate priority group for these locations will be determined based on the EV replacement schedule for the specific light duty fleet typically parked at those locations.

The following parking facilities are currently omitted from the Priority Groups 1 – 3:

- **East Economy Garage A** – note that EV charging introduced at both the East Economy Garages A and B can be consolidated at one of the East Economy garages to lower the cost of infrastructure upgrades and for easier wayfinding for EV's owners. The evaluation of the existing electrical infrastructure reveals that Garage B is a better candidate as it can support a high number of EV chargers at a lower implementation cost in comparison to Garage A.
- **West Economy Garage** – there are tentative plans to demolish the West Economy Garage in the future. However, if EV chargers are needed at this location in the near-term, up to 3% of the total number of parking stalls can be outfitted with EV chargers using the existing local electrical infrastructure – Panel 'LD'.
- **West Economy Park & Walk** – there are tentative plans to demolish the West Economy Park & Walk in the future. However, if EV chargers are needed at this location in the near-term, up to 2% of the total number of parking stalls can be outfitted with EV chargers using the existing local electrical infrastructure – TEMP 400A SES.
- **Executive Terminal** – the evaluation of the existing electrical infrastructure reveals that the capital expense required to provide additional EV chargers at this location is very high (as a new SES is needed at this location for very minimal projected EV charging needs). Nonetheless, this infrastructure upgrade will likely be necessary if fleet vehicles (e.g., official police pursuit vehicles) assigned to this location will be replaced with EV. These vehicles are not included in the City's fleet EV replacement plan at this time.



ON-AIRPORT EMPLOYEE PARKING

E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING[1]
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU[1]
E6 - FACILITIES & SERVICES BUILDING[1]
E7 - COMMAND CENTER BUILDING[1]
E8 - AVIATION HEADQUARTERS BUILDING[1]
E9 - DESIGN & CONSTRUCTION SERVICES BUILDING EMPLOYEE PARKING LOT[1]
E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT[1]
E11 - CITY HANGAR[1]
E12 - TERMINAL 4 SOUTH 1[1]
E13 - TERMINAL 3 SOUTH[1]

ON-AIRPORT PUBLIC PARKING

P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE
P5 - TERMINAL 4 PARKING GARAGE
P6 - WEST ECONOMY GARAGE
P7 - WEST ECONOMY PARK AND WALK
P8 - FUTURE 24TH ST. STATION
P9 - EAST CELL PHONE LOT
P10 - WEST CELL PHONE LOT

1) THESE FACILITIES INCLUDE PARKING FOR AVN FLEET VEHICLES.
2) THE FACILITIES & SERVICES PARKING LOT WILL BE SUBJECT TO RECONFIGURATION DUE TO PROGRAMMED AIRFIELD CONSTRUCTION.

DRAWING LEGEND

FUTURE EV CHARGING LOCATION (PRIORITY 1)	
FUTURE EV CHARGING LOCATION (PRIORITY 2)	
FUTURE EV CHARGING LOCATION (PRIORITY 3)	

PHX City of Phoenix

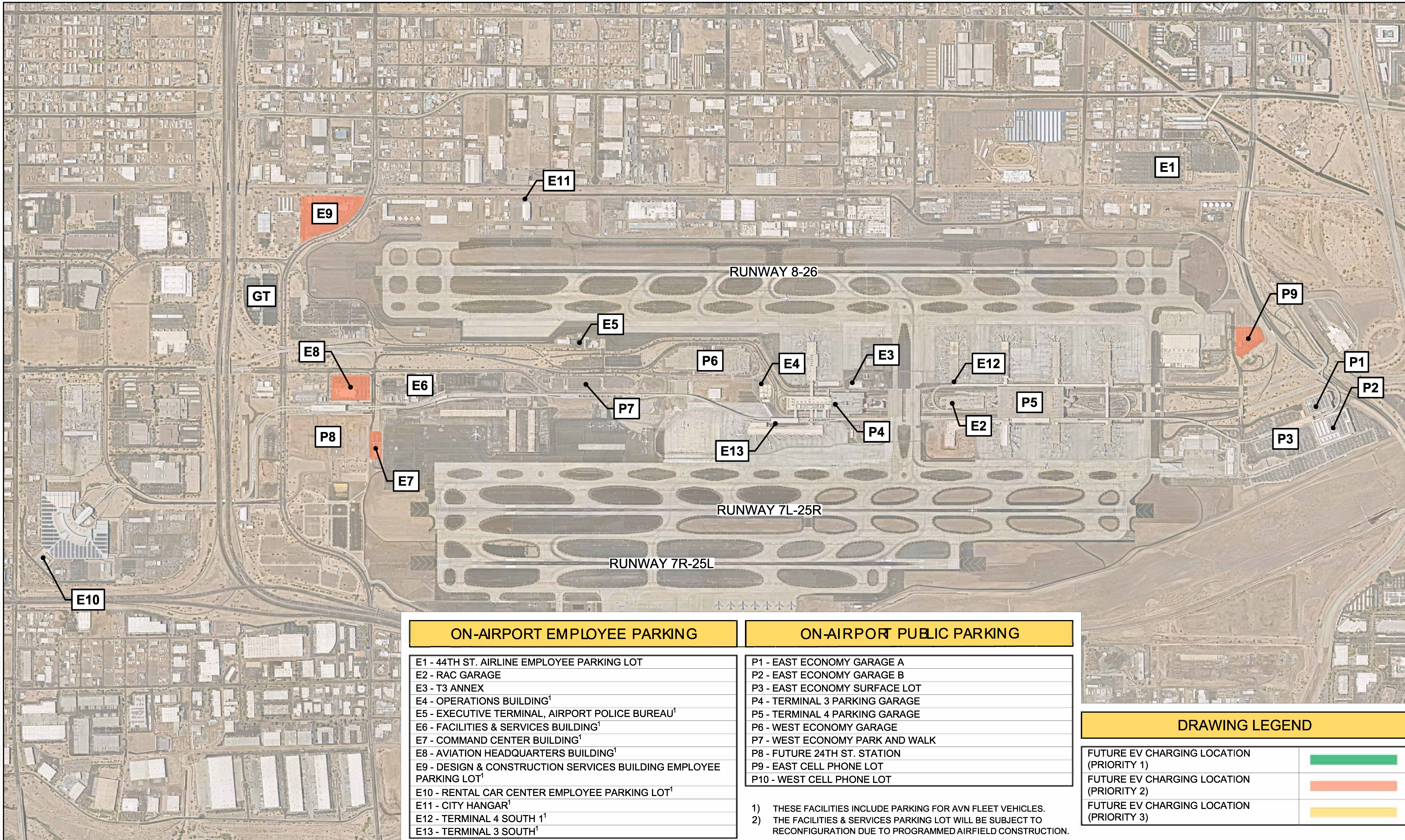
PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N

0 1,300' 2,600'

FIGURE 7-1 MAY 2023

EV CHARGING STATIONS IMPLEMENTATION (PRIORITY 1)



ON-AIRPORT EMPLOYEE PARKING
E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING[1]
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU[1]
E6 - FACILITIES & SERVICES BUILDING[1]
E7 - COMMAND CENTER BUILDING[1]
E8 - AVIATION HEADQUARTERS BUILDING[1]
E9 - DESIGN & CONSTRUCTION SERVICES BUILDING EMPLOYEE PARKING LOT[1]
E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT[1]
E11 - CITY HANGAR[1]
E12 - TERMINAL 4 SOUTH 1[1]
E13 - TERMINAL 3 SOUTH[1]

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE
P5 - TERMINAL 4 PARKING GARAGE
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P9 - EAST CELL PHONE LOT
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DRAWING LEGEND	
FUTURE EV CHARGING LOCATION (PRIORITY 1)	
FUTURE EV CHARGING LOCATION (PRIORITY 2)	
FUTURE EV CHARGING LOCATION (PRIORITY 3)	

PHX City of Phoenix

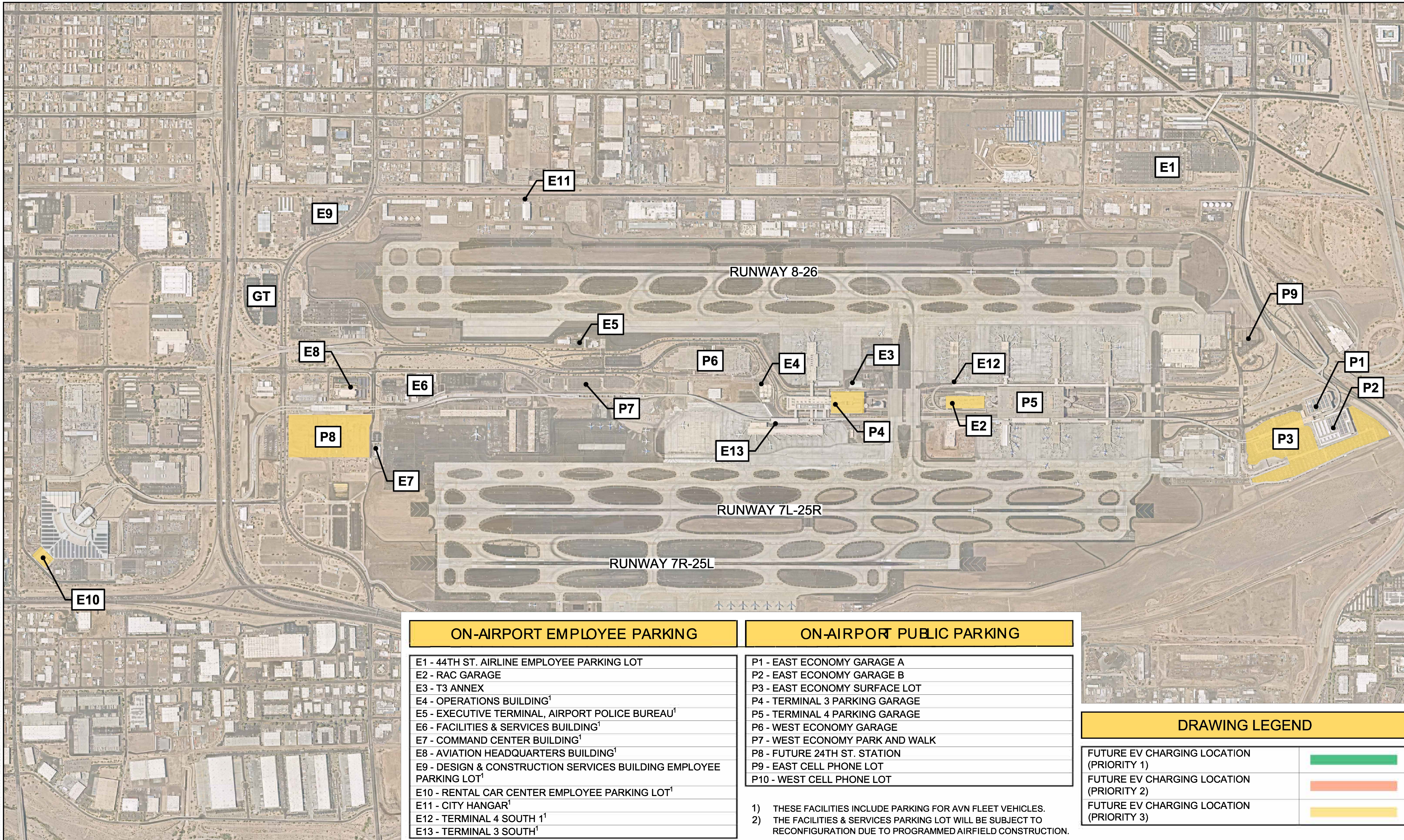
PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N

0 1,300' 2,600'

FIGURE 7-2 MAY 2023

EV CHARGING STATIONS IMPLEMENTATION (PRIORITY 2)



ON-AIRPORT EMPLOYEE PARKING
E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING[1]
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU[1]
E6 - FACILITIES & SERVICES BUILDING[1]
E7 - COMMAND CENTER BUILDING[1]
E8 - AVIATION HEADQUARTERS BUILDING[1]
E9 - DESIGN & CONSTRUCTION SERVICES BUILDING EMPLOYEE PARKING LOT[1]
E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT[1]
E11 - CITY HANGAR[1]
E12 - TERMINAL 4 SOUTH 1[1]
E13 - TERMINAL 3 SOUTH[1]

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE
P5 - TERMINAL 4 PARKING GARAGE
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P9 - EAST CELL PHONE LOT
P10 - WEST CELL PHONE LOT

1) THESE FACILITIES INCLUDE PARKING FOR AVN FLEET VEHICLES.
2) THE FACILITIES & SERVICES PARKING LOT WILL BE SUBJECT TO RECONFIGURATION DUE TO PROGRAMMED AIRFIELD CONSTRUCTION.

DRAWING LEGEND	
FUTURE EV CHARGING LOCATION (PRIORITY 1)	green
FUTURE EV CHARGING LOCATION (PRIORITY 2)	orange
FUTURE EV CHARGING LOCATION (PRIORITY 3)	yellow

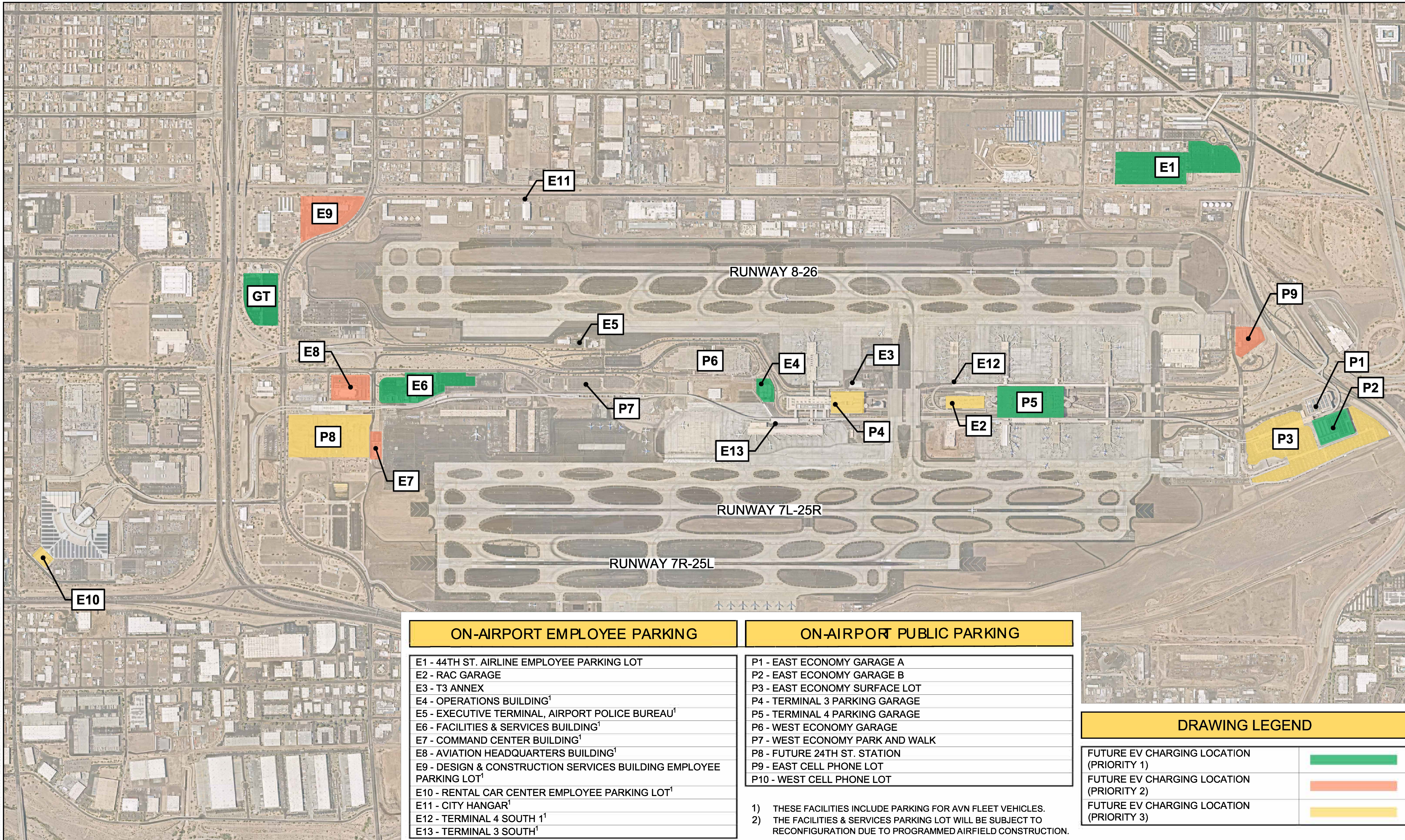
PHX City of Phoenix

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N
0 1,300' 2,600'

FIGURE 7-3 MAY 2023

EV CHARGING STATIONS IMPLEMENTATION (PRIORITY 3)



ON-AIRPORT EMPLOYEE PARKING
E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING[1]
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU[1]
E6 - FACILITIES & SERVICES BUILDING[1]
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E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT[1]
E11 - CITY HANGAR[1]
E12 - TERMINAL 4 SOUTH 1[1]
E13 - TERMINAL 3 SOUTH[1]

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE
P5 - TERMINAL 4 PARKING GARAGE
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DRAWING LEGEND	
FUTURE EV CHARGING LOCATION (PRIORITY 1)	green
FUTURE EV CHARGING LOCATION (PRIORITY 2)	orange
FUTURE EV CHARGING LOCATION (PRIORITY 3)	yellow

PHX

City of Phoenix

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N

0 1,300' 2,600'

FIGURE 7-4 MAY 2023

EV CHARGING STATIONS IMPLEMENTATION (ALL PRIORITY GROUPS)

7.2 Funding Sources

There are increasing grant opportunities available and under development which could help fund EVs and charging infrastructure upgrades and installation. The team is monitoring these opportunities and working with AVN to identify relevant grants to apply for. Initial programs identified as possible funding sources are included in the following discussion and as the market continues to mature, more opportunities will become available.

Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA)
The U.S. Department of Transportation has multiple funding opportunities for key programs within the BIL and IRA, as well as adjacent programs that support BIL and IRA objectives. The BIL includes up to a $7.5 billion investment in electric vehicle charging to help build out a national network of 500,000 electric vehicle chargers.

Charging and Fueling Infrastructure Grants:
Federal Highway Administration (FHWA) program made available each fiscal year for Community Grants, to install electric vehicle charging and alternative fuel in locations on public roads, schools, parks, and in publicly accessible parking facilities. Federal cost share requirement: 80 percent Federal / 20 percent non-Federal. Opening date is Winter 2023.

National Electric Vehicle Infrastructure Formula Program:
FHWA program supports strategic deployment of electric vehicle charging infrastructure and establishment of an interconnected network to facilitate data collection, access, and reliability. States are recipients, but 10 percent must be set aside for discretionary grants to State and local governments that require assistance to strategically deploy EV charging infrastructure.

Energy Efficiency and Conservation Block Grant (EECBG) Program
U.S. Department of Energy (Office of State and Community Energy Programs) program designed to assist states, local governments, and Tribes in implementing strategies to reduce energy use, to reduce fossil fuel emissions, and to improve energy efficiency. Communities can use this flexible source of funding to catalyze long-term, impactful, and self-sustaining plans, projects, and programs. Note that all eligible entities that intend to apply must submit their Pre-Award Information Sheet by April 28, 2023.

Voluntary Airport Low Emissions (VALE) Program
FAA VALE Program is available to airports located within nonattainment areas. Both EVs and charging infrastructure are eligible for funding through the VALE program using Passenger Facility Charges (PFCs) or Airport Improvement Program (AIP) grants.

VALE Application: Lengthy application with nine required sections and associated appendices: https://www.faa.gov/sites/faa.gov/files/airports/resources/publications/reports/vale_techreport_v7.pdf

Zero Emissions Vehicles (ZEV) Program

FAA ZEV Program allows airports to use AIP funds for acquisition and operation of EVs and charging stations but is limited to EVs that are owned or leased by the sponsor and used for airport purposes. The ZEV Program allows for limited public access to charging stations (10% of charging capacity and must charge a fee for use of facility).

ZEV Application: must include the completed ZEV worksheet in Attachment A of the Guidance: Zero Emission Vehicle Pilot Program Technical Guidance, version 2, 2022: https://www.faa.gov/sites/faa.gov/files/airports/environmental/zero_emissions_vehicles/Zero-Emissions-Vehicles-Tech-Guidance-v2.pdf

Applicable Eligible Projects for VALE and ZEV: Airport owned EVs and charging infrastructure for Airport-owned EVs. Equipment must remain at Airport for its useful life and sponsor must track and maintain records of equipment.

VALE and ZEV Program Application Timeline:

- Pre-applications are due to the FAA Airports District Office (ADO) on November 1st of Fiscal Year (FY) of funding (the pre-application is approximately 3 pages long)
- The FAA makes a decision on the pre-applications between late January and early March.
- The full applications are due between early May and late June.
- Grants are issued by end of the FY.

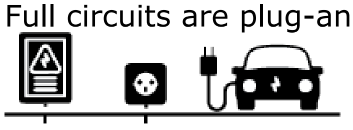
8.0 Additional EV Policies

8.1 New Construction Requirements

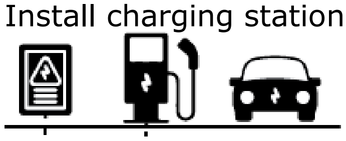
The following terminologies are often referenced in EV infrastructure building codes:

- EV-Capable Parking Space: Electrical panel capacity and conduit
  - Install panel capacity and conduit to accommodate the future build-out of EV charging with 208V, 40-amp circuits
  - This provides hard-to-retrofit elements during new construction while minimizing up-front cost

- EV-Ready Parking Space: Install full circuit
  - Full circuit installations include 208V, 40-amp panel capacity, raceway, wiring, receptacle, and overprotection devices
  - Full circuits are plug-and-play ready



- EV-Installed Parking Space: Install EV Charger
  - Install charging stations during new construction



The cost to install EV-Capable infrastructure during new construction is four to six times less expensive than during a stand-alone retrofit. Factors that contribute to higher costs of installing EV-Capable infrastructure during a retrofit are the need for demolition and repair of surface parking, breaking and repairing walls, upgrading electric service panels, additional soft cost (from permits, plans, and inspections), etc. Therefore, the following policies are suggested for new building construction and parking facilities and are based upon the established AVN targets and goals for EV charging discussed in **Appendix A** (refer to definition of EV-Installed and EV-Capable Parking Spaces above):

- Recommend up to **5%** of the total number of parking spaces to be **EV-Installed** parking spaces
- Recommend an **additional 15%** of the total number of parking spaces to be **EV-Capable** parking spaces

As discussed, **Appendix A** includes EV targets that were established to create a roadmap to meet the City's Climate Action Plan EV goal for installing charging ports on City properties to support 50% of all private vehicle sales as EVs by 2030.

For newly constructed stalls that are EV-Capable, it is recommended that construction documents, including electrical engineering and design related documents, demonstrate that the electrical service capacity and electrical system, including any onsite distribution transformer(s), have the capability to charge the EVs at a minimum of 20% of the total number of EV spaces simultaneously (5% EV-Installed Parking Spaces + 15% EV-Capable Parking Spaces), at the full rated amperage of the EV charger or a minimum of 40 amperes per branch circuit.

As a comparison, SFO requires that EV chargers be installed in at least 10% of all parking spaces Airport-wide by 2023. This is in addition to the City and County of San Francisco mandate that all parking spaces in new construction be "made-ready" to support EV charging and the California Building Code that requires all new construction provide 10% of all parking stalls as EV-Capable. At Seattle-Tacoma International Airport (SEA), electrical infrastructure for new facilities must be capable of supporting EV charging for 20% of the total stalls to meet the new building code requirements. Note that although the infrastructure must be able to support this quantity of EV charging stalls, it does not necessarily mean that the facilities at SEA are required to provide this quantity of EV chargers.

8.2 Accessibility Compliance

The U.S. Access Board, an independent federal agency that issues accessibility guidelines under the Americans with Disabilities Act (ADA), Architectural Barriers Act (ABA), Rehabilitation Act of 1973, and other laws, has prepared "Design Recommendations for Accessible Electric Vehicle Charging Stations," a technical assistance document that assists in the design and construction of EV charging stations that are accessible to and usable by people with disabilities. This document, last updated 7/21/2022, can be accessed here: https://www.access-board.gov/tad/ev/

According to "Design Recommendations for Accessible Electric Vehicle Charging Stations," EV chargers designed to serve people who use mobility devices must be located on an accessible route and should provide: (1) a vehicle charging space at least 11 feet wide and 20 feet long; (2) adjoining access aisle at least 5 feet wide; (3) clear floor or ground space at the same level as the vehicle charging space and positioned for an unobstructed side reach; and (4) accessible operable parts, including on the EV charger and connector.

The ADA and the ABA currently do not specifically identify how many EV chargers must be accessible at an EV charging station. The Access Board is soliciting comments from the public on the minimum number of EV chargers that must be accessible at EV charging stations. Here are the potential approaches:

- A minimum number based on Table 208.2 for accessible parking spaces
- Align with the 2021 International Building Code (IBC) which requires 5%
- A "use last" approach where a higher percentage have accessible mobility features, but are not reserved or restricted to people with disabled parking placards/license plates

  - Reserving a charging space only for use by a person with a disability placard may result in underutilized charges. However, the "use last" model will require more EV charging spaces be designed with accessible mobility features. In addition, a "use last" sign would indicate an EV charging space is accessible, but also direct people to use this space only when other charging spaces are occupied or accessibility features are needed.
- A hybrid approach of "use last" and reserved

The Access Board recommends designing at least two EV charging spaces with accessible mobility features and providing accessible communication features and operable parts at all EV chargers. Note that it is important to further evaluate the various approaches to EV chargers with accessible mobility features and understand which approach is preferred among the public.

8.3 Fleet EV Policies

The U.S. Department of Energy has published the following guidelines for EVs in fleet applications, which will be useful to AVN as fleet policies are established:

- Develop charging guidelines for drivers and staff
- Develop a training plan for EV drivers, vehicle technicians, electricians, and fleet operations staff (e.g., those responsible for the vehicle charging effort)
- Technicians will need to be trained in repairing and maintaining the vehicles, both during and after the warranty period
  - The National Alternative Fuels Training Consortium (NAFTC) provides training for vehicle technicians
- Operations staff will need to be trained on charging logistics
- Drivers will need to be trained in the use and charging of the vehicle, and this should include "refresher" training

8.4 Signage and Wayfinding

The following policies are proposed related to signage and wayfinding of the EV chargers.

For wayfinding signage, it is recommended:

- EV signage used for wayfinding should meet the minimum requirements defined in the Manual on Uniform Traffic Control Devices (MUTCD). Existing MUTCD EV charging signs D9-11b and/or D9-11bP and/or equivalent shall be used. Signage could also be combined with directional arrows or pavement markings if deemed necessary by AVN.

D9-11b
Electric Vehicle
Charging

D9-11bP
Electric Vehicle
Charging

For station signage, it is recommended:

- Each parking space with access to a charging port should include a sign to communicate the regulations associated with that parking stall (e.g., no parking except for electric vehicle charging).

For station availability signage, it is recommended:

- Dynamic EV signage capable of identifying available EV chargers (Level 2 and DC Fast chargers only) could be used if deemed necessary by AVN.

Appendix A
Electric Vehicle Inventory and Goal Setting Report

Electric Vehicle Inventory and Goal Setting Report

City of Phoenix Aviation Department

January 2022

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1.0 Introduction

The 2021 Phoenix Climate Action Plan (CAP), approved on October 12, 2021 by the Phoenix City Council, outlines necessary actions for the City of Phoenix (City) to achieve net-zero Greenhouse Gas (GHG) emissions by 2050. According to the 2018 GHG community inventory, 46% of all GHG emissions in the City originated from the transportation sector, and the use of gasoline fuel in passenger vehicles is the primary contributor. It is anticipated that Phoenix residents will continue to use their passenger vehicles as the primary mode of transport in 2030, and thus the City is focused on decreasing GHG emissions by influencing Electric Vehicle (EV) adoption in the community through public awareness and outreach and the expansion of its EV charging infrastructure.

This *EV Charging Inventory and Goal Setting Report (EV Inventory Report)* includes information that is considered the first phase of the *EV Charging Feasibility Study*. The purpose of the *EV Charging Feasibility Study* is to work with the City Aviation Department (AVN) and the City Manager's Office of Sustainability staff to set specific EV initiatives for airport users, employees, and AVN light-duty fleet at Phoenix Sky Harbor International Airport (PHX), Phoenix Deer Valley Airport (DVT), and Phoenix Goodyear Airport (GYR).

This *EV Inventory Report* includes an inventory of existing EV charging infrastructure and existing fleet vehicles at PHX, DVT and GYR. It also incorporates initial AVN 2030 goals as part of this information gathering process. Specifically, <u>this report summarizes the following information:</u>

- Inventory existing infrastructure and establish goals / targets:
    - Collect information on existing EV infrastructure and AVN fleet vehicles
    - Establish AVN goals / targets for EVs and associated infrastructure (for public, employee and AVN fleet vehicles)
    - Create a roadmap to meet 2030 goals (e.g., number, level and location of EV charging infrastructure by 2030)
        - The 2030 goals correspond to the 2021 Phoenix CAP EV goal for installing charging ports on City properties to support 50% of all private vehicle sales as EVs by 2030

These EV initiatives will help support the City's implementation of the 2022 Transportation Electrification Action Plan (TEAP), which is intended to support and accelerate the City's transition to EVs.

2.0 Background

City of Phoenix Mayor Kate Gallego launched an Ad Hoc Committee in 2021 to prepare recommendations for the 2022 TEAP. With forecasts predicting there may be up to 280,000 EVs on the road in Phoenix by the year 2030, and the current market desire for the electrification of transportation, the City has a responsibility to prepare for the forthcoming demand for EVs and the associated EV charging infrastructure. The 2022 TEAP made recommendations to facilitate the transition to EVs.

2.1 EV Charging Feasibility Study Objectives

To align with the 2022 TEAP and adequately accommodate projected EV growth, the *EV Charging Feasibility Study* includes the following key objectives:

- Collect information on all existing EV infrastructure, EV chargers, and inventory available electrical infrastructure
- Summarize anticipated demand for each user group and identify opportunities for new EV charging stations
- Review and evaluate each EV charging opportunity and its power needs
- Develop draft policy guidance surrounding EV charging

Specifically, this *EV Inventory Report* includes the following information and analysis in support of the *EV Charging Feasibility Study*:

- Create a phased implementation plan identifying the following:
    - Type of chargers by facility location and user group
    - AVN fleet EV replacement targets
    - Infrastructure needs to install chargers (e.g., additional chargers, electrical infrastructure improvements, new conduit) and proposed distribution approach
    - Funding sources and opportunities
- Establish draft policy surrounding EV charging:
    - Identify priority groups for EV infrastructure development by user group and location
    - Recommend current and future policies to meet AVN goals (e.g., percent of required EV stalls for new construction, level of chargers, fleet)

2.2 Define User Groups

The following user groups are accounted for in defining the 2030 EV targets at PHX:

- Revenue public vehicles (e.g., self-serve parking and valet parking)
- Non-revenue public vehicles (e.g., cell phone lot users and visitor parking at the AVN headquarters building)
- Revenue employee private vehicles (e.g., airlines and concessions employees)
- Non-revenue employee private vehicles (e.g., AVN staff)

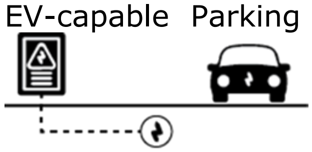
- AVN fleet vehicles (e.g., at AVN headquarters, design and construction services, emergency preparedness, facilities and services, operations, and contractor offices)
    - Official police pursuit vehicles are not included in AVN fleet vehicle EV replacement plan
- Shuttle buses
- Rental cars
- Ground transportation (e.g., Taxi, TNC vehicles)

Demand for user groups that require DC Fast chargers (e.g., ground transportation and cell phone lot users) will be reviewed in *EV Charging Feasibility Study* once the existing electrical capacity has been validated.

2.3 EV Infrastructure Terms Definition

The three different types of EV charging parking spaces are defined below:

1. EV-capable Parking Space: provide electrical panel capacity and conduit

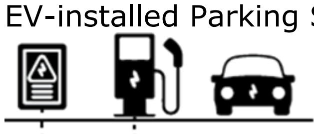
    a. Install panel capacity and conduit (raceway) to accommodate the future build-out of EV charging with 208/240V, 40-amp circuits

2. EV-ready Parking Space: install full circuit

    a. Provide full circuit installations include 208/240V, 40-amp panel capacity, raceway, wiring, receptacle, and overprotection devices

3. EV-installed Parking Space: install EV charging station

2.4 2021 Phoenix Climate Action Plan EV Goals

The 2021 Phoenix CAP projects that approximately 280,000 vehicles on the road will be EVs in the City by 2030, and sets the following goals for transitioning the City's fleet vehicles to EVs and influencing rapid EV adoption in the community:

- Install charging ports on City properties to support 50% of all private vehicle sales as EVs by 2030
    - Non-AVN properties: 500 charging ports
    - AVN property's goal to be determined by the EV study

    - Note that the 2030 EV sales target directly aligns with the target set in the current federal administration's Executive Order issued on August 5, 2021
- Replace 200 light-duty internal combustion engine City fleet vehicles with EVs by 2030, where operationally feasible
- Replace all light-duty internal combustion engine City fleet vehicles with EVs by 2050, where operationally feasible

In addition, the 2021 Phoenix CAP indicated that future development of the City's EV programs and policies will consider those outlined in the Arizona's Statewide Transportation Electrification Plan (STEP), which was developed by the Arizona Public Service (APS), Tucson Electric Power (TEP), and other stakeholders in 2020.

2.5 Review of EV Policies at Other U.S. Airports

EV infrastructure development policies were reviewed at the following U.S. airports: San Francisco International Airport (SFO), Seattle-Tacoma International Airport (SEA), and San Diego International Airport (SAN). The bulleted list below illustrates the EV charging goals for both personal vehicles and fleet vehicles owned by SFO, SEA, and SAN, respectively. This list will be updated pending on responses from other U.S. airports.

- EV infrastructure goals for SFO:
    - 10% of the total personal vehicle parking spaces will be outfitted with Level 2 charging ports by 2023. This goal corresponds to the San Francisco's Commercial Garage Ordinance (amended September 2019), which requires commercial parking lots and garages with more than 100 parking spaces to provide EV charging ports for 10% of the total personal vehicle parking spaces.
    - 25% of the total personal vehicle parking spaces will be outfitted with Level 2 charging ports by 2040.
    - All light-duty fleet sedans will be converted to Zero Emission Vehicle (ZEV) by 2023.
    - All fleet vehicles will be converted to ZEVs by 2040.
- EV infrastructure goals for SEA:
    - 5% of the total existing and future public and employee parking stalls will be outfitted with either Level 2 or DC Fast charging ports. This goal corresponds to the Washington State EV Adoption Rate Projections, which estimate that roughly 5% of vehicles on the road in the state of Washington will be EVs by 2030.
    - All fleet vehicles will be converted to ZEVs by 2050.
- EV infrastructure goals for SAN:
    - 25% of total personal vehicle parking spaces will be EV-ready with pre-wiring by 2025.
    - 50% of total personal vehicle parking spaces will be EV-ready with pre-wiring by 2035.
    - All fleet vehicles will be converted to hybrids, EVs, or powered by alternative fuel by 2035.

2.6 Establish AVN Targets and Goals for EV Charging

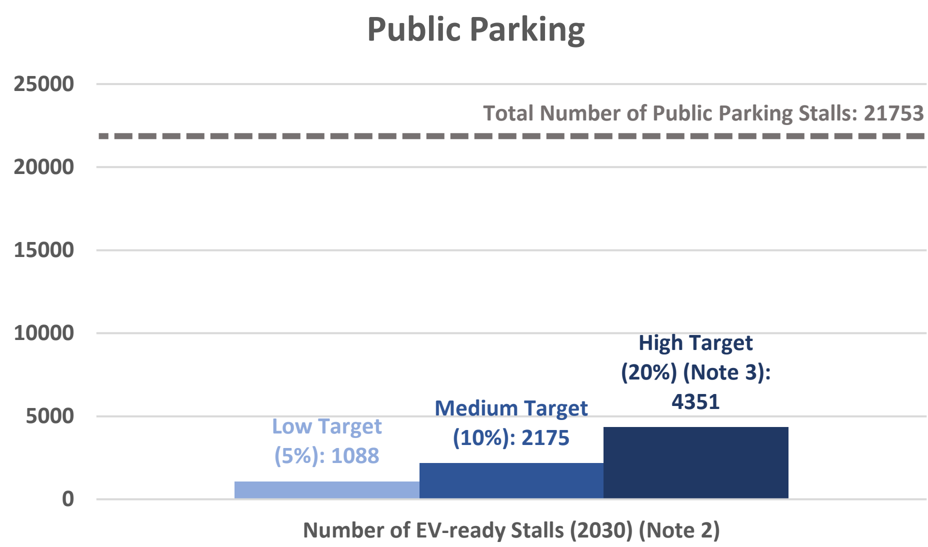
The following EV charging targets were established with AVN staff for public and employee parking at PHX. The three targets represent various EV growth scenarios in the region. In addition, the public and employees may have different expectation for EV charging and trend toward different targets at the airport. For example: employees may expect to charge their vehicles at work and will utilize the chargers more frequently than the public. Cost of charging is also an important factor that can influence the EV charging usage, which will be evaluated in the *EV Charging Feasibility Study*. It is important to monitor EV charging usage in future years and identify the target that AVN is tracking closer to and adjust its EV policies accordingly.

The low target was established based on a review of EV infrastructure development policies at other airports in the U.S., and the medium and high targets were derived from the projected number of EVs on the road by 2030 in the state of Arizona. **Figures 2-1** and **2-2** illustrate the AVN 2030 EV targets for public and employee parking, respectively.

- Low target (5% of the total number of parking stalls):
  - Number of EV-ready stalls for public: 1,088
  - Number of EV-ready stalls for revenue and non-revenue employees combined: 279
- Medium target (10% of the total number of parking stalls):
  - Number of EV-ready stalls for public: 2,175
  - Number of EV-ready stalls for revenue and non-revenue employees combined: 558
  - This target considers the medium adoption forecast established in the STEP, which projects that 15% of the state's local light-duty vehicles on the road will be EVs by 2030. However, noting that not every EVs arriving at the airport will require charging and through reviewing EV infrastructure development policies at other airports in the U.S., this target is scaled down from the medium adoption forecast established at 15% in the STEP to 10%.
- High target (20% of the total number of parking stalls):
  - Number of EV-ready stalls for public: 4,351
  - Number of EV-ready stalls for revenue and non-revenue employees combined: 1,116
  - This target corresponds to the high adoption forecast established in the STEP, which projects that 20% of the state's local light-duty vehicles on the road will be EVs by 2030.

In addition to public and employee parking, AVN has established a goal to replace light-duty fleet vehicles with EVs as vehicles become due for replacement where vehicle utility allows. The number of EV-ready stalls for AVN fleet vehicles will correspond to the AVN fleet vehicle replacement target.

Figure 2-1: AVN 2030 EV Targets for Public Parking

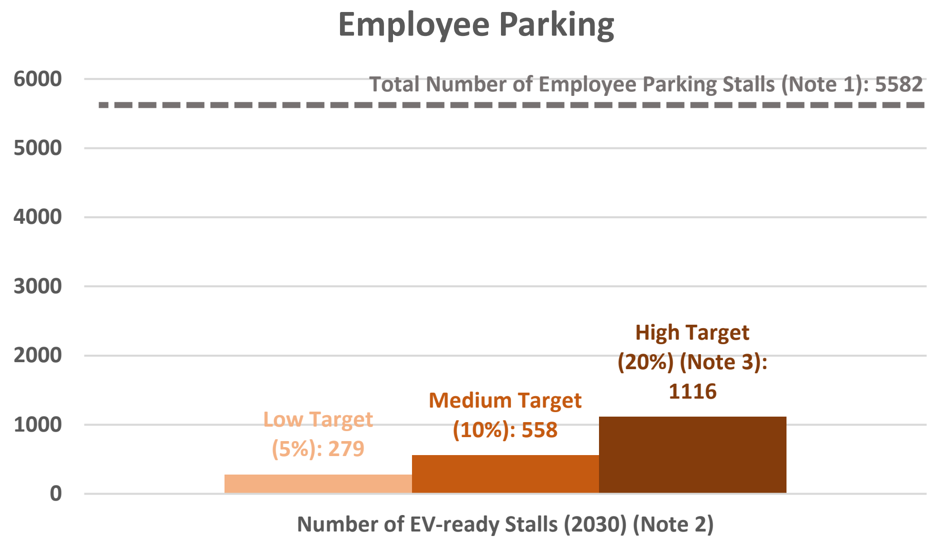


Source: HNTB analysis

Notes:

(1) The parking space counts are based on the Sky Harbor Airport Public Parking Spaces spreadsheet dated April 7, 2021.
(2) The existing electrical capacity will be further reviewed to determine whether these targets can be accommodated by 2030.
(3) This target corresponds to the high adoption forecast established in the Arizona's Statewide Transportation Electrification Plan, at which 20% of the state's local light-duty vehicles on the road will be EVs by 2030.

Figure 2-2: AVN 2030 EV Targets for Employee Parking



Source: HNTB analysis

Notes:

(1) The parking space counts are based on the Sky Harbor Airport Employee Parking Spaces spreadsheet dated April 7, 2021.
(2) The existing electrical capacity will be further reviewed to determine whether these targets can be accommodated by 2030.
(3) This target corresponds to the high adoption forecast established in the Arizona's Statewide Transportation Electrification Plan, at which 20% of the state's local light-duty vehicles on the road will be EVs by 2030.

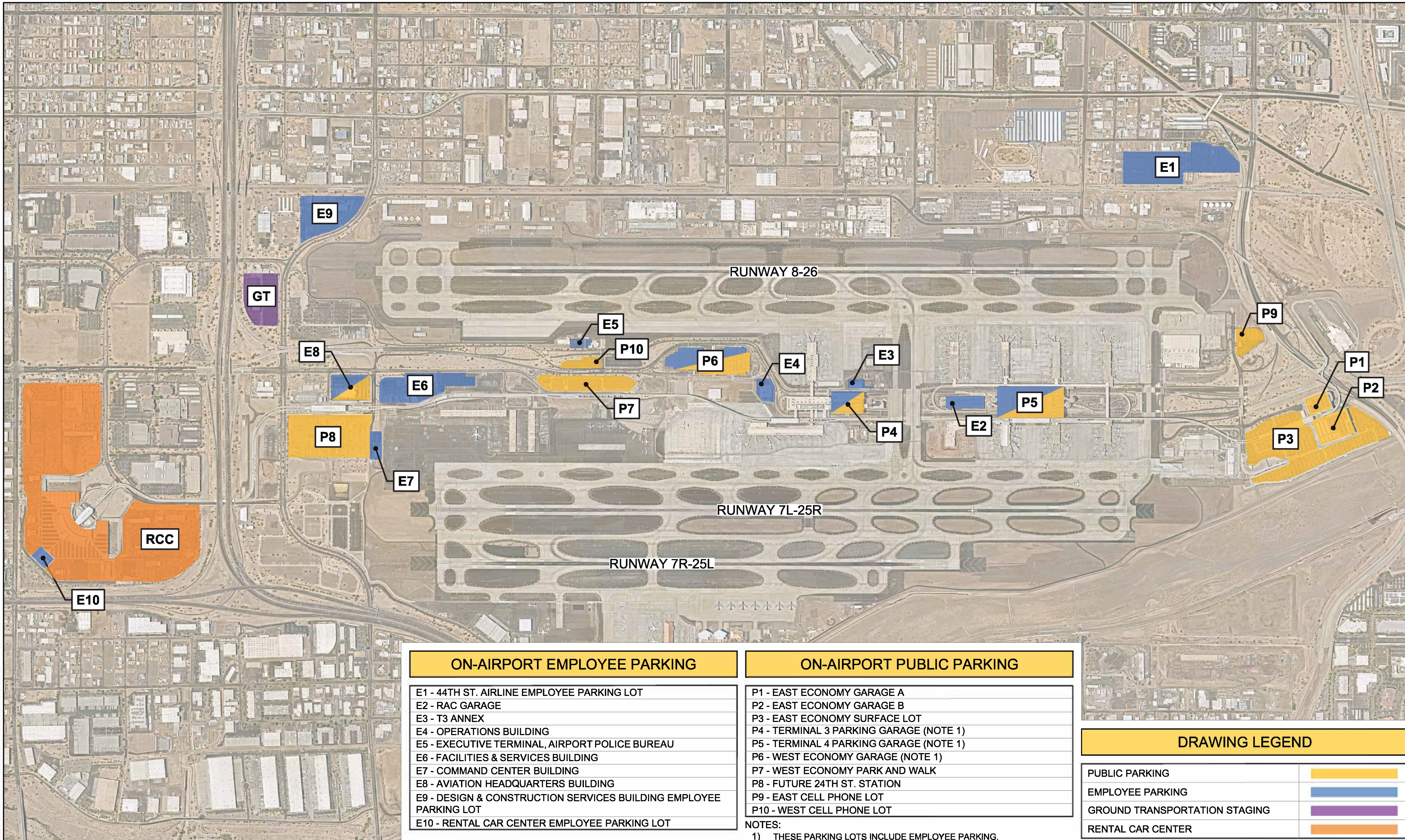
3.0 Inventory of Existing EV Infrastructure

The inventory of existing parking facilities at PHX and the associated EV infrastructure provides the baseline framework for identifying potential opportunities for future EV charging stations as well as defining charging needs and anticipated demand for each user group. This chapter provides an inventory of all existing parking facilities and the associated EV infrastructure at PHX.

3.1 Existing Parking Facilities

Section 2.6 established the AVN 2030 EV targets for public and employee parking. In order to create a roadmap to meet these 2030 goals, it is important to first review the current parking space counts for each type of user at all landside parking facilities at PHX. All landside parking facilities at PHX are illustrated graphically in **Figure 3-1.**

Table 3-1 illustrates the number of parking spaces available at each lot by the following user groups: revenue public vehicles (self-serve parking), revenue public vehicles (valet parking), non-revenue public vehicles (e.g., cell phone lot users, and visitor parking at the AVN headquarters building), revenue employee private vehicles, non-revenue employee private vehicles, AVN fleet vehicles, ground transportation staging, and rental cars, respectively.



ON-AIRPORT EMPLOYEE PARKING
E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU
E6 - FACILITIES & SERVICES BUILDING
E7 - COMMAND CENTER BUILDING
E8 - AVIATION HEADQUARTERS BUILDING
E9 - DESIGN & CONSTRUCTION SERVICES BUILDING EMPLOYEE PARKING LOT
E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B
P3 - EAST ECONOMY SURFACE LOT
P4 - TERMINAL 3 PARKING GARAGE (NOTE 1)
P5 - TERMINAL 4 PARKING GARAGE (NOTE 1)
P6 - WEST ECONOMY GARAGE (NOTE 1)
P7 - WEST ECONOMY PARK AND WALK
P8 - FUTURE 24TH ST. STATION
P9 - EAST CELL PHONE LOT
P10 - WEST CELL PHONE LOT

NOTES:
1) THESE PARKING LOTS INCLUDE EMPLOYEE PARKING.

DRAWING LEGEND
PUBLIC PARKING
EMPLOYEE PARKING
GROUND TRANSPORTATION STAGING
RENTAL CAR CENTER

PHX
City of Phoenix
PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

DRAFT WORKING DOCUMENT | NOT FOR DISSEMINATION

FIGURE 3-1
JANUARY 2022

EXISTING AND PLANNED PARKING FACILITIES

Table 3-1: Existing Parking Facilities Inventory

Location	User Groups							
	Revenue Public Vehicles (Self-serve)	Revenue Public Vehicles (Valet)	Non-revenue Public Vehicles	Revenue Employee Private Vehicles	Non-revenue Employee Private Vehicles	AVN Fleet Vehicles	Ground Transportation Staging	Rental Car
East Economy Garage A	2,343	-	-	-	-	-	-	-
East Economy Garage B	3,505	-	-	-	-	-	-	-
East Economy Surface Lot	3,625	-	-	-	5	-	-	-
T-3 Parking Garage	2,020	-	-	148	-	-	-	-
T-4 Parking Garage	6,157	219	-	469	-	-	-	-
West Economy Garage	1,254	-	-	1,144	-	-	-	-
West Economy Park & Walk	985	-	-	-	-	-	-	-
East Cell Phone Lot	-	-	84	-	-	-	-	-
West Cell Phone Lot	-	-	78	-	-	-	-	-
West Ground Transportation Lot	-	-	-	-	-	-	260	-
Future 24th St. Station Lot	*1,645*	-	-	-	-	-	-	-
44th St. Airline Employee Parking Lot	-	-	-	2,235	-	9	-	-
RAC Garage	-	-	-	553	-	-	-	-
Aviation Headquarters Building	-	-	5	-	245	20	-	-
Command Center Building	-	-	-	-	73	2	-	-
Operations Building	-	-	-	-	110	12	-	-
Rental Car Center Employee Parking	-	-	-	-	18	-	-	-
Design & Construction Services Building	-	-	-	-	235	-	-	-
Executive Terminal, Airport Police Bureau	-	-	-	-	87	-	-	-
Facilities & Services	-	-	-	-	224	20	-	-
T-3 Annex Building	-	-	-	-	29	-	-	-
Rental Car Center	-	-	-	-	-	-	-	5,600 (Note 1)

Source: Sky Harbor Airport Public and Employee Parking Spaces spreadsheet, dated April 7, 2021

Note 1: To be validated with AVN staff.

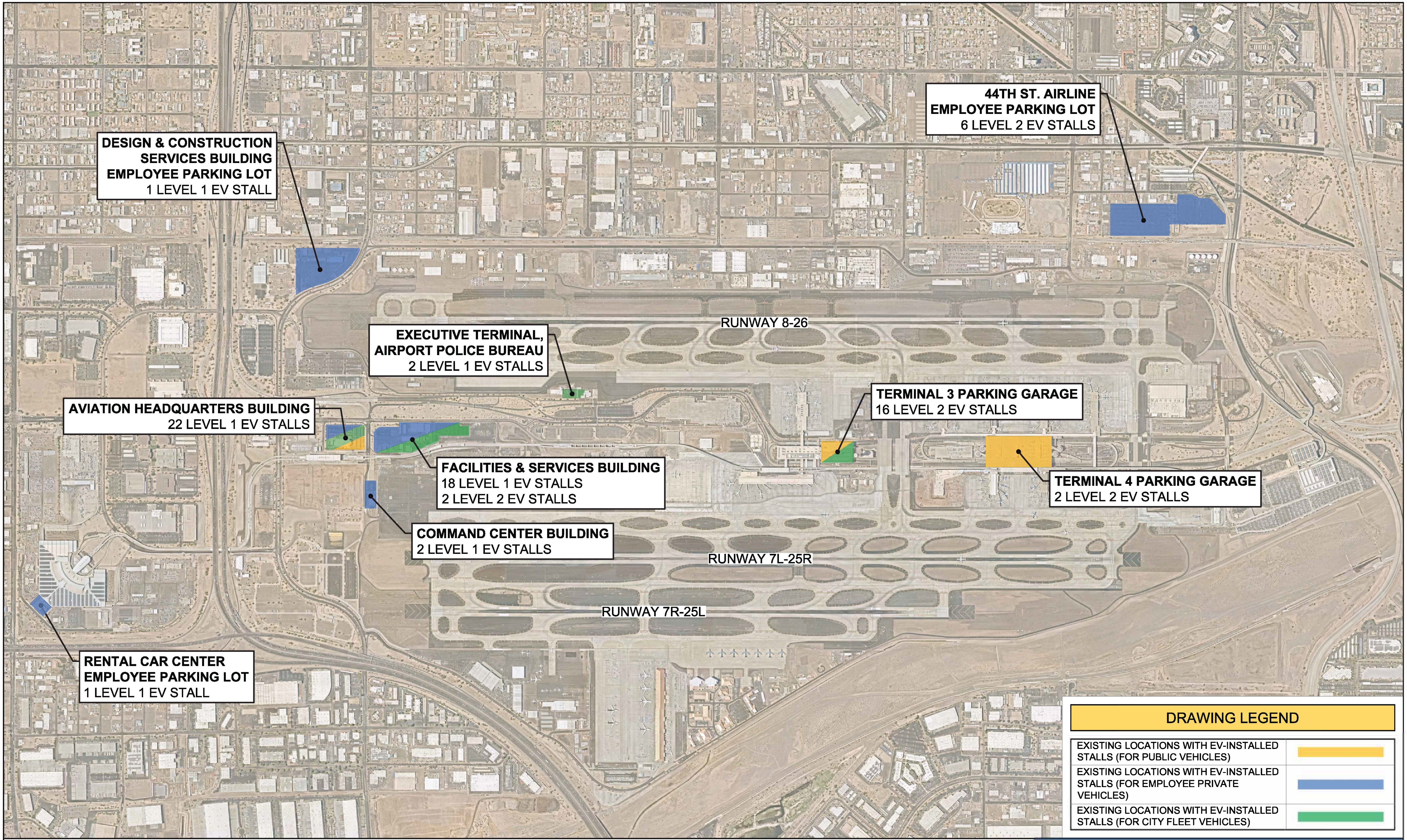
3.2 Existing EV-installed Parking Stalls

This section details the types of chargers available at parking lots with existing EV-installed parking stalls and identifies the user group(s) who are currently utilizing these EV chargers. **Table 3-2** summarizes the number of existing EV-installed stalls available at each location by the Electric Vehicle Service Equipment (EVSE) Levels 1 and 2, respectively. A Level 1 EV charger uses a standard 120 Volt, 20 Amp circuit wall outlet, and delivers an electrical current from the outlet to the vehicle via the connector. A Level 2 charger delivers an electrical current from an outlet or a hardwired unit to the vehicle via the connector and requires a 208-240 Volt, 40 Amp circuit. A Level 1 will deliver 1.4 kW to the vehicle and can provide 3.5-6.5 miles of driving range per hour of charge, while a Level 2 will deliver 6.2 to 7.6 kW to the vehicle and can provide 14-35 miles of driving range per hour of charge. The Level 2 chargers located in the Terminals 3 and 4 parking garages for public use were installed by Blink. It is important to note that these are first-generation Blink chargers, which utilize 2G cellular signals. It is anticipated that cellular signal providers will be shutting down 2G service by early 2022, and the first-generation chargers will then go offline and be out of service. The existing locations with EV-installed stalls are also depicted graphically in **Figure 3-2**.

Table 3-2: Number of Existing EV-installed Parking Stalls at PHX

Location	User Groups	Number of EV-installed Stalls		
		Level 1	Level 2	Total
44th St. Airline Employee Parking Lot	Revenue Employee Private Vehicles	0	6	**6**
Aviation Headquarters Building	Employee Private Vehicles, AVN Fleet Vehicles, and Non-revenue Public Vehicles (Visitor Parking)	22	0	**22**
Command Center Building	Non-revenue Employee Private Vehicles	2	0	**2**
Design & Construction Services Building	Non-revenue Employee Private Vehicles	1	0	**1**
Rental Car Center Employee Parking Lot	Non-revenue Employee Private Vehicles	1	0	**1**
Facilities & Services Building	Non-revenue Employee Private Vehicles	18	0	**18**
	AVN Fleet Vehicles	0	2	**2**
Executive Terminal, Airport Police Bureau	AVN Fleet Vehicles	2	0	**2**
Terminal 3 Parking Garage	ACE Parking	0	4	**4**
	Revenue Public Vehicles (Self-serve Parking)	0	12 (Blink)	**12**
Terminal 4 Parking Garage	Revenue Public Vehicles (Self-serve Parking)	0	2 (Blink)	**2**
	Total	**46**	**26**	**72**

Source: City of Phoenix EVSE Master List, dated September 10th, 2021, and HNTB analysis



PHX

City of Phoenix

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

DRAFT WORKING DOCUMENT | NOT FOR DISSEMINATION

FIGURE 3-2

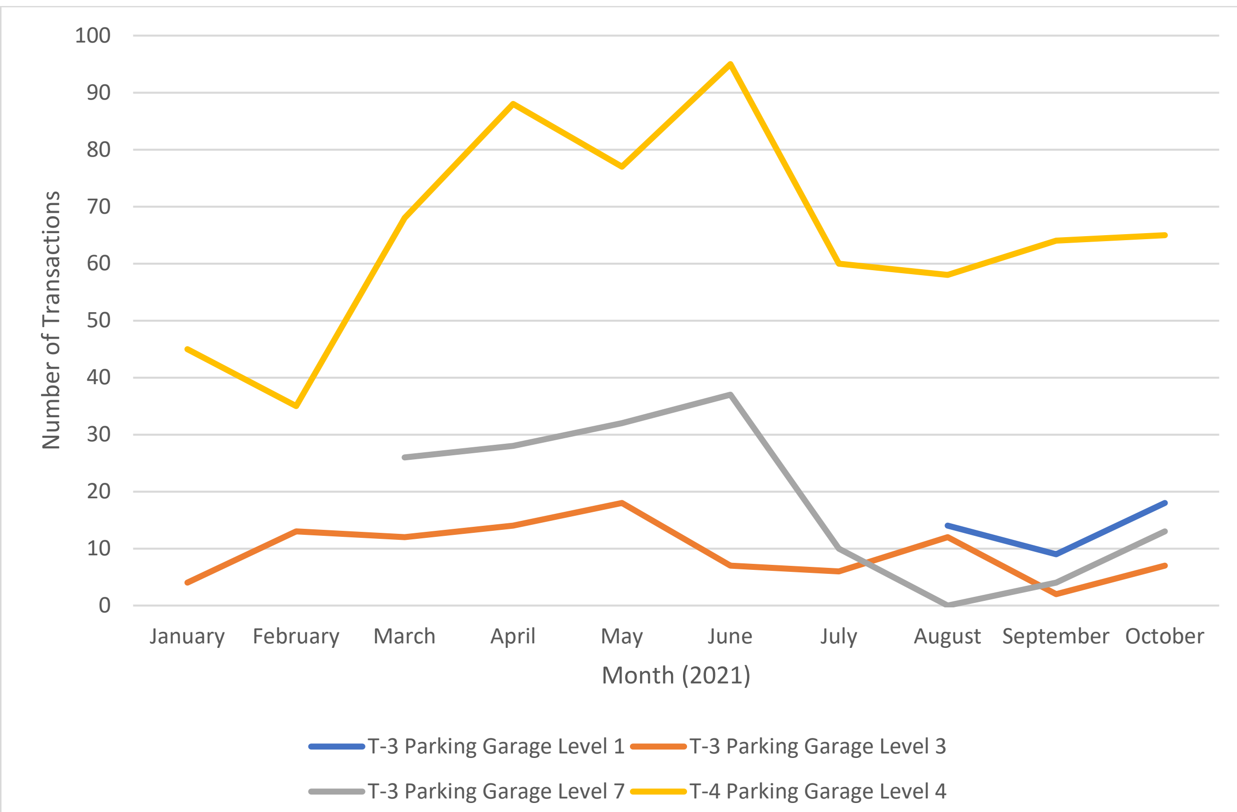
JANUARY 2022

EXISTING LOCATIONS WITH EV-INSTALLED STALLS

3.2.1 Current Usage of Existing EV Charging Stations

The following EV charging stations at PHX provide current usage data: Level 2 chargers installed by Blink at the Terminals 3 and 4 parking garages. All of Blink's EV chargers are available for public use and require payment. All other EV charging stations at PHX do not currently provide usage data that are readily available. **Figure 3-3** summarizes the total number of EV charging transactions by month from January through October 2021 for all EV chargers located on Levels 1, 3, and 7 at the Terminal 3 parking garage, and Level 4 of the Terminal 4 parking garage, respectively. One observation to note is that the EV chargers located in the Terminal 4 parking garage are utilized much more frequently than the chargers located at the Terminal 3 parking garage based on the number of EV charging transactions.

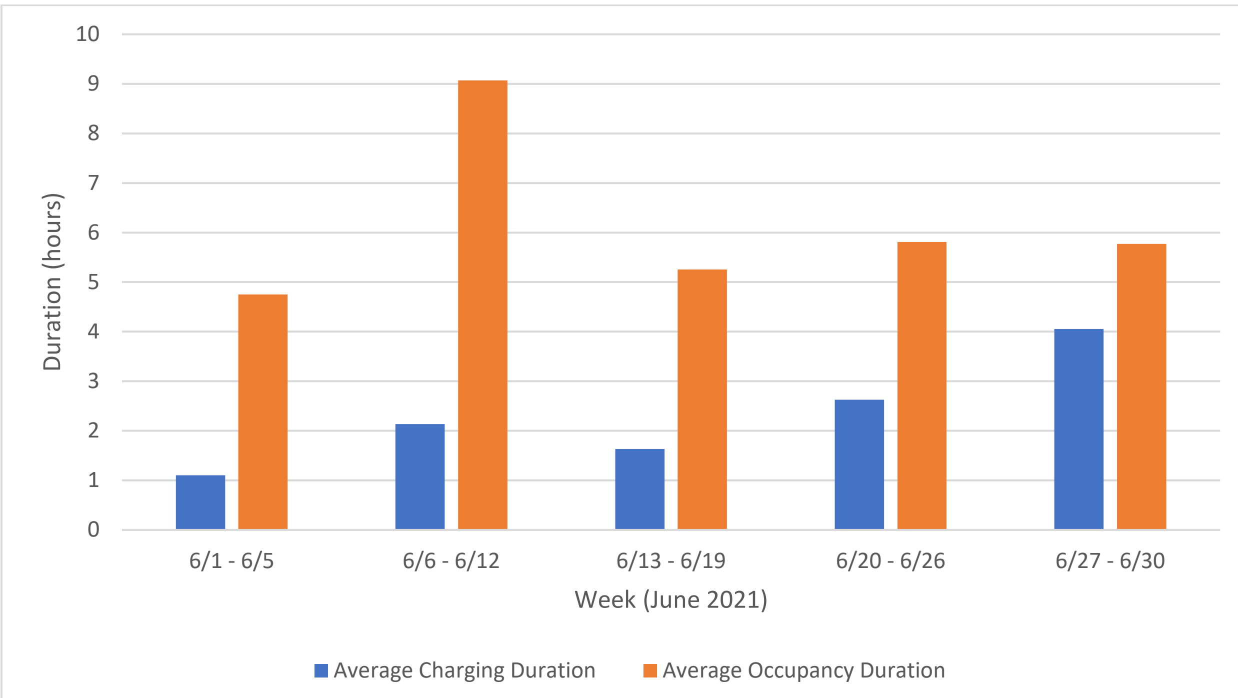
Figure 3-3: EV Charging Transactions for Terminals 3 and 4 Parking Garages



Source: Blink EVSE Unit Usage Report, and HNTB analysis

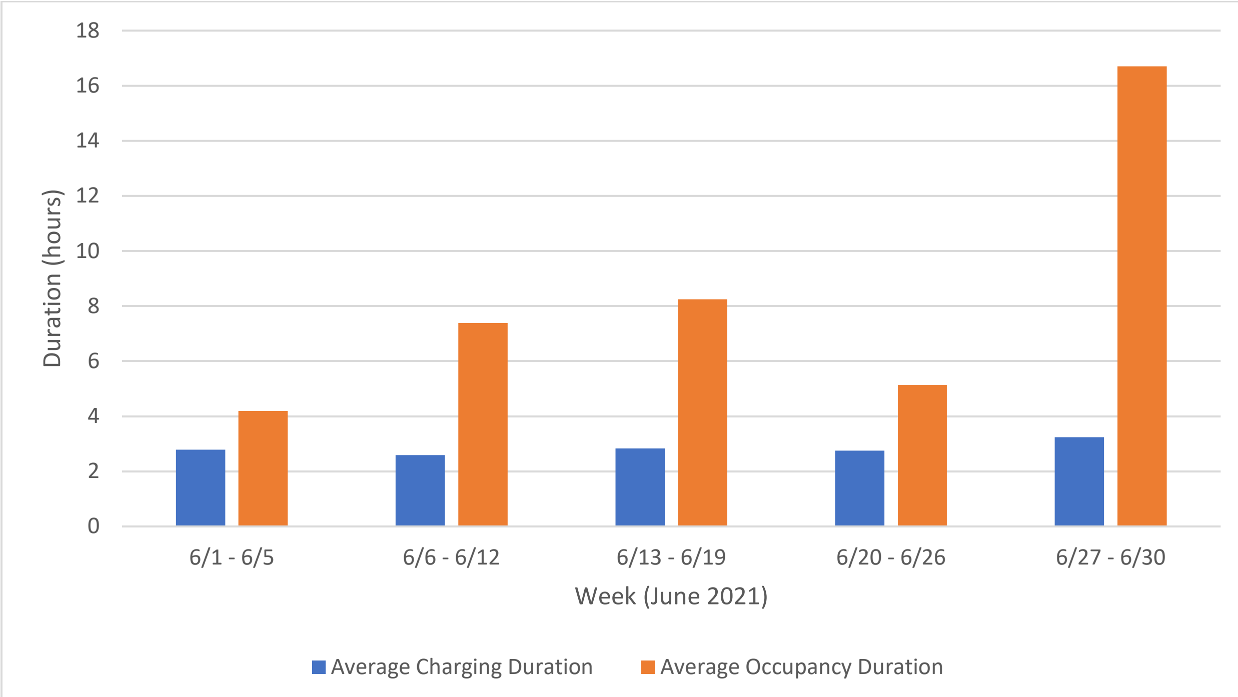
Figures 3-4 and **3-5** illustrate the average charging and occupancy durations in July 2021 (peak transaction month) for the Level 2 EV charging stations installed by Blink located at the Terminals 3 and 4 parking garages, respectively. The difference between the charging and occupancy durations reflects a specific public user behavior at an airport, where a charging port can be occupied for multiple days even though charging is complete. It is important to consider this behavior when determining which EV target to work toward for public parking. Additionally, this behavior also points to the possibility for off-peak charging and other demand management strategies, which will be evaluated in the *EV Charging Feasibility Study*. In addition, the existing EV chargers are usually installed at locations that provide convenient access to the terminals, both because the electrical conduits are more easily accessible but also to incentivize the public to use EVs. However, this may also encourage EV drivers to park at these stalls to get more convenient parking even when they do not intend to charge their vehicle, which is reflected by short charging durations observed in some charging transactions. This situation can be mitigated in the future by placing EV chargers elsewhere in the parking lot as EV adoption increases in the community and / or requiring a minimum charge for usage. This will be explored further in the *EV Charging Feasibility Study*.

Figure 3-4: EV Charger Peak Transaction Month Usage at Terminal 3 Parking Garage



Source: Blink EVSE Unit Usage Report, and HNTB analysis

Figure 3-5: EV Charger Peak Transaction Month Usage at Terminal 4 Parking Garage



Source: Blink EVSE Unit Usage Report, and HNTB analysis

3.2.2 Rate Structures

Table 3-3 illustrates the usage rates for Blink members and guests (non-members) at the Blink EV chargers located at the Terminals 3 and 4 parking garages, respectively. No other EV charging stations at PHX currently require payment.

Table 3-3: Usage Rates for Blink EV Chargers at PHX

Location	User Groups	Charging Usage Rates ($/kWh)	
		Guest	Blink Member
Terminal 3 Parking Garage	Revenue Public Vehicles (Self-serve Parking)	0.49	0.39
Terminal 4 Parking Garage	Revenue Public Vehicles (Self-serve Parking)	0.49	0.39

Source: Blink Dashboard – Usage Rates, and HNTB analysis

3.3 Existing AVN Light-duty Fleet Information

3.3.1 Existing AVN Light-duty Fleet Vehicles

Table 3-4 summarizes the total number of AVN light-duty fleet vehicles based on their assigned location. The assigned location for each AVN fleet vehicle is established based on its division and will need to be validated during the *EV*

Charging Feasibility Study. Out of the 178 AVN light-duty fleet vehicles, one of them is an EV – a Chevrolet Bolt that is assigned to the AVN Facilities and Services division.

Table 3-4: AVN Light-duty Fleet Vehicle Inventory

Assigned Location	Number of Vehicles
PHX AVN Headquarters (Note 1)	22
PHX Command Center	2
PHX Design & Construction Services	14
PHX Facilities & Services	51
PHX Fire Station #19	2
PHX Operations	41
PHX Police	40 (Note 2)
Deer Valley Airport (DVT)	3
Goodyear Airport (GYR)	3
Total	**178**

Source: AVN Facilities & Services Asset Report, dated November 16, 2021, and HNTB analysis

Note:

(1) It is assumed that AVN light-duty fleet vehicles assigned to the following divisions park at the AVN Headquarters: Administration, Business and Properties, Human Resources, Planning and Environmental, and Technology.

(2) This includes official police pursuit vehicles.

3.3.2 AVN Light-duty Fleet Vehicle Replacement Plan with EVs

Section 2.6 identifies AVN's goal to replace all applicable light-duty fleet vehicles with EVs as vehicles become due for replacement. Official police pursuit and fire department vehicles are not included in the City's fleet vehicle EV replacement plan. **Table 3-5** provides a preliminary AVN light-duty vehicle EV replacement schedule (up to Fiscal Year 2030). It is important to note that this schedule only considers the age of the vehicle. The AVN Facilities and Services Fleet Section undergoes a comprehensive evaluation process to determine replacements every year in September for the upcoming fiscal year. Factors involved to quantify vehicle eligibility for the disposition process include vehicle hours, age, mileage, life to date maintenance costs, and overall condition associated with the fleet vehicle.

Table 3-5: AVN Light-duty Fleet Replacement Schedule (Using Vehicle Age Criteria Only)

Assigned Location	Projection EV Replacement Fiscal Year (Note 1)							
	2023	2024	2025	2026	2027	2028	2029	2030
PHX AVN Headquarters	5	3	4	1	2	4	3	0
PHX Command Center	0	0	0	0	0	1	1	0
PHX Design & Construction Services	4	2	1	0	4	2	0	1
PHX Facilities & Services	13	5	9	4	8	14	6	5
PHX Operations	1	1	3	3	5	2	7	1
DVT	1	0	0	0	1	1	0	0
GYR	1	0	0	0	2	2	0	0
Total	**25**	**11**	**17**	**8**	**22**	**26**	**17**	**7**

Source: AVN Facilities & Services Fleet List, dated October 2021, and HNTB analysis

Note:

(1) This vehicle replacement schedule above only considers the age of the vehicle. However, the AVN Facilities and Services Fleet Section undergoes a comprehensive evaluation process to determine replacements every year in September for the upcoming fiscal year. Factors involved to quantify vehicle eligibility for the disposition process include vehicle hours, age, mileage, life to date maintenance costs, and overall condition associated with the fleet vehicle.

3.4 Existing Electrical Infrastructure

Table 3-6 illustrates the maximum number of EV-installed stalls that may be implemented at the PHX parking facilities listed in **Section 4.1** using existing electrical infrastructure, subject to confirmation of capacity using thirty-day metering. It is important to note that the estimated number of EV chargers reflects the maximum number of chargers that can be implemented for only one level of chargers (i.e., only Level 1s, only Level 2s, or only DC Fast chargers). Adequate existing electrical infrastructure means available spare circuit breakers or adequate breaker space on existing panels such that new circuit breakers can be installed. These projections assume that the existing spare breakers or breaker space is not reserved for other future projects and the available capacity on the panel or switchboard is adequate to support the number of EV chargers. Thirty-day metering will need to be conducted on all panels and switchboards that are being targeted to support EV chargers to ensure adequate electrical capacity is available on the infrastructure. Additional coordination with the AVN Facilities & Services division is necessary to install meters on the indicated infrastructure if it is not currently metered in order to attain the thirty-day readings. Metering of the upstream panel or SESs supporting the indicated infrastructure should be conducted as well to ensure there is capacity available on the infrastructure supporting the panel being modified to directly support EV charging stalls. Metering of the upstream infrastructure is important for locations that have constraints due to the existing available electrical capacity being limited or where a large number of EV chargers will be installed. The T-4 parking garage is a good example of a location that should receive special considerations, due to much of the existing infrastructure being dedicated to support lighting loads and the large quantity of EV Chargers that would be installed at this location. The estimated number of EV-ready stalls included under **Table 3-6** utilizes data acquired from the most recent as-built documents; thus, field verification of the existing infrastructure will also be required to ensure that the spare breakers haven't been repurposed following project construction. Coordination with PHX stakeholders will be required to ensure the indicated existing panels and switchboards are viable candidates to support EV chargers. **Table 3-6** assumes no implementation of Load Management, however this is in the *EV Charging Feasibility Study*. Additional consideration should be made for other future electrical demand and overall additional capacity that may be required to support future EV and other infrastructure.

Table 3-6: Evaluation of Existing Electrical Infrastructure

Location	Existing Electrical Infrastructure (Note 2)	Maximum Number of EV-ready Stalls (Note 3)		
		Level 1 (1.8kW)	Level 2 (3.6kW)	DC Fast (50kW)
East Economy Garage A	Panels 'HP1' & 'LP1'	50	25	-
East Economy Garage B	'SES-C'	333	166	-
East Economy Surface Lot	Panel 'H1'	75	37	-
T-3 Parking Garage	'SES-A1'/TBD	333	166	-
T-4 Parking Garage	'SES-TB3A'	998	499	-
West Economy Garage	Panel 'LC'	28	14	-
West Economy Park & Walk	Panel 'HA'	47	24	-
24th St. Station (Future)	*Panel '24HD2'*	*48*	*24*	-
West Ground Transportation Lot	Panel 'GTH1'	35	18	-
44th St. Airline Employee Parking Lot	Panel '44-PL-H1'	30	15	-
RAC Garage	(Note 1)			-
Aviation Headquarters Building	Panel 'PV-AC2'	6	3	-
Command Center Building	Panel 'COPS3-H1'	49	24	-
Operations Building	Panel 'P1B'	28	14	-
Rental Car Center Employee Parking Lot	Panel 'HCPA'	14	7	-
Design & Construction Services Building	Panel 'MDP' (Old SES)	83	42	-
Executive Terminal, Airport Police Bureau	'SES'	18	9	-
Facilities & Service Building	Panel '2HP2'	42	21	-
T-3 Annex Building	Panel 'HC'	17	8	-
Rental Car Center	'SES-B'	499	249	17

Source: PHX As-built Documents and HNTB analysis

Notes:

(1) The RAC Garage requires a site visit to provide an estimate on the number of EV charging stations that may be implemented as the as-builts are insufficient in making a determination.

(2) Infrastructure targeted to support EV chargers to be verified for viability with AVN Facilities & Services division.

(3) The estimated number of EV chargers reflects the maximum number of chargers that can be implemented <u>for only one level of chargers</u> (i.e., only Level 1s, only Level 2s, or only DC Fast chargers).

4.0 Potential Locations for Future EV-ready Stalls

This chapter identifies and evaluates the potential locations for future EV charging stations at PHX.

4.1 Potential Locations and Considerations for Users

Figure 4-1 depicts the potential locations for future EV charging stations for the following user groups: public vehicles, employee private vehicles (revenue and non-revenue employees combined), AVN light-duty fleet vehicles, ground transportation staging, shuttle buses, and rental cars, respectively. Demand for user groups that require DC Fast chargers (e.g., ground transportation and cell phone lot users) will be reviewed in the *EV Charging Feasibility Study* once the existing electrical capacity has been validated.

4.1.1 Public Vehicles

Tables 4-1 illustrates the number of EV-ready stalls for each public parking lot identified in **Figure 4-1** utilizing the low, medium, and high EV targets established in **Section 2.6**. Here are additional considerations when preparing the phased implementation plan for the *EV Charging Feasibility Study*:

- The number of EV-ready stalls proposed for both East Economy Garages A and B can be combined and consolidated at either Garage A or B. The initial evaluation of the existing electrical infrastructure reveals that Garage B is a better candidate as it can support a much higher number of EV-ready stalls than Garage A.
- It is important to prioritize the installation of additional EV chargers at the Terminal 4 Parking Garage. Currently, there are only two existing EV-installed stalls within the T-4 Garage, which includes a total of 6,157 self-serve public parking stalls. However, it was noted that the T-4 Garage does not have a lot of excess electrical capacity due to continued and increased electrical demands. Therefore, additional electrical capacity analysis is necessary to examine the upstream switchboards/SESs in addition to metering the local panel to ensure that there is sufficient electrical capacity.
- EV chargers provided for valet parking at the Terminal 4 Parking Garage would likely see a much higher utilization rate than EV chargers allocated for self-serve parking. It is important to consider this factor when determining which target to select for valet parking.
- There are tentative plans to demolish the West Economy Garage and the West Economy Park & Walk lot in the future. These two parking facilities will likely be in service for at least 5 more years. This will be considered when determining the priorities for EV infrastructure development.

Table 4-1: AVN EV 2030 Targets for Public Parking

Location	Number of EV-ready Stalls (Notes 1 and 2)		
	Low Target (5%)	Medium Target (10%)	High Target (20%)
East Economy Garage A	117	234	469
East Economy Garage B	175	350	701
East Economy Surface Lot	181	362	725
T-3 Parking Garage	101	202	404
T-4 Parking Garage (Self-serve Parking)	309	616	1,231
T-4 Parking Garage (Valet Parking)	11	22	44
West Economy Garage	63	125	251
West Economy Park & Walk	49	99	197
24th St. Station (Future)	*82*	*165*	*329*
TOTAL	**1,088**	**2,175**	**4,351**

Source: HNTB analysis

Notes:

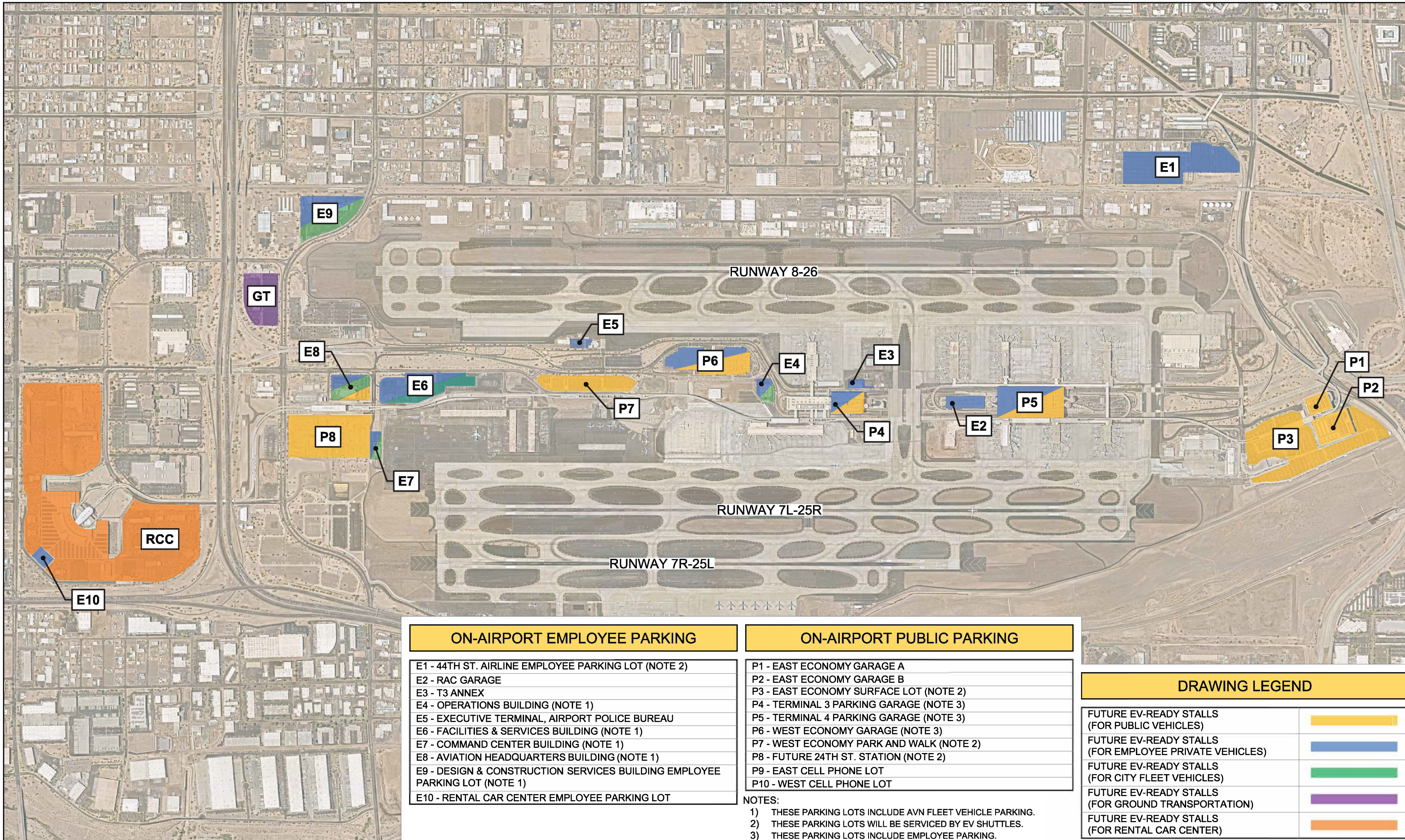
(1) The parking space counts are based on the Sky Harbor Airport Public Parking Spaces spreadsheet dated April 7, 2021.

(2) The existing electrical capacity will be further reviewed to determine whether these targets can be accommodated by 2030.

4.1.2 Employee Private Vehicles

Tables 4-2 illustrates the number of EV-ready stalls for each employee parking lot identified in **Figure 4-1** utilizing the three EV targets established previously.

- The selected EV charging target may vary between revenue and non-revenue employees as the City can incentivize AVN employees for switching to EVs.
- There are tentative plans to demolish the West Economy Garage in the future. This parking facility will likely be in service for at least 5 more years. This will be considered when determining the priorities for EV infrastructure development.
- There are future projects planned near the T-3 Annex parking area. It is important to understand the timeline for these projects and discuss with AVN staff on whether providing EV chargers at this location in the interim is necessary and/or beneficial.



ON-AIRPORT EMPLOYEE PARKING
E1 - 44TH ST. AIRLINE EMPLOYEE PARKING LOT (NOTE 2)
E2 - RAC GARAGE
E3 - T3 ANNEX
E4 - OPERATIONS BUILDING (NOTE 1)
E5 - EXECUTIVE TERMINAL, AIRPORT POLICE BUREAU
E6 - FACILITIES & SERVICES BUILDING (NOTE 1)
E7 - COMMAND CENTER BUILDING (NOTE 1)
E8 - AVIATION HEADQUARTERS BUILDING (NOTE 1)
E9 - DESIGN & CONSTRUCTION SERVICES BUILDING EMPLOYEE PARKING LOT (NOTE 1)
E10 - RENTAL CAR CENTER EMPLOYEE PARKING LOT

ON-AIRPORT PUBLIC PARKING
P1 - EAST ECONOMY GARAGE A
P2 - EAST ECONOMY GARAGE B
P3 - EAST ECONOMY SURFACE LOT (NOTE 2)
P4 - TERMINAL 3 PARKING GARAGE (NOTE 3)
P5 - TERMINAL 4 PARKING GARAGE (NOTE 3)
P6 - WEST ECONOMY GARAGE (NOTE 3)
P7 - WEST ECONOMY PARK AND WALK (NOTE 2)
P8 - FUTURE 24TH ST. STATION (NOTE 2)
P9 - EAST CELL PHONE LOT
P10 - WEST CELL PHONE LOT

NOTES:
1) THESE PARKING LOTS INCLUDE AVN FLEET VEHICLE PARKING.
2) THESE PARKING LOTS WILL BE SERVICED BY EV SHUTTLES.
3) THESE PARKING LOTS INCLUDE EMPLOYEE PARKING.

DRAWING LEGEND	
FUTURE EV-READY STALLS (FOR PUBLIC VEHICLES)	yellow
FUTURE EV-READY STALLS (FOR EMPLOYEE PRIVATE VEHICLES)	blue
FUTURE EV-READY STALLS (FOR CITY FLEET VEHICLES)	green
FUTURE EV-READY STALLS (FOR GROUND TRANSPORTATION)	purple
FUTURE EV-READY STALLS (FOR RENTAL CAR CENTER)	orange

PHX
City of Phoenix
PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EV CHARGING STATION PLANNING

N
0 1,300' 2,600'

DRAFT WORKING DOCUMENT | NOT FOR DISSEMINATION

FIGURE 4-1 JANUARY 2022

POTENTIAL LOCATIONS FOR FUTURE EV-READY STALLS

Table 4-2: AVN EV 2030 Targets for Employee Parking

Location	Number of EV-ready Stalls (Notes 1, 2, and 3)		
	Low Target (5%)	Medium Target (10%)	High Target (20%)
Aviation Headquarters Building	18 (13)	25	50
Command Center Building	4	7	15
Design & Construction Services Building	12	23	47
East Economy Surface Lot	0	1	1
Executive Terminal, Airport Police Bureau	4	9	17
Facilities & Service Building	18 (11)	22	45
Operations Building	6	11	22
RAC Garage	28	55	111
Rental Car Center Employee Parking Lot	1	2	3
T-3 Annex Building	1	3	6
T-3 Parking Garage	7	15	29
T-4 Parking Garage	23	47	94
West Economy Garage	57	114	229
44th St. Airline Employee Parking Lot	112	224	447
TOTAL	**291**	**558**	**1,116**

Source: HNTB analysis

Notes:

(1) The parking space counts are based on the Sky Harbor Airport Public Parking Spaces spreadsheet dated April 7, 2021.

(2) The existing electrical capacity will be further reviewed to determine whether these targets can be accommodated by 2030.

(3) Any target values in parenthesis indicate that the existing number of EV-ready stalls at that location is higher than the target.

4.1.3 AVN Light-duty Fleet Vehicles

As noted in **Section 2.6,** AVN has established a goal to replace all AVN light-duty fleet vehicles with EVs as vehicles become due for replacement where utility of vehicle allows. The number of EV-ready stalls for AVN fleet vehicles will correspond to the AVN fleet vehicle replacement target. The preliminary AVN light-duty vehicle replacement schedule illustrated in **Table 3-5** provides a rough estimate of when a light-duty fleet vehicle may become due for a replacement, considering only the age of the vehicle. Another tool that was utilized for fleet analysis is the Dashboard for Rapid Vehicle Electrification (DRVE) tool developed by the Electrification Coalition, which is a nonpartisan, not-for-profit group committed to promoting policies and actions that facilitate the deployment of EVs on a mass scale.

The DRVE tool provides decision-relevant information on the financial viability and environmental impact of light-, medium-, and heavy-duty vehicle procurements across an entire fleet. For this analysis, all of AVN's light-duty fleet vehicle information was imported into the Excel-based DRVE tool. The results then compare the total cost of ownership between replacing the fleet vehicle with a conventional vehicle versus an EV alternative. Additional discussion with AVN Facilities & Services division staff is needed to arrive at the 2030 AVN fleet replacement targets during the *EV Charging Feasibility Study*. Additionally, it is important to verify the assigned location for each fleet vehicle and understand how each vehicle is utilized, which will influence the locations of future EV-ready stalls for fleet vehicles.

4.1.4 Shuttle Buses

AVN currently has two EV shuttles on order, which will service the East Economy Surface Lot. In addition, AVN intends to procure and purchase additional EV shuttles serving the following parking facilities at PHX. It is anticipated that DC Fast chargers will need to be installed at these locations to service the electric shuttles, which will be reviewed further in the *EV Charging Feasibility Study* once the existing electrical capacity has been validated.

- East Economy Surface Lot: 2 EV shuttles on order and 2 future EV shuttles
- 44th Street Airline Employee Parking Lot: 2 future EV shuttles
- West Economy Park & Walk: 2 future EV shuttles
- *Future 24th St. Station Lot* – 2 future EV shuttles

4.1.5 Summary

Table 4-3 compares the anticipated demand for EV chargers (for the following user groups: public vehicles, employee private vehicles, AVN light-duty fleet vehicles [based on the preliminary light-duty fleet EV replacement schedule included in **Table 3-5**], and shuttle buses [assumed one DC Fast charger required for two EV shuttles]) against the maximum number of EV-ready stalls that may be implemented at PHX parking facilities illustrated in **Table 3-6**.

4.2 Next Steps

This EV Charging Inventory and Goal Setting report collected information on the existing EV infrastructure and fleet vehicles and created targets to meet AVN 2030 goals. The next step is to develop the *EV Charging Feasibility Study*, which will further evaluate the electrical infrastructure capacity and needs to support future EV chargers. Additional coordination with the AVN Facilities & Services division is necessary to install meters on the indicated infrastructure to attain the thirty-day readings. The capacity and needs analysis will be completed along with a phased implementation plan. Next steps also include establishment of draft policy surrounding EV charging for the *EV Charging Feasibility Study*. Additional details regarding next steps are included below:

- Create a phased implementation plan identifying the following:
  - Phased plan for installing EV charging infrastructure for each user group
  - Level of chargers by facility location and user group

    - AVN fleet EV replacement targets
    - Infrastructure needs to install chargers (e.g., additional chargers, electrical infrastructure improvements, new conduit)
    - Funding / grant opportunities
- Establish draft policy surrounding EV charging:
    - Set current and future policies to meet AVN goals (e.g., percent of required EV stalls in new parking development, tenant/concessions agreements, level of chargers)
    - Identify priorities for EV infrastructure development for each user group and location
    - Provide electrical cost, payment options and timing recommendations

Table 4-3: EV Charger Demand Comparison with Existing Electrical Infrastructure

Location	Public & Employee			AVN Fleet (Note 4)	Shuttles	Maximum Number of EV-ready Stalls (Notes 2 & 3)		
	Low	Medium	High			Level 1 (1.8kW)	Level 2 (3.6kW)	DC Fast (50kW)
East Economy Garage A	117	234	469	-	-	50	25	-
East Economy Garage B	175	351	701	-	-	333	166	-
East Economy Surface Lot	181	364	726	-	2	75	37	-
T-3 Parking Garage	108	217	434	-	-	333	166	-
T-4 Parking Garage	340	685	1,369	-	-	998	499	-
West Economy Garage	120	239	480	-	-	28	14	-
West Economy Park & Walk	49	99	197	-	1	47	24	-
24th St. Station (Future)	*82*	*165*	*329*	-	*1*	*48*	*24*	-
West Ground Transportation	-	-	-	-	-	35	18	-
44th St. Airline Employee	112	224	447	-	1	30	15	-
RAC Garage	28	55	111	-	-	(Note 1)		-
Aviation Headquarters Building	18	25	50	22	-	6	3	-
Command Center Building	4	8	15	2	-	49	24	-
Operations Building	6	11	22	24	-	28	14	-
Rental Car Center Employee	1	2	4	-	-	14	7	-
DCS Building	12	24	47	14	-	83	42	-
Executive Terminal, Airport Police Bureau	4	9	17	-	-	18	9	-
Facilities & Service Building	18	22	45	64	-	42	21	-
T-3 Annex Building	1	3	6	-	-	17	8	-
Rental Car Center	-	-	-	-	-	499	249	17

Source: PHX As-built Documents and HNTB analysis

Notes:

(1) The RAC Garage requires a site visit to provide an estimate on the number of EV charging stations that may be implemented.
(2) Infrastructure targeted to support EV chargers to be verified for viability with AVN Facilities & Services division.
(3) The estimated number of EV chargers reflects the maximum number of chargers that can be implemented for only one level of chargers (i.e., only Level 1s, only Level 2s, or only DC Fast chargers).
(4) This 2030 AVN fleet replacement target only considers the age of the vehicle.

Appendix B

Acronyms, Abbreviations and Glossary

Acronyms, Abbreviations and Glossary

B.1 Acronyms and Abbreviations

AC	Alternative Current
APS	Arizona Public Service
AVN	Aviation Department
BMP	Best Management Practice
CAMP	Comprehensive Asset Management Plan
CAP	Climate Action Plan
CCS	Combined Charging Systems
City	City of Phoenix
DC	Direct Current
DCFC	DC Fast Charger
DCS	Design & Construction Services
DRVE	Dashboard for Rapid Vehicle Electrification
DVT	Phoenix Deer Valley Airport
EV	Electric Vehicle
EVC	Electric Vehicle Charger
EVSE	Electric Vehicle Supply Equipment
F&S	Facilities and Services
GHG	Greenhouse Gas
GM	General Motors
GT	Ground Transportation
GYR	Phoenix Goodyear Airport
L1	Level 1 Charger
L2	Level 2 Charger
LM	Load management
NEC	National Electrical Code
OCPP	Open Charge Point Protocol
PHX	Phoenix Sky Harbor International Airport
RAC	Rent-a-Car
SAN	San Diego International Airport
SEA	Seattle-Tacoma International Airport

SES	Service Entrance Sections
SFO	San Francisco International Airport
STEP	Statewide Transportation Electrification Plan
TEAP	*Transportation Electrification Action Plan* (City, 2022)
TEP	Tucson Electric Power
TNC	Transportation Network Companies
VALE	Voluntary Airport Low Emissions
ZEV	Zero Emission Vehicle

B.2 Glossary

Charging Cluster: A group of EV chargers networked together.

DC Fast Charging: 480V 3-phase, 100 Amp circuit. Produces approximately 60-80 miles of range per 20 minutes of charging.

Electric Vehicle Supply Equipment (EVSE): The hardware, including connectors, fixtures, devices, and other components required to charge an electric vehicle.

Level 1 Charging: 120 Volt, 10-20 Amp circuit. Produces approximately 2-5 miles of range per hour of charging.

Level 2 Charging: 208 Volt, 15-80 Amp circuit. Produces approximately 10-20 miles of range per hour of charging.

Load Managed Charger: A networked charger capable of manipulating the amount of electricity based on the overall load of the system, typically in near real time for an entire cluster of EV chargers. Among other benefits, load managed chargers allow for the ability to avoid electricity demand charges. Also known as load shifting, load control, load curtailment, and load restricting.

Networked Charger: A charger that can send and receive communications for data exchange. Also known as a “smart charger.”

Non-Networked Charger: A charger without network access. Also known as a “dumb charger.”

Port: The cord and connection from an EVSE used to charge an electric vehicle. Many EV chargers are dual port. Also known as a connector.

Unmanaged Charger: EV chargers incapable of adapting the electrical load or used when it is not desirable to manage load (e.g. DC Fast chargers).

Appendix C

City of Phoenix Aviation Department Section Head Interview

Asset Number	Year	Make	Model	Class Description	Using Section	Class Code	Parking Location	Operating Shifts	Section Head Interviewed	Notes
921207	2019	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	BUSINESS AND PROPERTIES	2101	AVN Headquarters Building, Oversized Lot	6AM-3PM	Stephen Vital	Low idle time
121242	2006	FORD	EXPEDITION	TRUCK, 1/2 TON SUV	BUSINESS AND PROPERTIES	2102	AVN Headquarters Building, Oversized Lot	Daily basis	Stephen Vital	Low idle time
610009	2006	CHEVROLET	MALIBU	AUTO,STAFF INTERMEDIATE	DCS POOL	1003	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
810031	2007	CHEVROLET	MALIBU	AUTO,STAFF INTERMEDIATE	DCS POOL	1003	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
710043	2007	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	DCS POOL	1004	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
721441	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	DCS POOL	2101	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
610008	2006	CHEVROLET	MALIBU	AUTO,STAFF INTERMEDIATE	DEER VALLEY OPERATIONS/MAINTENANCE	1003	DVT Terminal Covered Shade	1st and 2nd shift	Joel Quinn	
621059	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	DEER VALLEY OPERATIONS/MAINTENANCE	2101	DVT Terminal Covered Shade	24/7	Joel Quinn	
621062	2016	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	DEER VALLEY OPERATIONS/MAINTENANCE	2102	DVT Terminal Covered Shade	24/7	Joel Quinn	
822583	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	DEER VALLEY OPERATIONS/MAINTENANCE	2211	DVT Terminal Covered Shade, Maintenance Building for Extended hours	24/7	Joel Quinn	Possible conversion to 1/2 Ton
22123	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	DEER VALLEY OPERATIONS/MAINTENANCE	2211	DVT Terminal Covered Shade, Maintenance Building for Extended hours	24/7	Joel Quinn	Possible conversion to 1/2 Ton
222059	2012	CHEVROLET	SILVERADO 2500HD	TRUCK, SERVICE BODY 3/4 TON	DEER VALLEY OPERATIONS/MAINTENANCE	2211	DVT Terminal Covered Shade, Maintenance Building for Extended hours	24/7	Joel Quinn	Possible conversion to 1/2 Ton
723124	2007	FORD	F350	TRUCK, SERVICE BODY 1 TON	DEER VALLEY OPERATIONS/MAINTENANCE	2311	DVT Terminal Covered Shade, Maintenance Building for Extended hours	24/7	Joel Quinn	
720196	2007	FORD	EXPLORER	TRUCK,COMPACT SUV	DESIGN & CONSTRUCTION	2002	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
820967	2007	FORD	EXPLORER	TRUCK,COMPACT SUV	DESIGN & CONSTRUCTION	2002	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
820968	2008	FORD	EXPLORER	TRUCK,COMPACT SUV	DESIGN & CONSTRUCTION	2002	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
921163	2009	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	DESIGN & CONSTRUCTION	2101	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
21078	2020	FORD	F150	TRUCK, 1/2 TON STANDARD BED	DESIGN & CONSTRUCTION	2101	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
621051	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	DESIGN & CONSTRUCTION	2101	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
621052	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	DESIGN & CONSTRUCTION	2101	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
521373	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	DESIGN & CONSTRUCTION	2101	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
521374	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	DESIGN & CONSTRUCTION	2101	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
621061	2016	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	DESIGN & CONSTRUCTION	2102	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
922026	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	DESIGN & CONSTRUCTION	2211	DCS Building	one shift (1st shift/3rd shift)	Kato Warren	
810036	2018	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	EMERGENCY PREPAREDNESS	1004	Operations Building	7AM-5PM	Olivia Coleman	Shared with supervisors for business-related needs - going to the bank for deposits & to do security inspections
720826	2017	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	EMERGENCY PREPAREDNESS	2002	Command Center	24/7	Olivia Coleman	Shared with ADM staff and command center staff
721426	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S AIRFIELD MNT/CRACK SEAL	2101	Facilities Parking Lot	10PM-8:30AM, M-Th	Pete Taylor	Striping supervisor truck, used for quality checks
822577	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S AIRFIELD MNT/CRACK SEAL	2201	Facilities Parking Lot	10PM-8:30AM	Pete Taylor	Crack seal supervisor truck, Can go down to 1/2 Ton, idles 20% of the night
22122	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S AIRFIELD MNT/CRACK SEAL	2211	Facilities Parking Lot	8 hrs, M-F	Pete Taylor	Striping truck, 4 hrs of driving and 4 hrs of idling
322138	2013	CHEVROLET	SILVERADO 2500HD	TRUCK, SERVICE BODY 3/4 TON	F&S AIRFIELD MNT/CRACK SEAL	2211	Facilities Parking Lot		Pete Taylor	Crack seal truck
723113	2007	CHEVROLET	W4500	TRUCK, FLATBED 1 TON	F&S AIRFIELD MNT/CRACK SEAL	2320	Facilities Parking Lot		Pete Taylor	High idle, low mileage, used for big cracks
323008	2013	CHEVROLET	SILVERADO 3500HD	TRUCK, SERVICE BODY W/CC 1 TON	F&S AIRFIELD MNT/CRACK SEAL	2335	Facilities Parking Lot		Pete Taylor	High idle, low mileage, used for big cracks
423302	2014	FORD	F350	TRUCK, SERVICE BODY W/CC 1 TON	F&S AIRFIELD MNT/CRACK SEAL	2335	Facilities Parking Lot		Pete Taylor	High idle, low mileage, used for big cracks
922020	2019	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S AIRFIELD MNT/GENERAL MNT	2201	Facilities Parking Lot	5AM -1:30PM, M-F	Pete Taylor	Used by leads
923022	2019	FORD	F350	TRUCK, SERVICE BODY 1 TON	F&S AIRFIELD MNT/GENERAL MNT	2311	Facilities Parking Lot	8 hrs, M-F	Pete Taylor	4 hrs of driving and 4 hrs of idle
23208	2020	FORD	F350	TRUCK, SERVICE BODY W/CC 1 TON	F&S AIRFIELD MNT/GENERAL MNT	2335	Facilities Parking Lot	8 hrs, M-F	Pete Taylor	4 hrs of driving and 4 hrs of idle
922021	2019	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S AIRFIELD MNT/PAVEMENT MAINTENANCE	2201	Facilities Parking Lot	2AM-10:30AM, 5 days a week	Pete Taylor	75% inspection (idle), 25% at a site
723112	2007	CHEVROLET	W4500	TRUCK, FLATBED 1 TON	F&S AIRFIELD MNT/PAVEMENT MAINTENANCE	2320	Facilities Parking Lot	2AM-10:30AM, 3 days a week	Pete Taylor	Stake bed truck, used for larger jobs
423298	2014	FORD	F350	TRUCK, DUMP BED 2 YD	F&S AIRFIELD MNT/PAVEMENT MAINTENANCE	2328	Facilities Parking Lot	2AM-10:30AM, 5 days a week	Pete Taylor	75% inspection (idle), 25% at a site
423299	2014	FORD	F350	TRUCK, SERVICE BODY W/CC 1 TON	F&S AIRFIELD MNT/PAVEMENT MAINTENANCE	2335	Facilities Parking Lot	2AM-10:30AM, 5 days a week	Pete Taylor	If doing repair, can be idling the entire shift
422394	2014	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S AIRFIELD MNT/STRIPING	2211	Facilities Parking Lot	10PM-8:30AM, M-Th	Pete Taylor	Can go down to 1/2 Ton
422395	2015	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S AIRFIELD MNT/STRIPING	2211	Facilities Parking Lot	10PM-8:30AM, M-Th	Pete Taylor	idles at a location for 4 hours
22106	2020	FORD	F250	TRUCK, SERVICE W/CC 3/4 TON	F&S AIRFIELD MNT/STRIPING	2235	Facilities Parking Lot	10PM-8:30AM	Pete Taylor	2-3 jobs at a time
22107	2020	FORD	F250	TRUCK, SERVICE W/CC 3/4 TON	F&S AIRFIELD MNT/STRIPING	2235	Facilities Parking Lot	10PM-8:30AM	Pete Taylor	2-3 jobs at a time
~~823998~~	~~2008~~	~~FORD~~	~~F350~~	~~TRUCK, SERVICE BODY 1 TON~~	~~F&S AIRFIELD MNT/STRIPING~~	~~2311~~				
920192	2009	CHEVROLET	COLORADO	TRUCK,STANDARD BED	F&S BUILDING MNT	2001	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Foremen Truck
920193	2009	CHEVROLET	COLORADO	TRUCK,STANDARD BED	F&S BUILDING MNT	2001	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Foremen Truck
721442	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S BUILDING MNT	2101	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Used by the crew, painting jobs only, some idle time
421024	2014	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S BUILDING MNT	2101	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Used by the crew, painting jobs only, some idle time
821519	2008	CHEVROLET	EXPRESS	VAN, PASSENGER 1/2 TON	F&S BUILDING MNT	2106	T3 South Concourse	10 hrs a day	Jon Rudd	Only 1 person uses it
822655	2018	CHEVROLET	SILVERADO 2500	TRUCK, STANDARD BED OEM 3/4 TON	F&S BUILDING MNT	2201	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Foremen Truck
622269	2016	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S BUILDING MNT	2201	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Foremen Truck
622267	2016	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S BUILDING MNT	2201	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	High idle time
622270	2016	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
622271	2016	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
22108	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
22109	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
22110	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
22102	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
22103	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
22129	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
322514	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
922022	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T4	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
922023	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
922024	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT	2211	T3 South Concourse	1st and 2nd shift 5AM-3PM, 3PM-1:30AM	Jon Rudd	Fork lifts, ceramic towel, lift gates, portable jetters, go around airport, high idle time
921259	2019	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S BUILDING MNT/KEY SHOP	2101	RCC Lockshop	Mon-Fri 6:30AM-3:30PM	Daniel Bustamante	
521375	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S BUILDING MNT/KEY SHOP	2101	RCC Lockshop	Mon-Fri 6:30AM-3:30PM	Daniel Bustamante	
822659	2018	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT/KEY SHOP	2211	RCC Lockshop	Mon-Fri 6:30AM-3:30PM	Daniel Bustamante	
922050	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT/KEY SHOP	2211	RCC Lockshop	Mon-Fri 6:30AM-3:30PM	Daniel Bustamante	
822587	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S BUILDING MNT/WELDERS	2211	Facilities Parking Lot	6AM-2:30PM, 2:30PM-10:30PM, 10PM-6:30AM	Rusty Farnsworth	Carry medal, welder, pulling trailers
621053	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S EDS MNT	2101				
21079	2020	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S EDS MNT	2101				
921256	2019	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S EDS MNT	2101				
322539	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S EDS MNT	2211				
723122	2008	FORD	F350	TRUCK, SERVICE BODY 1 TON	F&S EDS MNT	2311				
721423	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S ELECTRICAL MNT	2101	North Hollywood	1st 05:00-15:30, 3rd 20:30-07:00. 20 Hours a day, 7 days a week	Joe Rosales III	
621060	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S ELECTRICAL MNT	2101	North Hollywood	1st 05:00-15:30, 3rd 20:30-07:00. 20 Hours a day, 7 days a week	Joe Rosales III	
721424	2017	CHEVROLET	SILVERADO 1500	TRUCK, STANDARD BED OEM 3/4 TON	F&S ELECTRICAL MNT	2201	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
722064	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
722122	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
722123	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
622273	2016	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	North Hollywood	1st 05:00-15:30, 3rd 20:30-07:00. 20 Hours a day, 7 days a week	Joe Rosales III	
622274	2016	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	North Hollywood	1st 05:00-15:30, 3rd 20:30-07:00. 20 Hours a day, 7 days a week	Joe Rosales III	
822584	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	North Hollywood	1st 05:00-15:30, 3rd 20:30-07:00. 20 Hours a day, 7 days a week	Joe Rosales III	
822580	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
822581	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
322512	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
322520	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
322140	2013	CHEVROLET	SILVERADO 2500HD	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	North Hollywood	1st 05:00-15:30, 3rd 20:30-07:00. 20 Hours a day, 7 days a week	Joe Rosales III	
922019	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
922025	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ELECTRICAL MNT	2211	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
723076	2008	FORD	F350	TRUCK, SERVICE BODY 1 TON	F&S ELECTRICAL MNT	2311	Facilities Parking Lot	1st 05:00-15:30, 2nd 14:30-01:00. 20 Hours a day, 7 days a week	Joe Rosales III	
625000	2016	DODGE	RAM 5500	TRK, SERVICE BODY 2 TON	F&S ELECTRICAL MNT	2511	North Hollywood	1st 05:00-15:30, 3rd 20:30-07:00. 20 Hours a day, 7 days a week	Joe Rosales III	
721443	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S ENERGY SYSTEM MNT	2101	Facilities Parking Lot	24/7	Al Plant	
721444	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S ENERGY SYSTEM MNT	2101	Facilities Parking Lot	24/7	Al Plant	
621054	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S ENERGY SYSTEM MNT	2101	Facilities Parking Lot	24/7	Al Plant	
621055	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S ENERGY SYSTEM MNT	2101	Facilities Parking Lot	24/7	Al Plant	
322141	2013	CHEVROLET	SILVERADO 2500HD	TRUCK, SERVICE BODY 3/4 TON	F&S ENERGY SYSTEM MNT	2211	Facilities Parking Lot	24/7	Al Plant	Can go down to 1/2 Ton
822657	2018	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S ENERGY SYSTEM MNT	2211	Facilities Parking Lot	24/7	Al Plant	Can go down to 1/2 Ton

Asset Number	Year	Make	Model	Class Description	Using Section	Class Code	Parking Location	Operating Shifts	Section Head Interviewed	Notes
922032	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S ENERGY SYSTEM MNT	2211	Facilities Parking Lot	24/7	Al Plant	Can go down to 1/2 Ton
522334	2015	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S FLEET MAINTENANCE	2201	Facilities Parking Lot	1 shift	Gary Jacobsen	Service truck, not flexible on parking location
322503	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S FLEET MAINTENANCE	2211	Facilities Parking Lot	1 shift	Gary Jacobsen	Technicians truck, not flexible on parking location
822665	2018	CHEVROLET	SILVERADO 2500HD	TRUCK, SERVICE BODY 3/4 TON	F&S FLEET MAINTENANCE	2211	Facilities Parking Lot	1 shift	Gary Jacobsen	Technicians truck, not flexible on parking location
220431	2012	CHEVROLET	COLORADO	TRUCK,STANDARD BED	F&S LANDSCAPE MAINTENANCE	2001	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
421012	2013	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S LANDSCAPE MAINTENANCE	2101	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
621365	2006	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S LANDSCAPE MAINTENANCE	2101	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
921164	2009	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S LANDSCAPE MAINTENANCE	2101	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
821513	2008	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S LANDSCAPE MAINTENANCE	2101	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
921166	2009	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S LANDSCAPE MAINTENANCE	2101	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
922007	2009	CHEVROLET	SILVERADO 2500HD	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
822573	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
822574	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
822575	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
822576	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
822615	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
822616	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
722049	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
722058	2008	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSCAPE MAINTENANCE	2201	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
322506	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S LANDSCAPE MAINTENANCE	2211	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
322510	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S LANDSCAPE MAINTENANCE	2211	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
322511	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S LANDSCAPE MAINTENANCE	2211	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
322523	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S LANDSCAPE MAINTENANCE	2211	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
322501	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S LANDSCAPE MAINTENANCE	2211	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
322502	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S LANDSCAPE MAINTENANCE	2211	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
623598	2016	FORD	T350	TRUCK, VAN HI-CUBE 1 TON	F&S LANDSCAPE MAINTENANCE	2309	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is the Parks Mechanic/Irrigation vehicle
723123	2008	FORD	F350	TRUCK, SERVICE BODY 1 TON	F&S LANDSCAPE MAINTENANCE	2311	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for tree trimming and hauling branches
223317	2003	FORD	F350	TRUCK, SERVICE BODY 1 TON	F&S LANDSCAPE MAINTENANCE	2311	Facilities Parking Lot	5:30-2PM	Tony Dobbs	This vehicle is used for Gardening & hauling spoils
524005	2015	CHEVROLET	3500HD	TRUCK, DUMPBED	F&S LANDSCAPE MAINTENANCE	2428			Tony Dobbs	
220436	2012	CHEVROLET	COLORADO	TRUCK,STANDARD BED	F&S LANDSIDE MAINTENANCE SERVICES	2001	Facilities Parking Lot	24/7	Matt Martinez	
721422	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S LANDSIDE MAINTENANCE SERVICES	2101	Facilities Parking Lot	24/7	Matt Martinez	
622268	2016	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSIDE MAINTENANCE SERVICES	2201	Facilities Parking Lot	24/7	Matt Martinez	
622266	2016	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSIDE MAINTENANCE SERVICES	2201	Facilities Parking Lot	24/7	Matt Martinez	
822658	2018	CHEVROLET	SILVERADO 2500	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSIDE MAINTENANCE SERVICES	2201	Facilities Parking Lot	24/7	Matt Martinez	
422391	2014	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S LANDSIDE MAINTENANCE SERVICES	2201	Facilities Parking Lot	24/7	Matt Martinez	
822656	2018	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S LANDSIDE MAINTENANCE SERVICES	2211	Facilities Parking Lot	24/7	Matt Martinez	
23122	2020	FORD	F350	TRUCK, STANDARD BED OEM 1 TON	F&S LANDSIDE MAINTENANCE SERVICES	2301	Facilities Parking Lot	24/7	Matt Martinez	
423303	2014	FORD	F350	TRUCK, DUMP BED 2 YD	F&S LANDSIDE MAINTENANCE SERVICES	2328	Facilities Parking Lot	24/7	Matt Martinez	
721421	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S MECHANICAL MNT	2101	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	Supervisor truck
622277	2016	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
622279	2016	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
822582	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
822585	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
822660	2018	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
822578	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
822579	2008	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
22124	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
22125	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
22126	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
22127	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
22128	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
322137	2013	CHEVROLET	SILVERADO 2500HD	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
322526	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
322533	2003	CHEVROLET	SILVERADO 2500	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
922027	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
922028	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
922029	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
922030	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
922031	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S MECHANICAL MNT	2211	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
923027	2019	FORD	T350	VAN, CARGO 1 TON	F&S MECHANICAL MNT	2305	Underneath T3, sky train area	24/7, 3 shifts	Rusty Farnsworth	All trucks are used for service with ladder racks, tools, parts, etc.
110002	2011	CHEVROLET	MALIBU	AUTO,STAFF INTERMEDIATE	F&S POOL	1003	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
110003	2011	CHEVROLET	MALIBU	AUTO,STAFF INTERMEDIATE	F&S POOL	1003	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
810037	2018	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	F&S POOL	1004	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
10232	2020	CHEVROLET	BOLT	AUTO,STAFF COMPACT ELECTRIC	F&S POOL	1009	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
220443	2012	JEEP	LIBERTY	TRUCK,COMPACT SUV	F&S POOL	2002	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
620310	2016	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	F&S POOL	2002	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
720827	2017	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	F&S POOL	2002	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
720830	2017	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	F&S POOL	2002	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
821129	2018	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S POOL	2101	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
521395	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S POOL	2101	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
520577	2015	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	F&S POOL	2102	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
421028	2014	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	F&S POOL	2102	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
121547	2021	FORD	EXPLORER	TRUCK, 1/2 TON SUV	F&S POOL	2102	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
21091	2020	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	F&S POOL	2102	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
21092	2020	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	F&S POOL	2102	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
621048	2016	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	F&S POOL	2102	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
921260	2019	FORD	EXPLORER	TRUCK, 1/2 TON SUV	F&S POOL	2102	Facilities Parking Lot		Gary Jacobsen / Kim Brown	
521390	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S SIGN SHOP	2101	Facilities Parking Lot	1st shift, M-F	Alex Moreno	
522332	2015	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	F&S SIGN SHOP	2211	Facilities Parking Lot	1st shift, M-F	Alex Moreno	
422393	2014	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	F&S SUPPLIES	2201	Facilities Parking Lot	1st and 2nd shifts 6-11PM	Pat Bazan / Gary Jacobsen	can go down to 1/2 Ton
820059	2007	CHEVROLET	UPLANDER	VAN, COMPACT PASSENGER	F&S TERMINAL SERVICE/CUSTODIAL T-4	2006	Westside of Facilities Building	1st and 2nd shifts 6-2PM, sits until 10PM	Laura Hernandez	
721425	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	F&S TERMINAL SERVICE/CUSTODIAL T-4	2101	DCS Building	1st shift 6-2:30PM	Laura Hernandez	
521394	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	F&S TERMINAL SERVICE/CUSTODIAL T-4	2101	T4 Airside	10-hr shift 4AM-3:30PM	Laura Hernandez	can be converted to SUV
922018	2019	FORD	F250	TRUCK, 1/2 TON STANDARD BED	F&S TERMINAL SERVICE/CUSTODIAL T-4	2101	T4 Airside	10-hr shift 4AM-3:30PM	Laura Hernandez	can be converted to SUV
821520	2008	CHEVROLET	EXPRESS	VAN, 1/2 TON CARGO	F&S TERMINAL SERVICE/CUSTODIAL T-4	2105	DCS Building	1st shift 6-2:30PM	Laura Hernandez	
721107	2007	CHEVROLET	EXPRESS	VAN, PASSENGER 1/2 TON	F&S TERMINAL SERVICE/CUSTODIAL T-4	2106	DCS Building		Laura Hernandez	
721438	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	GOODYEAR OPERATIONS/MAINTENANCE	2101	Covered Parking or behind maintenance	24/7	Ken Brock	General Use/Supervisor RWY TWY Inspection
721427	2017	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	GOODYEAR OPERATIONS/MAINTENANCE	2102	Covered Parking or behind maintenance	24/7	Ken Brock	General Use/Supervisor, also used for transport to PHX
721105	2007	CHEVROLET	EXPRESS	VAN, PASSENGER 1/2 TON	GOODYEAR OPERATIONS/MAINTENANCE	2106	Covered Parking or behind maintenance	24/7	Ken Brock	Used for group tours
422392	2014	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	GOODYEAR OPERATIONS/MAINTENANCE	2201	Covered Parking or behind maintenance	24/7	Ken Brock	Can go down to 1/2 Ton, RWY TWY inspections
522331	2015	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	GOODYEAR OPERATIONS/MAINTENANCE	2211	Covered Parking or behind maintenance	24/7	Ken Brock	Can go down to 1/2 Ton
22121	2020	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	GOODYEAR OPERATIONS/MAINTENANCE	2211	Covered Parking or behind maintenance	24/7	Ken Brock	Can go down to 1/2 Ton
622272	2016	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	GOODYEAR OPERATIONS/MAINTENANCE	2211	Covered Parking or behind maintenance	24/7	Ken Brock	Can go down to 1/2 Ton
821130	2018	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	HUMAN RESOURCES	2101	AVN Headquarters Building	8-5PM, M-F	Julia Quinones	
121235	2010	DODGE	CARAVAN SE	VAN, PASSENGER 1/2 TON	HUMAN RESOURCES	2106	AVN Headquarters Building	8-5PM, M-F	Julia Quinones	
323115	2003	DODGE	B250	VAN, CARGO 1 TON	MUSEUM PROGRAM	2305	3328 E Jackson St (Off Site)	7AM-5PM	Gary Martelli	
823684	1998	FORD	E350	VAN, CARGO 1 TON	MUSEUM PROGRAM	2305	3328 E Jackson St (Off Site)	7AM-5PM	Gary Martelli	
610015	2016	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	OPERATIONS POOL	1004				
720828	2017	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	OPERATIONS POOL	2002				

Asset Number	Year	Make	Model	Class Description	Using Section	Class Code	Parking Location	Operating Shifts	Section Head Interviewed	Notes
720829	2017	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	OPERATIONS POOL	2002				
22119	2020	CHEVROLET	EXPRESS	VAN, CARGO 3/4 TON	OPERATIONS POOL	2205				
121528	2021	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	24/7	Jody Springer / Dustin Loftis	
121530	2021	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	24/7	Jody Springer / Dustin Loftis	
121531	2021	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	24/7	Jody Springer / Dustin Loftis	
321105	2013	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building		Jody Springer / Dustin Loftis	
521396	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	24/7	Jody Springer / Dustin Loftis	
521376	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building		Jody Springer / Dustin Loftis	
421011	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	16 hrs a day, 7 days a week	Jody Springer / Dustin Loftis	
421008	2013	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	24/7	Jody Springer / Dustin Loftis	
821131	2018	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	10-12 hrs a day, 5-6 days a week	Jody Springer / Dustin Loftis	Assigned to an individual, construction coordinator, used to drive on airfield
821128	2018	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	24/7	Jody Springer / Dustin Loftis	
821126	2018	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/AIRSIDE	2101	East side of operations building	18 hrs, 10-hr shift, 8-hr shift, 7 days a week	Jody Springer / Dustin Loftis	
821132	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	OPERATIONS/AIRSIDE	2102	East side of operations building	8 hrs a day	Jody Springer / Dustin Loftis	Assigned to supervisor
621064	2016	CHEVROLET	SUBURBAN	TRUCK, 1/2 TON SUV	OPERATIONS/AIRSIDE	2102	East side of operations building	4-5 hrs a day, M-F	Jody Springer / Dustin Loftis	Assigned to supervisor Dustin
621049	2016	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	OPERATIONS/AIRSIDE	2102	East side of operations building	18 hrs a day	Jody Springer / Dustin Loftis	
621050	2016	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	OPERATIONS/AIRSIDE	2102	East side of operations building	16 hrs a day	Jody Springer / Dustin Loftis	Assigned to supervisor
421031	2014	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	OPERATIONS/AIRSIDE	2102	East side of operations building	18 hrs a day on 1st and 3rd shift	Jody Springer / Dustin Loftis	Assigned to supervisor
421032	2014	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	OPERATIONS/AIRSIDE	2102	East side of operations building	1st and 3rd shift, 18-20 hrs a day	Jody Springer / Dustin Loftis	
421033	2014	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	OPERATIONS/AIRSIDE	2102	East side of operations building	10 hrs a day when supervisor is in	Jody Springer / Dustin Loftis	Assigned to supervisor
222051	2012	CHEVROLET	SILVERADO 2500	TRUCK, STANDARD BED OEM 3/4 TON	OPERATIONS/AIRSIDE	2201	East side of operations building	8 hrs	Jody Springer / Dustin Loftis	
121529	2021	FORD	F150	TRUCK, SERVICE BODY 3/4 TON	OPERATIONS/AIRSIDE	2211	East side of operations building	24/7	Jody Springer / Dustin Loftis	
322132	2013	CHEVROLET	SILVERADO C2500HD	TRUCK, SERVICE W/CC 3/4 TON	OPERATIONS/AIRSIDE	2235	East side of operations building	10 hrs	Jody Springer / Dustin Loftis	Used for towing, emergency response trailer, ADA lift
723642	2017	CHEVROLET	SILVERADO 3500	TRUCK, STANDARD BED OEM 1 TON	OPERATIONS/AIRSIDE	2301	East side of operations building	Once a week	Jody Springer / Dustin Loftis	
921258	2019	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/GROUND TRANSPORTATION	2101	Operations Building	1st and 2nd shifts 6:30-11PM	Jeff Wainscott	
110004	2011	CHEVROLET	IMPALA	AUTO,STAFF INTERMEDIATE	OPERATIONS/TERMINAL	1003	Operations Building	1st and 2nd shifts, 5AM-9:30PM	Jeff Wainscott	Used by terminal operations, assigned to staff, used for lost and found agents
810030	2008	CHEVROLET	IMPALA	AUTO,STAFF INTERMEDIATE	OPERATIONS/LANDSIDE	1003	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
710046	2007	CHEVROLET	MALIBU	AUTO,STAFF INTERMEDIATE	OPERATIONS/TERMINAL	1003	Operations Building	1st and 2nd shifts, 5AM-9:30PM	Jeff Wainscott	Used by terminal operations, supervisor car
810035	2018	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	OPERATIONS/LANDSIDE	1004	Operations Building	M-W during 1st shift	Lesley Goodwill / Armando Jenkins	
620311	2016	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	OPERATIONS/LANDSIDE	2002	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
520570	2015	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	OPERATIONS/LANDSIDE	2002	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
520575	2015	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	OPERATIONS/LANDSIDE	2002	Operations Building	M-W during 1st shift	Lesley Goodwill / Armando Jenkins	
520576	2015	CHEVROLET	EQUINOX	TRUCK,COMPACT SUV	OPERATIONS/LANDSIDE	2002	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
521393	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/LANDSIDE	2101	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
421009	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/LANDSIDE	2101	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
821127	2018	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/LANDSIDE	2101	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
921165	2009	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/LANDSIDE	2101	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
921257	2019	FORD	F150	TRUCK, 1/2 TON STANDARD BED	OPERATIONS/LANDSIDE	2101	Operations Building	24/7	Lesley Goodwill / Armando Jenkins	
520578	2016	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	OPERATIONS/LANDSIDE	2102	Operations Building	M-W during 1st shift	Lesley Goodwill / Armando Jenkins	
510002	2015	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	BUSINESS & PROPERTIES/PARKING	1004	AVN Headquarters Building	8AM-5PM, M-F	Lea Cons	Low idle time
421010	2013	FORD	F150	TRUCK, 1/2 TON STANDARD BED	BUSINESS & PROPERTIES/PARKING	2101	AVN Headquarters Building	8AM-5PM, M-F	Lea Cons	Low idle time, to be replaced by 121546
121546	2021	FORD	F150	TRUCK, 1/2 TON STANDARD BED	BUSINESS & PROPERTIES/PARKING	2101	AVN Headquarters Building		Lea Cons	
820963	2008	FORD	EXPLORER	TRUCK,COMPACT SUV	PLANNING & ENVIRONMENTAL	2002	AVN Headquarters Building, north pool parking area with no shade	8-5PM, M-F	Rebecca Godley	33,000 miles, 3100 hrs, radio functionality, less clearance, go everywhere (construction sites and airfield), carries lights, keeps supplies in the car
121246	2005	FORD	F150	TRUCK, 1/2 TON STANDARD BED	PLANNING & ENVIRONMENTAL	2101	AVN Headquarters Building, north pool parking area with no shade	8-5PM, M-F	Rebecca Godley	41,000 miles, 3000 hrs, go to construction sites, don’t take it to the river, haul spill booth
321046	2003	FORD	EXPEDITION	TRUCK, 1/2 TON SUV	PLANNING & ENVIRONMENTAL	2102	AVN Headquarters Building, north pool parking area with no shade	8-5PM, M-F	Rebecca Godley	56,850 miles, 3800 hrs, radio functionality, use to go into salt river, high clearance, 4-wheel drive
611472	2016	CHEVROLET	CAPRICE	AUTO,PD MARKED FULLSIZE	POLICE	1114				
711773	2007	CHEVROLET	IMPALA	AUTO,PD MARKED FULLSIZE	POLICE	1114				
511213	2015	CHEVROLET	TAHOE	TRUCK,PD MARKED SUV	POLICE	1118				
211373	2012	CHEVROLET	SILVERADO 1500	TRUCK,PD UNMARKED	POLICE	1119				
211505	2021	CHEVROLET	C1500	TRUCK,PD UNMARKED	POLICE	1119				
311159	2013	FORD	F150	TRK, PD UNMRK K-9	POLICE	1120				
311160	2013	FORD	F150	TRK, PD UNMRK K-9	POLICE	1120				
111398	2011	CHEVROLET	SILVERADO 1500	TRK, PD UNMRK K-9	POLICE	1120				
111399	2011	CHEVROLET	SILVERADO 1500	TRK, PD UNMRK K-9	POLICE	1120				
110008	2021	FORD	F150	TRK, PD UNMRK K-9	POLICE	1120				
110009	2021	FORD	F150	TRK, PD UNMRK K-9	POLICE	1120				
611480	2016	FORD	F150	TRK, PD UNMRK K-9	POLICE	1120				
711971	2017	FORD	F150	TRK, PD UNMRK K-9	POLICE	1120				
811046	2018	FORD	F150	TRK, PD UNMRK K-9	POLICE	1120				
811049	2018	CHEVROLET	SILVERADO 1500	TRK, PD UNMRK K-9	POLICE	1120				
911731	2019	CHEVROLET	SILVERADO 1500	TRK, PD UNMRK K-9	POLICE	1120				
911732	2019	CHEVROLET	SILVERADO 1500	TRK, PD UNMRK K-9	POLICE	1120				
111811	2021	FORD	EXPEDITION	TRK,PD UNMRK SUV	POLICE	1123				
110010	2021	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	POLICE	2101				
611470	2016	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
611471	2016	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
511089	2015	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
511090	2015	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
511092	2015	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
511093	2015	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
511094	2015	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
511184	2015	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
911063	2009	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811254	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811255	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811256	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811257	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811258	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811304	2008	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811546	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811547	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811548	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811549	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811550	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
811551	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
711970	2017	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	POLICE	2102				
922035	2019	CHEVROLET	SILVERADO 1500	TRUCK, STANDARD BED OEM 3/4 TON	POLICE	2201				
T20200130-155115470	2019	CHEVROLET	SILVERADO 2500	TRUCK, STANDARD BED OEM 3/4 TON	POLICE	2201				
323018	2011	CHEVROLET	3500HD	VAN, PASSENGER 1 TON	POLICE	2306				
710047	2007	CHEVROLET	MALIBU	AUTO,STAFF INTERMEDIATE	SKY HARBOR ADMIN/POOL	1003				
810032	2007	CHEVROLET	MALIBU	AUTO,STAFF INTERMEDIATE	SKY HARBOR ADMIN/POOL	1003				
710044	2007	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	SKY HARBOR ADMIN/POOL	1004				
710045	2007	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	SKY HARBOR ADMIN/POOL	1004				
810038	2018	CHEVROLET	IMPALA	AUTO,STAFF FULLSIZE	SKY HARBOR ADMIN/POOL	1004				
220427	2012	DODGE	CARAVAN SE	VAN, COMPACT PASSENGER	SKY HARBOR ADMIN/POOL	2006				
521391	2014	FORD	F150	TRUCK, 1/2 TON STANDARD BED	SKY HARBOR ADMIN/POOL	2101				
721439	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	TECHNOLOGY/DESKTOP	2101	AVN Headquarters Building	This vehicle is used by a first shift employee. It has the tools, parts, and other resources assigned to this individual which are required to complete their daily work assignments.	Jamie Ritchie	The vehicle contains tools in a locked toolbox, spare parts in the locked passenger compartment, and is used to haul heavy equipment on campus, as required by daily work assignments.

Asset Number	Year	Make	Model	Class Description	Using Section	Class Code	Parking Location	Operating Shifts	Section Head Interviewed	Notes
721106	2007	CHEVROLET	EXPRESS	VAN, PASSENGER 1/2 TON	TECHNOLOGY/DESKTOP	2106	AVN Headquarters Building	share between endpoint service team	Jamie Ritchie	pool vehicle, check out in key watcher system
621057	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	TECHNOLOGY/NETWORK INFRASTRUCTURE	2101	AVN Headquarters Building	Used primarily during 1st shift, but also 24/7 for maintenance and emergencies	Jamie Ritchie	Used to transport people and equipment to network closetsand cabinets thoughout all three airport campuses, datacenters, and other City Departments. An alternative vehicle such as a compact SUV could be utilized as long as it can transport somewhat heavy network gear as large as 2x2x3 feet.
621056	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	TECHNOLOGY/NETWORK SERVICES	2101	AVN Headquarters Building	This vehicle is used by a first shift employee. It has the tools, parts, and other resources assigned to this individual which are required to complete their daily work assignments.	Jamie Ritchie	The vehicle contains tools in a locked toolbox, spare parts in the locked passenger compartment, and is used to haul heavy equipment on campus, as required by daily work assignments.
421007	2013	FORD	F150	TRUCK, 1/2 TON STANDARD BED	TECHNOLOGY/SYSTEMS MAINT	2101	AVN Headquarters Building	This vehicle is used by a first shift employee. It has the tools, parts, and other resources assigned to this individual which are required to complete their daily work assignments.	Jamie Ritchie	The vehicle contains tools in a locked toolbox, spare parts in the locked passenger compartment, and is used to haul heavy equipment on campus, as required by daily work assignments.
621058	2016	FORD	F150	TRUCK, 1/2 TON STANDARD BED	TECHNOLOGY/SYSTEMS MAINT	2101	AVN Headquarters Building	This vehicle is used by a first shift employee. It has the tools, parts, and other resources assigned to this individual which are required to complete their daily work assignments.	Jamie Ritchie	The vehicle contains tools in a locked toolbox, spare parts in the locked passenger compartment, and is used to haul heavy equipment on campus, as required by daily work assignments.
721440	2017	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	TECHNOLOGY/SYSTEMS MAINT	2101	AVN Headquarters Building	This vehicle is used by a first shift employee. It has the tools, parts, and other resources assigned to this individual which are required to complete their daily work assignments.	Jamie Ritchie	The vehicle contains tools in a locked toolbox, spare parts in the locked passenger compartment, and is used to haul heavy equipment on campus, as required by daily work assignments.
821512	2008	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	TECHNOLOGY/SYSTEMS MAINT	2101	AVN Headquarters Building	This vehicle is used by a first shift employee. It has the tools, parts, and other resources assigned to this individual which are required to complete their daily work assignments.	Jamie Ritchie	The vehicle contains tools in a locked toolbox, spare parts in the locked passenger compartment, and is used to haul heavy equipment on campus, as required by daily work assignments.
922017	2019	FORD	F250	TRUCK, STANDARD BED OEM 3/4 TON	TECHNOLOGY/SYSTEMS MAINT	2201	Terminal 3 Apron	24/7	Jamie Ritchie	This vehicle is used for tech to respond to trouble calls submitted by airline partners. It is also used to receive and deliver paper and parts to both Terminal 3 and Terminal 4. A truck with a lift gate is required due to transporting pallets of part/paper. airport information system (shared across the entire work group) - go between Terminals 3 and 4, predominanly on the airside (but also go landside)
T20170823-202230630	2019	CHEVROLET	SILVERADO 1500	TRUCK, 1/2 TON STANDARD BED	UNKNOWN	2101				
T20190517-194853720	2019	FORD	F150	TRUCK, 1/2 TON STANDARD BED	UNKNOWN	2101				
T20190610-195000233	2019	FORD	EXPLORER	TRUCK, 1/2 TON SUV	UNKNOWN	2102				
T20140813-224211900	2018	CHEVROLET	TAHOE	TRUCK, 1/2 TON SUV	UNKNOWN	2102				
T20190610-204212920	2019	FORD	F250	TRUCK, SERVICE BODY 3/4 TON	UNKNOWN	2211				
			F450	TRUCK, SERVICE BODY 1 TON	F&S BUILDING MNT/WELDERS			6AM-2:30PM, 2:30PM-10:30PM, 10PM-6:30AM		has a crane
910119	2009	TOYOTA	PRIUS	AUTO,STAFF HYBRID	OPERATIONS/LANDSIDE, OPERATIONS/TERMINAL (POOL)	1008	Operations Building	M-W during 1st shift	Lesley Goodwill / Armando Jenkins	Supervisor, will be replaced by a Chevrolet Bolt
910120	2009	TOYOTA	PRIUS	AUTO,STAFF HYBRID	OPERATIONS/LANDSIDE (POOL)	1008	Operations Building		Lesley Goodwill / Armando Jenkins	Used by terminal operations, will be replaced by a Chevrolet Bolt

Appendix D
EV Charger Quantity Calculations

	AVN 2030 MEDIUM EV-CAPABLE PARKING STALL IMPLEMENTATION TARGETS (NOTE 10)							AVAILABLE ELECTRICAL CAPACITY (NOTE 11)																	
	Public Stalls	City Fleet Stalls	Employee Stalls	Ground Transport Stalls	Total Stalls	Existing L1 Charging Ports	Existing L2 Charging Ports	Power Source (Note 5) (Note 9)	Metered Existing Panel/SWGR Capacity (Available Capacity/Panel or SWGR Rating) (Note 20)			As-built Calculated Existing Infrastructure Capacity (Available Capacity/Infrastructure Rating) (Note 6) (Note 19)			Available Spare Breakers/Breaker Space (Note 1)	Spare Breaker/Breaker Space Assumed for Use (Amp Frame)				Maximum Additional # of L1 Ports Existing Infrastructure can Support (without LM) (Note 7)	Maximum Additional # of L1 Ports Existing Infrastructure can Support (with LM) (Note 3)	Maximum Additional # of L2 Ports Existing Infrastructure can Support (without LM) (Note 2)	Maximum Additional # of L2 Ports Existing Infrastructure can Support (with LM) (Note 3)	Maximum Additional # of DC Fast Chargers Existing Infrastructure can Support (without LM) (Note 14)	Initial Review Data/Infrastructure Required for EVSE Installation (Note 4)
Garage/Surface Parking Lots								**480V Infrastructure (Unless Noted)**	**Capacity (A)**	**Capacity (kVA)**	**Rating (A)**	**Capacity (A)**	**(kVA)**	**Rating (A)**		**Quantity**	**Spare**	**Space**	**kVA**						
East Economy Garages A & B	585				585	0	0																		
Garage A - HP1								Existing Panel 'HP1'	Insufficient Capacity			395	328	800	7 spare single-phase 20A breakers	7	20	0	31						Refer to 150000015 SKE-4 for HP1 location, E5.1 for HP1 panel schedule (in Park. Gar. #1 Elec Rm.) E4.0 for One-Line.
Garage A - LP1								Existing Panel 'LP1' (Note 8)	Insufficient Capacity			171	61	225	21 spare single-phase 20A breakers	21	0	20	40						Refer to 150000015 SKE-4 for LP1 location, E5.1 for LP1 panel schedule (in Park. Gar. #1 Elec Rm.) E4.0 for One-Line.
Garage B - SES-A								Existing 'SES-A'	2893	2405	3000		NA	400	2-400A three-phase spare breakers	2	400	0	532	266	532	74	147		Refer to 150000016 E6.0 for panel locations. Appears adding a new panel off of SES-C is only option (see E8.0)
Garage B - DB1								Existing Switchboard 'DB1'	465	585	600		NA	600	3-150A/3-60A three-phase spare breakers	6		210	838	419	838	116	232		From field investigation. Fed by SES-A.
East Economy Lot	363				363	0	0	Existing Panel 'H1' (Note 17)	Insufficient Capacity			273	227	400	6 single-phase 20A spares, 21 spaces	6	20	20	143					2	Refer to 10000001 C09-TPEB0-101A/111A for H1, location of H1 on 042A.
44th St. Airline Employee Parking Lot			224		224	0	6	Existing Panel '44-PL-H1/2' (Note 18)	Insufficient Capacity on H2			Insufficient Space on H1													Refer to H02/3-ESCV2004 & H02/3-ESCV006 from As-built H02/3, Vol 1 of 2. Meter upstream 4000A panel 44-MDH1-1.
T4 Parking Garage	343		343		686	0	2	Existing 'SES-TB3A'	2494	2073	3000		NA	3000	1-800A, 4-400A, 3-200A, 4-100A spares	6	400		1596	798	1596	221	442		Refer to 150000052 E-501 for SES 'TB3A', but any SES with spare 400A breakers works. Meter to determine capacity.
RAC Garage			55		55	0	0	TBD													0		0		Refer to 1400025 drawing E4.1 for locations of panels. Elec rooms T213/T243. Also 893586 sheet ERC-106 for SES.
T3 Annex			3		3	0	0	Local SES	1046	869	1200				3-200A Spaces	3	0	200	399	200	399	55	111		Refer to Building Electrical E4.1 for one-line, E4.2 for panel, E2.1 for location. Lots of space on HA, HB, & HC too.
T3 Parking Garage	109		109		218	0	16	GHDB1	489	406	800	800	665	800	6-100A Breaker Space/Spares	6		100	399	200	399	55	111		Refer tp 15000068 Sheet E5.01 for One-line. Spare 800AF breakers indicated, could use on of SES-A1.
Operations Building		6	6		12	0	0														0		0		
Existing Panel 'P1B'								Existing Panel 'P1B' (Note 8)	APS Capacity Insufficient for Existing Circuits			156	56	225	9 spare single-phase 20A breakers	9	20	0	17	28	56	8	16		Refer to 17000008 drawing E-6 for available panels. Metering required. Location needs to be verified.
Existing Panel 'T2 Chargers'								Existing Panel 'T2 Chargers' (Note 15)	APS Capacity Insufficient for Existing Circuits			152	55	200	2 spare 1-phase 20 breakers, 9 spaces	2	20	20	25	13	25	4	7		Refer to FD-012 drawing EA201 for panel schedules and one-line.
West Economy Garage	120		120		240	0	0	Existing Panel 'LD'	196	163	250	NA	NA	250	5 70A breaker spaces	5		70	168	81	163	23	45		Refer to 835355 drawing E-10. Very old as-built, needs field verification and metering. LA or LB also options.
West Economy Park and Walk	99				99	0	0	TEMP 400A SES (Note 8)	291	105	400	114	95	225	1-225A Breaker	1	225	0	65	47	95	13	26	1	Refer to 941039 drawing E5 for Panel 'HA' schedule. Location shown on drawing E2.
Executive Terminal, Airport Police Bureau			9		9	2	0	Existing 'SES' (Note 8)	436	157	600		NA	600	1 Spare 100A breaker on 208/120V panel	1	100	0	29	14	29	4	8		Refer to 1900023 drawing E1.1. Need to verify this spare is viable. Metering required on SES. E2.1 for SES location.
Facilities & Service Building		11	11		22	18	2	Buckeye 'SES'	1337	1136	3000		NA	3000	3 3-ph 200A spares, 5 3-ph 225A spaces	8	200	225	1147	574	1147	159	318		Refer to 160000018 drawing E2.02 for location of panels, E4.01 for one-line. Panel sched on E5.01. Should be room.
Command Center Building		4	4		8	2	0														0		0		
COPS3-H1								Existing Panel 'COPS3-H1'	285	237	400	117	97	400	10 spare single-phase 20A breakers	12	20	0	53	49	97	13	27		Refer to 17000048 drawings ES01-01, ES01-02, & E10-02. Need to verify COP3-H1 location. COPS3-HDP1 is also viable.
COPS3-HDP1								Existing Panel 'COPS3-HDP1'	352	293	600	476	395	600	2 unidentified spares (slots 5 and 6)	2	0	225	299	147	293	41	81		Refer to 17000048 drawings ES01-01, ES01-02, & E10-02.
AVN HQ Building		13	13		26	22	0	Existing Switchboard 'DSCCB1'	630	523	800	18	15	400	Plenty of space, assumed for 8-100A, 3P	8	0	100	532	262	523	72	145		Refer to Sky Harbor PV1 Project 1, drawings E-1100 & E-2000
Future 24th St. Station	165				165	0	0	Existing Panel '24-SHD2'	Insufficient Capacity			115	96	200	11 spare three-phase 20A breakers	11	20	0	146					1	Refer to RFI-3036 drawing B05-TKEL1001 for panel schedules, TKEL0201 for locations. Need info on 24-SDH1 spares.
DCS Building Employee Parking Lot		12	12		24	1	0	Existing Panel 'MDP'/Old SES	Insufficient Capacity				NA	800	1-200A 3p, 1-60A 3p, & 2-30A 3p	1	200	0	133						Refer to DCS Parking 8000002 drawings E05 & E1.1. Assumed 200A breaker being used. Need to verify MDP location.
West Ground Transportation Lot					0	0	0	Existing Panel 'GTH1'	Insufficient Capacity			85	71	200	22 spare 1-phase breakers (Note 13)	1	0	100	67					1	Refer to 10000011 drawing B01-AGEL0901 for panel schedules, locations on B01-AGEL0401. SES would be better.
Rental Car Center							16	SES-2' (Note 16)	2346	1950	3000		NA	3000	7 to 9 spaces on this SES (Note 16)	3	0	400	798	399	798	111	221	14	Refer to 15000013 E14.1 drawings for SES-2 one-lines. Refer to E18.5 for section view showing spaces.
Rental Car Center Employee Parking Lot			2		2	1	0	Existing Panel 'HCPA'	193	160		180	150	225	4 spaces for 100A breakers	4		100	154	77	154	21	43		Refer to 15000013 drawing E1.2.1 for panel locations. E17.1 for panel schedule for HCPA.
Grand Total	**1,784**	**46**	**911**	**0**	**2,741**	**46**	**42**												**7,612**	**3,572**	**7,145**	**989**	**1,979**		

Footnotes:

1 480V electrical infrastructure evaluated will be prioritized in the capacity evaluation, as these panels will have higher ratings, larger spare breakers, and allows for the implementation of a new EV charger dedicated panel to support larger clusters of EV chargers.
2 Assumed L2 EVSE, maximum output power of 6.5kW per port.
3 Permanent adoption of LM will allow 2-3x+ more EVSE ports for a given area by reducing the charger outputs by 50-67%, respectively. For areas with sufficient capacity for EVSE clusters, a factor of 2.5 will be used to illustrate the benefits. For areas with deficient capacity, a more aggressive factor of 3 will be used.
4 Current assumptions exclude feeders to EVSE clusters, new 120/208V panels, and step-down transformers. This will be required for all clusters that will be supported by existing 480V EVSE. Clusters supported by 208V or 240V infrastructure will not require a step-down transformer.
5 30-day metering will be required to determine existing capacity of existing equipment. Upstream panels, feeders, and transformers may also need to have their available capacaties evaluated to ensure the additional EV charging load can be support.
6 Available capacity based on connected load documented in the most recent set of drawings available. 30-day metering will be required moving forward on indicated panel and upstream equipment, if any.
7 Assumed L1 EVSE, maximum output power of 1.8kW per port. Pending verification of metered peak demand data when not readily available at the time of this report.
8 120/208V
9 Spare breakers must be field verified.
10 Based on AVN 2030 medium implementation targets for EV-capable Public and Employee parking stalls. Low implemenation level is 50% of medium implementation. High implementation in 200% of medium implementation. Even distribution of parking stalls assumed.
11 Available capacity based on calculated load, unless otherwise specified. To be updated with metered load data, when metered data is acquired.
12 Capacity calculated based on available spare breaker capacity and panel/as-built indicated loads (whichever is smaller). To be updated with load study calculation information based on metered data.
13 If 50kW output DC fast chargers are implemented at the West GT Lot, the spare single-phase 20A breakers will need to be replaced with larger 3-phase breakers to support individual chargers. The upstream SES would be a much more viable candidate to support these, but appears to have no more spares according to B01-AGEL1002.
14 Assumes 50kW per each DC Fast Charger Parking stall. DC Fast Chargers can output power at levels of 150-350kW depending on type of charger installed. Larger panels/switchboards and breakers will be required to support these stalls if higher outputs are implemented.
15 An efficient option to provide the target of 6 additional EV Charging stalls at the Operations building. If consirably more are desired, recommend using another source. Verify upstream SES can support additional EV chargers. Meter SES to determine available capacity.
16 Field verify/coordinate with Skyharbor that additional breakers can be installed in the spaces indicated on E18.5 of 150000013 as-built. Assumes three 400A breakers can be installed, each to serve a third of the RCC. Meter SES-2 to determine if more/larger breakers can be used.
17 If 50kW output DC fast chargers are implemented at the East Lot, the spare single-phase 20A breakers will need to be replaced with larger 3-phase breakers to support individual chargers. The upstream SES would be a much more viable candidate to support these, if desired.
18 If 50kW output DC fast chargers are implemented at the 44th Lot, the spare single-phase 20A breakers will need to be replaced with larger 3-phase breakers to support individual chargers. Larger upstream infrastructure may be required to support these, if desired.
19 Infrastructure refers directly to breaker spares and breaker space on existing panels that can support Electric Vehicle Charging. If breaker spares or breaker space cannot be identified, overall panel ratings are used. Refer to Column M for more detailed information on available spare breakers and breaker space.
20 Refer to Load Calculation for calculated available capacity based on metered data.

EAST ECONOMY PARKING GARAGE A

PANEL/SWITCHBOARD/SES	NOTES
NEW SES/SES-C	Located on the east side of Garage A. Section 5 of this SES appears to be all empty space, can be used to support new Panels throughout Garage A. Installing breakers in the SES space involves temporarily shutting down the SES. Involves running conduit along the exterior of the garage or boring through floors to get to the upper floors. Meter No. EW7206.

INFRASTRUCTURE EVALUATION

LOAD STUDY - NEW SES/SES-C

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
3000	458	1942
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	381	1614
EQUIPMENT RATING (KVA)		
2494		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	807.2
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	1614.5
MAX # OF L2 CHARGERS (NOTE 3):	248.4
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	496.8
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - NEW SES/SES-C

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (SECT. 5, SIZES ASSUMED)	3	480	3	800	1995
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				1596	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	798.1
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	1596.2
MAX # OF L2 CHARGERS (NOTE 3):	245.6
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	491.1
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

EAST ECONOMY PARKING GARAGE B

PANEL/SWITCHBOARD/SES	NOTES
Distribution Board 'DB1'	DB1 has good space available, seems relatively lightly loaded, and is a 600A board at 480V. Future APMS indicated on page E8.0 of 15000016 appear to have never been installed. If EV charging stall targets can be met using the capacity available on this distribution board, then this would be the most ideal infrastructure to use between Garage A and B.
Panel 'H1'	Subfed by DB1, located in the same electrical room. Can be used if necessary, though with the space available on DB1 there should be no issue with maximizing the available capacity and space on DB1.
SES-A	Limited space available on this SES, likely only room for 1-100AF breaker to be installed. If DB1 falls just short of being able to meet the EV charger implementation targets for Garage B, then this can be utilized to support additional chargers. If the combination of DB1 and SES-A cannot meet EV charger implementation targets, then recommend using the SES at Garage A to outfit that garage with EV chargers. Meter No. CK2066.
Panels 'HP1' & 'LP1'	Panels not viable due to size and limited breaker spaces.

INFRASTRUCTURE EVALUATION

LOAD STUDY - DISTRIBUTION BOARD 'DB1'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
600	15	465
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	13	386
EQUIPMENT RATING (KVA)		
499		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	193.0
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	386.1
MAX # OF L2 CHARGERS (NOTE 3):	59.4
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	118.8
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - DISTRIBUTION BOARD 'DB1'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (SIZES ASSUMED)	3	480	3	150	374
SPACE (SIZES ASSUMED)	3	480	3	60	150
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				419	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	209.5
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	419.0
MAX # OF L2 CHARGERS (NOTE 3):	64.5
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	128.9
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - SES-A

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
1600	95.6	1184.4
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	79.5	984.6
EQUIPMENT RATING (KVA)		
1330		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	492.3
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	984.6
MAX # OF L2 CHARGERS (NOTE 3):	151.5
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	303.0
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES-A

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (SIZES ASSUMED)	1	480	3	100	83
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				67	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	33.3
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	66.5
MAX # OF L2 CHARGERS (NOTE 3):	10.2
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	20.5
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

EAST ECONOMY LOT

PANEL/SWITCHBOARD/SES	NOTES
Panel 'H1'	Panel could not be located during sitewalk. Possibly removed.
NEW SES-2/SES-B	Located on the west side of Garage A. Is backed up by 600kW EM generator. Not much info that could be identified in the field. Appears to have been modified since C09-TPEB101A. Additionally, this infrastructure is on the North side of the roadway, a distance from the larger lot on the south side. New SES to the southwest would be a good approach.

INFRASTRUCTURE EVALUATION

LOAD STUDY - NEW SES-2/SES-B

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
800		
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480		
EQUIPMENT RATING (KVA)		
665		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - NEW SES-2/SES-B

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (TBD)	TBD	480	3	TBD	#VALUE!
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				#VALUE!	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

44TH STREET EMPLOYEE PARKING LOT

PANEL/SWITCHBOARD/SES	NOTES
Panels '44-PL-H1' & '44-PL-L1'	44-PL-H1 operated at 480V and is rated for 400A. 44-PL-L1 rated for 100A and is partially loaded. To provide a higher quantity of EV chargers, recommend using 44-PL-H1 to subfeed a new stepdown transformer/208V panel to support new chargers. There is adequate room for new transformer and panel in the area. Viable strategy would be installing a 200AF breaker (depending on results of load study and existing breaker arrangement/space). If capacity is not adequate, then 44-PL-H2 isn't viable either and a new SES will be required to meet targets.
Panels '44-PL-H2' & '44-PL-L2'	44-PL-H2 is subfed by 44-PL-H1. If spare breakers/breaker space is not adequate on 44-PL-H1, then the spare infrastructure at this location can be used. Can also be used to reduce voltage drop. Likely will require either linking three 1ϕ, 20A breakers or removing two for a larger 120/240V breaker or three for a larger 120/208V breaker. 44-PL-L2 is loaded to near capacity with EV chargers near the panels and transformer. If used, same approach as described for 44-PL-H1 should be taken. Space for new panel and transformer is more limited, but should permit new installation.

INFRASTRUCTURE EVALUATION

LOAD STUDY - PANEL '44-PL-H1'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
400	137	183
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	115	151
EQUIPMENT RATING (KVA)		
333		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	75.5
MAX # OF L1 CHARGERS (NOTE 2):	151.0
MAX # OF L2 CHARGERS (NOTE 3):	23.2
MAX # OF L2 CHARGERS (NOTE 2):	46.5
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL '44-PL-H1'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (SLOTS 25,27,29)	1	480	3	200	166
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				133	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	66.5
MAX # OF L1 CHARGERS (NOTE 2):	133.0
MAX # OF L2 CHARGERS (NOTE 3):	20.5
MAX # OF L2 CHARGERS (NOTE 2):	40.9
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - PANEL '44-PL-H2'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
200	130.1	29.9
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	108.2	24.8
EQUIPMENT RATING (KVA)		
166		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	12.4
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	24.8
MAX # OF L2 CHARGERS (NOTE 3):	3.8
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	7.6
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL '44-PL-H2'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (MULT. LOCATIONS WORK)	1	480	3	100	83
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				67	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	33.3
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	66.5
MAX # OF L2 CHARGERS (NOTE 3):	10.2
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	20.5
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

T4 PARKING GARAGE	
PANEL/SWITCHBOARD/SES	**NOTES**
SES-TB3A	Located at base of T4 garage. Based breaker space provisions indicated on one-line of T4 Parking Garage as-built, page E-501 and preliminary site survey evaluation, there is roughly space for 2-400AF breakers, 2-200AF breakers, 2-100AF breakers, and 4-60AF breakers across various sections of the SES. There is potentially room for more depending on more in depth field vericiation work to determine the quantity of breakers that can be installed in the SES space provisions. Involves running new conduit up the garage to charger panel locations. Meter No.

INFRASTRUCTURE EVALUATION

LOAD STUDY - SES-TB3A

EQUIPMENT RATING (AMPS)	**METERED PEAK DEMAND (AMPS, PF: 0.9)**	**AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)**
3000	507	1893
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	421	1574
EQUIPMENT RATING (KVA)		
2494		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	787.0
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	1573.9
MAX # OF L2 CHARGERS (NOTE 3):	242.1
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	484.3
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES-TB3A

BREAKER SPACE/SPARE	**QUANTITY**	**VOLTAGE (V)**	**# OF PHASES**	**SIZE (A)**	**CAPACITY (KVA)**
SPACE	2	480	3	400	665
SPACE	2	480	3	200	333
SPACE	2	480	3	100	166
SPACE	4	480	3	60	200
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				532	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	266.0
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	532.1
MAX # OF L2 CHARGERS (NOTE 3):	81.9
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	163.7
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

RAC GARAGE

PANEL/SWITCHBOARD/SES	NOTES
SES-AWT-1	SES outside at base of T4 Garage that can potentially be used for T4, RAC Garage, or High Profile Lot EV chargers. Located next to SES-AWT-2. Existing space could not be verified in the field. TBD when additional as-built info is provided.
SES-AWT-2	SES outside at base of T4 Garage that can potentially be used for T4, RAC Garage, and/or High Profile Lot EV chargers. Located next to SES-AWT-1. Existing space could not be verified in the field. TBD when additional as-built info is provided.

INFRASTRUCTURE EVALUATION

LOAD STUDY - SES-AWT-1

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
2500		
3ϕ VOLTAGE	METERED PEAK DEMAND (KVA, PF: 0.9)	AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)
480		
EQUIPMENT RATING (KVA)		
2078		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES-AWT-1

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (TBD)	TBD	480	3	TBD	#VALUE!
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				#VALUE!	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - SES-AWT-2

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
2500		
3ϕ VOLTAGE	METERED PEAK DEMAND (KVA, PF: 0.9)	AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)
480		
EQUIPMENT RATING (KVA)		
2078		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES-AWT-2

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (TBD)	TBD	480	3	TBD	#VALUE!
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				#VALUE!	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

T3 ANNEX	
PANEL/SWITCHBOARD/SES	NOTES
Panel 'HC'	200A Panel, space on HC beyond slots 23/24. Existing breakers are 30/40A, 3-phase. Likely subfeed a small 208V EV charger panel from a 40A breaker. EV charging targets here are lower than other locations.
Upstream 'SES'	APS Meter #W96997, potentially some space at the bottom for a new ~200A breaker.

INFRASTRUCTURE EVALUATION

LOAD STUDY - PANEL 'HC'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
200		
3ϕ VOLTAGE	METERED PEAK DEMAND (KVA, PF: 0.9)	AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)
480		
EQUIPMENT RATING (KVA)		
166		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'HC'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARE	2	480	3	40	67
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				53	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	26.6
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	53.2
MAX # OF L2 CHARGERS (NOTE 3):	8.2
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	16.4
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - SES

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
1200	154.4	805.6
3ϕ VOLTAGE	METERED PEAK DEMAND (KVA, PF: 0.9)	AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)
480	128.3	669.8
EQUIPMENT RATING (KVA)		
998		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	334.9
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	669.8
MAX # OF L2 CHARGERS (NOTE 3):	103.0
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	51.5
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE	1	480	3	200	166
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				133	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	66.5
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	133.0
MAX # OF L2 CHARGERS (NOTE 3):	20.5
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	40.9
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

T3 PARKING GARAGE

PANEL/SWITCHBOARD/SES	NOTES
SES-A1/A2 & A1/A2 Distribution Board	Likely has space, but is located in the terminal and is a considerable distance from the garage. To avoid high distribution costs, this should only be used if existing downstream infrastructure lacks capacity and/or spare breakers/breaker space. SES-A1 Meter No. CW8897.
Distribution Board 'GHDB1'	Fed from SES A2, and feeds the GH panels on every floor of the T3 garage. Main feeds lighting loads, but also supports the existing charger panels in the garage. Previously the lights in the T3 garage were HID, but where replaced with LED alternatives. Per PHX personnelle input, this distribution board is viable to feed charger dedicated panels despite mainly supporting lighting loads. New panels can be located near electrical rooms on one or multiple floors in fenced off areas, smilar to what has been done for the existing EV charger panels. Can also use GH3, where chargers are already supported to make a floor dedicated to chargers, or other existing panels labeled as 'GHX'.
Panel 'GH3'	Fed from GHDB1. Load reduced due to HID replacement with LED alternatives. Is a lighting/signage panel, but also feeds a 100/3 EV panel via transformer, powering the existing EV chargers. Meter this panel, or the same panels on the other floors of the parking garage that are targets for floor-wide EV charger stall implementation. Can be used to minimize distribution costs from 'GHDB1'. 125AF Main may require upsizing. 12 space slots.

INFRASTRUCTURE EVALUATION

LOAD STUDY - DISTRIBUTION BOARD GHDB1

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
800	151.3	488.8
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	125.7	406.3
EQUIPMENT RATING (KVA)		
665		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	203.2
MAX # OF L1 CHARGERS (NOTE 2):	406.3
MAX # OF L2 CHARGERS (NOTE 3):	62.5
MAX # OF L2 CHARGERS (NOTE 2):	125.0
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - DISTRIBUTION BOARD GHDB1

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE	6	480	3	100	499
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				399	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	199.5
MAX # OF L1 CHARGERS (NOTE 2):	399.1
MAX # OF L2 CHARGERS (NOTE 3):	61.4
MAX # OF L2 CHARGERS (NOTE 2):	122.8
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - PANEL 'GH3'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
225	108.2	71.8
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	89.9	59.7
EQUIPMENT RATING (KVA)		
187		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	29.9
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	59.7
MAX # OF L2 CHARGERS (NOTE 3):	9.2
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	18.4
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'GH3'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE (MULT. LOCATIONS WORK)	2	480	3	100	166
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				133	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	66.5
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	133.0
MAX # OF L2 CHARGERS (NOTE 3):	20.5
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	40.9
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - SES-A1

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
3000	763.3	1636.8
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	634.5	1360.7
EQUIPMENT RATING (KVA)		
2494		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	680.4
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	1360.7
MAX # OF L2 CHARGERS (NOTE 3):	209.3
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	418.7
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES-A1

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
NA	NA	NA	NA	NA	NA
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				NA	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	NA
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	NA
MAX # OF L2 CHARGERS (NOTE 3):	NA
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	NA
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

OPERATIONS BUILDING

PANEL/SWITCHBOARD/SES	NOTES
Panel 'P1B'	Could not locate panel. Referenced from an older as-built. Not on newer drawings.
Existing Operations SES	1000A, 120/208V SES. Currently supports downstream panel that powers existing EVs. Appears to not have any spare breakers or breaker space.
Panel 'T2 Chargers'	Panel 'T2 Chargers', can potentially support some additional chargers.
SES - Operation Annex Trailers	600A, 120/208V SES. Appears to not have any spare breakers or breaker space.
Proposed APS Service	Unless a panel downstream the Existing Operations SES is not in use, a new SES will be needed to support a meaningful quantity of EV chargers. If charger targets at this location are low, can potentially use Panel P1A and/or P2A.

INFRASTRUCTURE EVALUATION

LOAD STUDY - EXISTING OPERATIONS SES

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
1000	374.0	426.0
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
208	134.7	153.5
EQUIPMENT RATING (KVA)		
360		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	76.8
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	153.5
MAX # OF L2 CHARGERS (NOTE 3):	23.6
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	47.2
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - EXISTING OPERATIONS SES

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
NONE	NA	NA	NA	NA	#VALUE!
					CAPACITY (KVA)
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)					#VALUE!

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	NA
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	NA
MAX # OF L2 CHARGERS (NOTE 3):	NA
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	NA
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - PANEL 'T2 CHARGERS'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
200		
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
208		
EQUIPMENT RATING (KVA)		
72		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'T2 CHARGERS'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
BOTH	12	208	1	20	50
					CAPACITY (KVA)
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)					40

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

WEST ECONOMY GARAGE

PANEL/SWITCHBOARD/SES	NOTES
T2GSES	Older SES, next to no space on it. Recommend using downstream panels as much as possible. 800A SES. Meter No. 1367360.
Panel 'LB'	Old 125A, 480/277V panel. Some space available, but panel is small and old. Recommend other options.
Panel 'CH1L'	Subfed by Panel 'LB'. Lots of space, can use if absolutely necessary to hit targets.100A, 208V.
Panel 'LD'	Most suitable option. 480/277V, 250A. Subfeeds panel T2, but otherwise has a lot of space. Received input that the chargers the downstream panels feeds aren't in service now. Space on slots 21, 23, & 25-42. Can install one or more 100A, 3 ϕ breakers to subfeed new transformers to support charger dedicated 208V panels.

INFRASTRUCTURE EVALUATION

LOAD STUDY - PANEL 'LD'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
250	4.43	195.58
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	3.68	162.59
EQUIPMENT RATING (KVA)		
208		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	81.3
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	162.6
MAX # OF L2 CHARGERS (NOTE 3):	25.0
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	50.0
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'LD'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE	5	480	3	70	291
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				233	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	116.4
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	232.8
MAX # OF L2 CHARGERS (NOTE 3):	35.8
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	71.6
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - SES T2GSES

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
800	202.6	437.4
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	168.5	363.6
EQUIPMENT RATING (KVA)		
665		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	181.8
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	363.6
MAX # OF L2 CHARGERS (NOTE 3):	55.9
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	111.9
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES T2GSES

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
NA	NA	NA	NA	NA	#VALUE!
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				#VALUE!	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	NA
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	NA
MAX # OF L2 CHARGERS (NOTE 3):	NA
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	NA
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

WEST ECONOMY PARK & WALK

PANEL/SWITCHBOARD/SES	NOTES
SES-TEMP 400A	Small 400A, 208V SES at the end of the parking lot with one 225AF provision. Meter No. ET0717.
New SES	If the 400A Temp SES can't be used, a new SES will be required if EV chargers are to be implemented.

INFRASTRUCTURE EVALUATION

LOAD STUDY - TEMP 400A SES

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
400	109.6	210.4
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
208	39.5	75.8
EQUIPMENT RATING (KVA)		
144		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	37.9
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	75.8
MAX # OF L2 CHARGERS (NOTE 3):	11.7
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	23.3
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - TEMP 400A SES

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE	1	208	3	225	81
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				65	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	32.4
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	64.8
MAX # OF L2 CHARGERS (NOTE 3):	10.0
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	20.0
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

EXECUTIVE TERMINAL

PANEL/SWITCHBOARD/SES	NOTES
NEW SES	600A, 208/120V SES. Potentially has some space. Could not access downstream panels. Additionally, EV charging implementation at this location is lower priority. Meter No. CK0625.

INFRASTRUCTURE EVALUATION

LOAD STUDY - NEW SES

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
600	163	317
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
208	59	114
EQUIPMENT RATING (KVA)		
216		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	57.1
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	114.3
MAX # OF L2 CHARGERS (NOTE 3):	17.6
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	35.2
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - NEW SES

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE	1	208	3	60	22
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				17	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	8.6
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	17.3
MAX # OF L2 CHARGERS (NOTE 3):	2.7
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	5.3
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

FACILITIES & SERVICES BUILDING

PANEL/SWITCHBOARD/SES	NOTES
2515 E. BUCKEYE SES	2000A, 480V SES. 3-200AF Spare breakers with provisions for 5-225AF breakers. Can be used to subfeed charger dedicated panels. Meter No. EU6285.
RELOCATED 800A SES IN REMOTE LOT	800A, 480/277V. Previously served crane loads that no longer exist. SES is essentially full of spare breakers. Viable candidate to serve chargers in the remote lot near the F&S Building. Meter No. R80549.
PANEL '2HP2'	Panel not viable for chargers due to location in building and limited space. Recommendation of PHX to use the building SES to install new EV charger dedicated panels.

INFRASTRUCTURE EVALUATION

LOAD STUDY - 2515 E. BUCKEYE SES

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
2000	233.5	1366.5
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	194.1	1136.0
EQUIPMENT RATING (KVA)		
1663		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	568.0
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	1136.0
MAX # OF L2 CHARGERS (NOTE 3):	174.8
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	349.6
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - 2515 E. BUCKEYE SES

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARE	3	480	3	200	499
SPACE	5	480	3	225	935
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				1147	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	573.6
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	1147.3
MAX # OF L2 CHARGERS (NOTE 3):	176.5
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	353.0
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - RELOCATED 800A SES

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
800	13.73	626.27
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	11.41	520.66
EQUIPMENT RATING (KVA)		
665		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	260.3
MAX # OF L1 CHARGERS (NOTE 2):	520.7
MAX # OF L2 CHARGERS (NOTE 3):	80.1
MAX # OF L2 CHARGERS (NOTE 2):	160.2
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - RELOCATED 800A SES

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARE	3	480	3	400	998
SPACE	1	480	3	20	17
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				811	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)	
MAX # OF L1 CHARGERS (NOTE 1):	405.7
MAX # OF L1 CHARGERS (NOTE 2):	811.4
MAX # OF L2 CHARGERS (NOTE 3):	124.8
MAX # OF L2 CHARGERS (NOTE 2):	249.7
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

COMMAND CENTER

PANEL/SWITCHBOARD/SES	NOTES
Panel COPS3-HDP1	2-225AF spare breakers per site survey and panel schedule. Is backed up by emergency power. SES must be evaluated to determine if addition of EV chargers will exceed generator capacity.
Panel COPS3-H1	Subfed by COPS3-HDP1. Is backed up by emergency power. SES must be evaluated to determine if addition of EV chargers will exceed generator capacity. 7 spare 1ϕ, 277V breakers, slots 25-35 odd and 36. Assuming replacing 6 of the 20A breakers with two 3-phase, 60A breakers.
SES N-SG1	Peak demand over a period of 1 year must be evaluated to ensure emergency generator capacity is adequate to support additional EV charger load. Meter No. CN6206.

INFRASTRUCTURE EVALUATION

LOAD STUDY - PANEL 'COPS3-HDP1'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
600	306	174
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	254	145
EQUIPMENT RATING (KVA)		
499		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	72.3
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	144.7
MAX # OF L2 CHARGERS (NOTE 3):	22.3
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	44.5
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'COPS3-HDP1'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARE	2	480	3	225	374
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				299	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	149.6
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	299.3
MAX # OF L2 CHARGERS (NOTE 3):	46.0
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	92.1
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - PANEL 'COPS3-H1'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
400		
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480		
EQUIPMENT RATING (KVA)		
333		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'COPS3-H1'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARE	2	480	3	60	100
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				80	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	39.9
MAX # OF L1 CHARGERS (NOTE 2):	79.8
MAX # OF L2 CHARGERS (NOTE 3):	12.3
MAX # OF L2 CHARGERS (NOTE 2):	24.6
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

INFRASTRUCTURE EVALUATION

LOAD STUDY - SES N-SG1

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
600	199	281
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	165	234
EQUIPMENT RATING (KVA)		
499		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	117.0
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	234.0
MAX # OF L2 CHARGERS (NOTE 3):	36.0
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	72.0
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES N-SG1

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
NA	NA	NA	NA	NA	#VALUE!
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				#VALUE!	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	NA
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	NA
MAX # OF L2 CHARGERS (NOTE 3):	NA
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	NA
MAX # OF DCFC CHARGERS (NOTE 4):	NA
NOTES	
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

AVN HQ BUILDING

PANEL/SWITCHBOARD/SES	NOTES
SES-CCB1	Upstream SES feeding viable downstream panels/switchboards. Meter No. 1183976.
Distribution Switchboard 'DSCCB1'	800A, 480V. Fed by SES-CCB1, feeds viable downstream panels/switchboards. Has space.
Panel '1HA'	400A, 480/277V panel with 1ϕ-20A spares on 7, 9, 11, 13-28. Space for 3ϕ breakers between slots 29-42 for 100A breakers. Most suitable panel to feed charger dedicated panels for the parking lot.
Panels '1LGA' & '1LWA'	Panel '1LWA' is 200A, 208/120V, largely full of 1ϕ, 20A breakers in use. Some 1ϕ, 20A spares at the bottom of the panel. Some have been repurposed for EV chargers, indicating this panel might not have adequate space to accomodate more. Chargers are fed directly by 1ϕ, 20A breakers. Fed by Switchboard 'DSCCB1', viable if Panel '1HA' can't be used. Subfeeds Panel '1LGA' (100A, 208/120V).

INFRASTRUCTURE EVALUATION

LOAD STUDY - SWITCHBOARD 'DSCCB1'					
EQUIPMENT RATING (AMPS)	**METERED PEAK DEMAND (AMPS, PF: 0.9)**		**AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)**		
800	170.4		640		
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**		**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**		
480	141.6		390.4		
EQUIPMENT RATING (KVA)					
665					
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	195.2				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	390.4				
MAX # OF L2 CHARGERS (NOTE 3):	60.1				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	120.1				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				
SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL '1HA'					
BREAKER SPACE/SPARE	**QUANTITY**	**VOLTAGE (V)**	**# OF PHASES**	**SIZE (A)**	**CAPACITY (KVA)**
SPACE	7	480	3	100	582
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				466	
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	232.8				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	465.6				
MAX # OF L2 CHARGERS (NOTE 3):	71.6				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	143.2				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				

INFRASTRUCTURE EVALUATION

LOAD STUDY - SES-CCB1					
EQUIPMENT RATING (AMPS)	**METERED PEAK DEMAND (AMPS, PF: 0.9)**		**AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)**		
2000	585.3		1014.7		
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**		**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**		
480	486.6		843.6		
EQUIPMENT RATING (KVA)					
1663					
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	421.8				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	843.6				
MAX # OF L2 CHARGERS (NOTE 3):	129.8				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	259.6				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				
SPARE BREAKER/BREAKER SPACE CAPACITY - SES-CCB1					
BREAKER SPACE/SPARE	**QUANTITY**	**VOLTAGE (V)**	**# OF PHASES**	**SIZE (A)**	**CAPACITY (KVA)**
NA	NA	NA	NA	NA	#VALUE!
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				#VALUE!	
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	NA				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	NA				
MAX # OF L2 CHARGERS (NOTE 3):	NA				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	NA				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				

INFRASTRUCTURE EVALUATION

LOAD STUDY - PANEL '1LWA'					
EQUIPMENT RATING (AMPS)	**METERED PEAK DEMAND (AMPS, PF: 0.9)**		**AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)**		
200					
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**		**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**		
208					
EQUIPMENT RATING (KVA)					
72					
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):					
MAX # OF L1 CHARGERS WITH LM (NOTE 2):					
MAX # OF L2 CHARGERS (NOTE 3):					
MAX # OF L2 CHARGERS WITH LM (NOTE 2):					
MAX # OF DCFC CHARGERS (NOTE 4):					
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				
SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL '1LWA'					
BREAKER SPACE/SPARE	**QUANTITY**	**VOLTAGE (V)**	**# OF PHASES**	**SIZE (A)**	**CAPACITY (KVA)**
SPACE	16	120	1	20	38
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				31	
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):					
MAX # OF L1 CHARGERS WITH LM (NOTE 2):					
MAX # OF L2 CHARGERS (NOTE 3):					
MAX # OF L2 CHARGERS WITH LM (NOTE 2):					
MAX # OF DCFC CHARGERS (NOTE 4):					
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				

24TH STREET STATION	
PANEL/SWITCHBOARD/SES	NOTES
24-MSB-1	Could not field verify. Subfeeds Panel '24-SDH1'. In 24th St. Station Elec Room TBST131.
Panel '24-SDL2'	Located near parking lot that would have EV chargers installed. As-builts are very recent, thus the calculated load is being used for the load study on this panel (per RFI #3606). Would be using the abundant SPARE 120V, 20A breakers to feed individual L1 EV chargers, or linking together for L2s.
Panel '24-SDL3'	Located near parking lot that would have EV chargers installed. As-builts are very recent, thus the calculated load is being used for the load study on this panel (per RFI #3606). Would be using the abundant SPARE 120V, 20A breakers to feed individual L1 EV chargers, or linking together for L2s.
Panel '24-SDH1'	Could not be field verified. 600A, 480V. Subfeeds '24-SDH2'. Panel is already 84.8% loaded. In order to implement EV chargers using either '24-SLD2' or '24-SLD3', the rest of the capacity of this panel would need to be exhausted. This is the bottleneck for this location, unless a new SES is installed for the new chargers.
Panel '24-SDH2'	Could not be field verified. Subfed by '24-SDH1'. 200A, 480V. 11 spare 3ϕ-20A, 480V breakers according to as-built. If these are already spares, it appears as though there is no more space on the panel and 20amp breakers are not suitable for subfeeding a larger panel downstream. recommend using either '24-SLD3' or '24-SLD2' instead.

INFRASTRUCTURE EVALUATION					
LOAD STUDY - PANEL '24-SDL2'					
EQUIPMENT RATING (AMPS)	CALCULATED PEAK DEMAND (AMPS, PF: 0.9)		AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)		
400	161.3		158.7		
3ϕ VOLTAGE	CALCULATED PEAK DEMAND (KVA, PF: 0.9)		AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)		
208	58.13		57.15		
EQUIPMENT RATING (KVA)					
144					
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	28.6				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	57.2				
MAX # OF L2 CHARGERS (NOTE 3):	8.8				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	17.6				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				
SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL '24-SDL2'					
BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARE	19	120	1	20	46
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				36	
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	18.2				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	36.5				
MAX # OF L2 CHARGERS (NOTE 3):	5.6				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	11.2				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				

INFRASTRUCTURE EVALUATION					
LOAD STUDY - PANEL '24-SDH2'					
EQUIPMENT RATING (AMPS)	CALCULATED PEAK DEMAND (AMPS, PF: 0.9)		AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)		
200	85.2		74.8		
3ϕ VOLTAGE	CALCULATED PEAK DEMAND (KVA, PF: 0.9)		AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)		
480	70.73		62.3		
EQUIPMENT RATING (KVA)					
166					
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	31.1				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	62.3				
MAX # OF L2 CHARGERS (NOTE 3):	9.6				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	19.2				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				
SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL '24-SDH2'					
BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
NA	NA	NA	NA	NA	#VALUE!
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				#VALUE!	
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	NA				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	NA				
MAX # OF L2 CHARGERS (NOTE 3):	NA				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	NA				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				

INFRASTRUCTURE EVALUATION					
LOAD STUDY - PANEL '24-SDL3'					
EQUIPMENT RATING (AMPS)	CALCULATED PEAK DEMAND (AMPS, PF: 0.9)		AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)		
225	110		70		
3ϕ VOLTAGE	CALCULATED PEAK DEMAND (KVA, PF: 0.9)		AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)		
208	39.6		25.2		
EQUIPMENT RATING (KVA)					
81					
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	12.6				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	25.2				
MAX # OF L2 CHARGERS (NOTE 3):	3.9				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	7.8				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				
SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL '24-SDL3'					
BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARE	20	120	1	20	48
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				38	
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	19.2				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	38.4				
MAX # OF L2 CHARGERS (NOTE 3):	5.9				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	11.8				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				

INFRASTRUCTURE EVALUATION					
LOAD STUDY - PANEL '24-SDH1'					
EQUIPMENT RATING (AMPS)	CALCULATED PEAK DEMAND (AMPS, PF: 0.9)		AVAILABLE CAPACITY (AMPS, FULL RATINGS USED)		
600	509		91		
3ϕ VOLTAGE	CALCULATED PEAK DEMAND (KVA, PF: 0.9)		AVAILABLE CAPACITY (KVA, FULL RATINGS USED)		
480	422.7		76		
EQUIPMENT RATING (KVA)					
499					
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	38.1				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	76.1				
MAX # OF L2 CHARGERS (NOTE 3):	11.7				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	23.4				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				
SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL '24-SDH1'					
BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
NA	NA	NA	NA	NA	#VALUE!
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				#VALUE!	
EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)					
MAX # OF L1 CHARGERS (NOTE 1):	NA				
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	NA				
MAX # OF L2 CHARGERS (NOTE 3):	NA				
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	NA				
MAX # OF DCFC CHARGERS (NOTE 4):	NA				
NOTES					
1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.				
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.				
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)				
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.				
5	Maximum number of chargers assumes only that type of charger is implemented.				

DCS BUILDING EMPLOYEE PARKING LOT	
PANEL/SWITCHBOARD/SES	**NOTES**
SES Near DCS Building	No space on SES. Low priority area, so either provide new SES or don't implement chargers.

WEST GT LOT

PANEL/SWITCHBOARD/SES	NOTES
Old SES, converted to SWBD	400A, 480/277V switchboard. Space available, but is old and likely is low on capacity. Subfeeds 'GTH1'. For this location, New SES would be more ideal to support L2s/DCFC charger loads.
Security Building Panel 'GTH1'	200A, 480V panel. Breakers 22-42 even are 1ϕ-20A spares. Panel is likely low on capacity, but could potentially support a 60A panel for a handful of chargers. Upstream 400A SES will also need to be metered to ensure capacity is there.

INFRASTRUCTURE EVALUATION

LOAD STUDY - PANEL 'GTH1'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
200		
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480		
EQUIPMENT RATING (KVA)		
166		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'GTH1'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARES (Link 1ϕ breakers)	1	480	3	60	50
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				40	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	
MAX # OF L2 CHARGERS (NOTE 3):	
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	
MAX # OF DCFC CHARGERS (NOTE 4):	

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

RCC

PANEL/SWITCHBOARD/SES	NOTES
SES-2	3000A, 480/277V SES. SES-1&3 are dedicated for lighting and seasonal HVAC loads, making SES-2 the most ideal candidate. Assuming space for 3-1000AF breakers (could potentially install larger ones) across the three SES-2 Sections. To subfeed 3 EV charger dedicated panels, if necessary. The RCC is responsible as a tenant for their own charging infrastructure and power, thus SES-2 might be excluded from use due to being PHX infrastructure. Meter No. 91558.

INFRASTRUCTURE EVALUATION

LOAD STUDY - SES-2

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
3000	654	1746
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	544	1451
EQUIPMENT RATING (KVA)		
2494		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	725.7
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	1451.4
MAX # OF L2 CHARGERS (NOTE 3):	223.3
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	446.6
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - SES-2

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE	3	480	3	1000	2494

	CAPACITY (KVA)
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)	1995

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	997.6
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	1995.3
MAX # OF L2 CHARGERS (NOTE 3):	307.0
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	613.9
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

RCC EMPLOYEE PARKING LOT

PANEL/SWITCHBOARD/SES	NOTES
Panel 'HCPA'	200A, 480/277V. Inside the building, southwest corner, near the parking area where chargers would be installed. Can be used if the 208V Panel 'LCPA' doesn't have capacity. 2-30A, 1ϕ, 480V spare breakers available. Plenty of space available. Could subfeed a 150A panel, depending on available capacity. Subfeeds Panel 'LCPA'/
Panel 'LCPA'	200A, 208/120V. Plenty of breaker space. 2 1ϕ-20A breakers available as well. Likely can install a series of new 20A breakers to support EV chargers directly from the panel, as needed. Assumes capacity is available on the panel and upstream panel 'HCPA'

INFRASTRUCTURE EVALUATION

LOAD STUDY - PANEL 'HCPA'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
225	32.5	117.2
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
480	27.0	97.4
EQUIPMENT RATING (KVA)		
187		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	48.7
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	97.4
MAX # OF L2 CHARGERS (NOTE 3):	15.0
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	30.0
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'HCPA'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPACE	4	480	3	100	333
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				266	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	133.0
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	266.0
MAX # OF L2 CHARGERS (NOTE 3):	40.9
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	81.9
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

LOAD STUDY - PANEL 'LCPA'

EQUIPMENT RATING (AMPS)	METERED PEAK DEMAND (AMPS, PF: 0.9)	AVAILABLE CAPACITY (AMPS, MAX OF 80% EQUIPMENT RATING)
200	50.3	7.3
3ϕ VOLTAGE	**METERED PEAK DEMAND (KVA, PF: 0.9)**	**AVAILABLE CAPACITY (KVA, MAX OF 80% EQUIPMENT RATING)**
208	18.1	2.6
EQUIPMENT RATING (KVA)		
72		

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE METERED CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	1.3
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	2.6
MAX # OF L2 CHARGERS (NOTE 3):	0.4
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	0.8
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

SPARE BREAKER/BREAKER SPACE CAPACITY - PANEL 'LCPA'

BREAKER SPACE/SPARE	QUANTITY	VOLTAGE (V)	# OF PHASES	SIZE (A)	CAPACITY (KVA)
SPARES/SPACE	30	208	3	20	216
				CAPACITY (KVA)	
TOTAL AVAILABLE BREAKER CAPACITY (MAX OF 80% BREAKER CAPACITY)				173	

EV CHARGER IMPLEMENTATION CAPABILITIES (BASED ON AVAILABLE BREAKER CAPACITY) (NOTE 5)

MAX # OF L1 CHARGERS (NOTE 1):	86.5
MAX # OF L1 CHARGERS WITH LM (NOTE 2):	172.9
MAX # OF L2 CHARGERS (NOTE 3):	26.6
MAX # OF L2 CHARGERS WITH LM (NOTE 2):	53.2
MAX # OF DCFC CHARGERS (NOTE 4):	NA

NOTES

1	L1 charger input power assumed to be 1ϕ, 208V, 2kVA per parking stall.
2	With implementation of load management, assumed at 50%. Double maximum # of chargers.
3	L2 charger input power assumed to be 1ϕ, 208V, 6.5kVA per parking stall (per BLINK PE-30KICE40)
4	DCFC chargers assumed to be 3ϕ, 480V, 300KVA per charging port for shuttle buses.
5	Maximum number of chargers assumes only that type of charger is implemented.

Appendix E
APS EV Target Estimation

APPENDIX E - APS EV TARGET ESTIMATION

Public & Employee

Location	Local SES	SES Meter #	LOW TARGET	MEDIUM TARGET	HIGH TARGET	Feeder Source	Low Target Ability to serve	Medium Target Ability to serve	High Target Ability to serve
T-4 Parking Garage	SES-AWT #1/SES-AWT #2	P98558/Q99781	340	685	1369	A	956.3	1926.6	3850.3
East Economy Garage B	SES-A/SES-C	CK2066/EW7206	175	351	701	B	492.2	987.2	1971.6
East Economy Garage A	SES-A/SES-C	CK2066/EW7206	117	234	469	B	329.1	658.1	1319.1
East Economy Surface Lot	SES-2	CK2065	181	364	726	B	509.1	1023.8	2041.9
44th St. Airline Employee	NA	NA	112	224	447	C	315.0	630.0	1257.2
West Ground Transportation ***(Potential for Level 3 chargers?)***	NA	NA	-	-	-	D	DCFC 5 MW capacity remaining on feeder source	DCFC 4.5MW capacity remaining on feeder source	DCFC 3.9MW capacity remaining on feeder source
RAC Garage	SES-AWT #1/SES-AWT #2	P98558/Q99781	28	55	111	A	78.8	154.7	312.2
T-3 Parking Garage	SES-A1/SES-A2	P98259/98530	108	217	434	H	303.8	610.3	1220.6
24th St. Station (Future)	NA	NA	82	165	329	F	230.6	464.1	925.3
West Economy Garage	T2GSES	1367360	120	239	480	G	337.5	672.2	1350.0
Aviation Headquarters Building	SES-CCB1	1183976	18	25	50	G	50.6	70.3	140.6
Facilities & Service Building	Buckeye SES/Old SES	EU6285/R80549	18	22	45	G	50.6	61.9	126.6
Operations Building	SES/ANNEX SES	1077332/1120727	6	11	22	H	16.9	30.9	61.9
Command Center Building	SES N-SG1	CN6206	4	8	15	G	11.3	22.5	42.2
West Economy Park & Walk	TEMP 400A SES	ET0717	49	99	197	G	137.8	278.4	554.1
East Cell Phone Lot ***(Potential for Level 3 chargers?)***	NA	NA	-	-	-	B	DCFC No existing capacity, project Req to provide capacity	DCFC No existing capacity, project Req to provide capacity	DCFC No existing capacity, project Req to provide capacity
Rental Car Center Employee Lot	SES-2	V91558	1	2	4	I	2.8	5.6	11.3
DCS Building	Old SES	Q20832	12	24	47	K	33.8	67.5	132.2
Executive Terminal, Airport Police Bureau	SES	CK0625	4	9	17	D	11.3	25.3	47.8
T-3 Annex Building	SES	W96997	1	3	6	H	2.8	8.4	16.9
Rental Car Center ***(Tentative: Rental Car Companies to set up separate service with APS)***	SES-2	V91558				E	N/A	N/A	N/A

DRAFT WORKING DOCUMENT - NOT FOR PUBLIC DISSEMINATION

LEGEND

LEGEND
Capacity available
No capacity available, system upgrades required

NOTE: *These capacity assumptions are based on a study conducted on 4/1/2022. These assumptions may change as other customer growth occurs on the system and capacity cannot be guaranteed until a project is initiated for a specific site. If feeder capacity becomes unavailable, additional system upgrades may be required, possibly resulting in customer cost.*

The table is intended as a guide and should not be used for final site analysis. Further study by APS will be required once specific sites are targeted for consideration.