Alternative and Renewable Fuel and Vehicle Technology Program

FINAL PROJECT REPORT

UPSTATE PLUG-IN ELECTRIC VEHICLE READINESS PROJECT

Prepared for: California Energy Commission

Prepared by: The City of Mt. Shasta, Siskiyou County Economic Development Council, GHD, and Schatz Energy Research Center

OCTOBER 2014

CEC-ARV-12-007

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Agreement Number: ARV-12-007

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ACKNOWLEDGEMENTS

Many individuals and organizations aided in the preparation of the Upstate California Plug-in Electric Vehicle Readiness Project and related products. Of particular note is the sustained involvement of the regional Plug-in Electric Vehicle Coordinating Council. Ongoing support and resources were provided by the County of Siskiyou, Upstate California Economic Development, and the regional investor-owned utilities, Pacific Power (PP), Pacific Gas and Electric Company (PG&E), and the Redding Electric Utility (REU). Further, the authors acknowledge the work of Jason Darrow, Jenny Zink, Anne Criss, and the informational input from Caltrans District 2 and the Shasta Regional Transportation Agency. In addition, this project would not have been possible without the input and expertise of the community leaders in Tehama, Shasta, and Siskiyou Counties. The work undertaken in this grant was made possible through an opportunity provided by the California Energy Commission.

PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007), created the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVT Program). The statute, subsequently amended by AB 109 (Núñez) Chapter 313, Statutes of 2008), authorizes the California Energy Commission to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. The Energy Commission has an annual program budget of about $100 million and provides financial support for projects that:

- Develop and improve alternative and renewable low-carbon fuels.
- Enhance alternative and renewable fuels for existing and developing engine technologies.
- Produce alternative and renewable low-carbon fuels in California.
- Decrease, on a full-fuel-cycle basis, the overall impact and carbon footprint of alternative and renewable fuels and increase sustainability.
- Expand fuel infrastructure, fueling stations, and equipment.
- Improve light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets.
- Expand infrastructure connected with existing fleets, public transit, and transportation corridors.
- Establish workforce training programs, conduct public education and promotion, and create technology centers.

The Energy Commission issued solicitation PON-10-602 on May 12, 2011 to provide funding opportunities under the ARFVT Program for California's diverse regions to develop regional PEV strategic plans that will plan for the deployment of PEV electric vehicle supply equipment (EVSE), establish best practices for "PEV-ready" building and public works guidelines, and help to streamline PEV EVSE permitting, installation, and inspection processes. To be eligible for funding under PON-10-602, the projects must also be consistent with the Energy Commission's *ARFVT Investment Plan,* updated annually. In response to PON-10-602, the recipient submitted application 12, which was proposed for funding in the Energy Commission's Notice of Proposed Awards on June 19, 2012 and the agreement was executed as ARV-11-007 on August 28th, 2012.

ABSTRACT

The purpose of the Upstate Plug-in Electric Vehicle Readiness Project was to foster greater use of plug-in electric vehicles in our three county Upstate California region by preparing a plan to support infrastructure development. To address the scope of the project, the specific aims consisted of forming a collaborative and regionally representative coordinating council, producing an objective infrastructure deployment and siting plan, and developing an education plan that encouraged fleet adoption, support by transportation boards, consumer interest, and developed guidelines to facilitate an easier permitting process of electric vehicle charging stations.

The major findings of this project suggest that infrastructure siting and deployment in the Upstate California region will demand a greater number of level 3 (DC fast charge) stations, relative to metropolitan regions, due to the relatively large and rural geographical area, a high number of vehicle miles traveled, and a high throughput of transitory vehicles along a major interstate highway corridor. Due to the collaborative nature of the project's goals the Upstate region benefited greatly from the experience, expertise and methodology developed by the North Coast Region's Plug-in Electric Vehicle readiness plan. This methodology supported an objective result of the infrastructure deployment plan through a predictive modeling program, a refined micro-siting decision matrix, and a regional charging infrastructure ownership example. This objectivity was critical to the successful result of this project because the robust rationale addressed issues of fairness that arose in our coordinating council. The successful conclusions demonstrated by this method in two regions of California suggests that it can be used for plug-in electric vehicle planning in other regions, especially for other rural communities along a major transportation corridor like Interstate 5.

Keywords: Plug-in electric vehicles, electric vehicle supply equipment, greenhouse gas reduction, on-peak, permitting, fleet vehicles, incentives, education, outreach, readiness plan, infrastructure, planning, deployment

Please use the following citation for this report:

Carter, David, Colin Sheppard, James Zoellick, Niki Brown, Logan Smith. (GHD, Schatz Energy Research Center, Siskiyou County Economic Development Council,). 2014. ***Upstate Plug-in Electric Vehicle Readiness Project.*** California Energy Commission. Publication Number: CEC-ARV-12-007.

TABLE OF CONTENTS

Acknowledgements i

ABSTRACT iii

TABLE OF CONTENTS iv

EXECUTIVE SUMMARY 1

CHAPTER 1: Introduction 3

1.1 Problem Statement 3

1.2 Goals and Objectives 3

1.3 Project Metrics 3

1.4 Geographic Scope 4

1.5 Project Team 5

1.6 Background 7

1.6.1 Plug-in Electric Vehicles and Associated Charging Equipment 7

1.6.2 Regional Characteristics 8

CHAPTER 2: Project Approach, Methods, and Results 12

2.1 Plug-in Electric Vehicle Coordinating Council 12

2.1.1 Purpose of the Upstate Plug-in Electric Vehicle Coordinating Council 12

2.1.2 Upstate PEVCC Activities and Accomplishments 12

2.2 Infrastructure Deployment Plan 14

2.2.1 Macro-Level EVSE Deployment Plan 14

2.2.2 Conclusions about Macro Level EVSE Deployment 27

2.2.3 EVSE Micro-Siting 27

2.3 Plan to Collect Data on Consumer Charging Behavior 34

2.3.1 Need 34

2.3.2 Scope of Work 35

2.3.3 Uses for Consumer Charging Behavior 35

2.3.4 Types of Consumer Charging Behavior Data 36

2.3.5 Review of Available Data Collection Technology 37

2.3.6 EVSE Charge Ratings 40
2.3.7 Plan for Data Acquisition 42
2.4 Greenhouse Gas Reduction Estimates 45
2.4.1 Greenhouse Gas Reduction Estimates - Methodology 45
2.4.2 Greenhouse Gas Reduction Estimates - Results 47
2.5 Plan to Mitigate On-Peak PEV Charging 50
2.5.1 Distribution Level Peak Demand Analysis 51
2.5.2 Site Level Peak Demand Analysis 55
2.5.3 Methods for Mitigating or Deterring On-Peak Charging 57
2.5.4 Plan for Mitigating or Deterring On-Peak Charging 58
2.6 Plan for Streamlining EVSE Permitting, Installation and Inspection 59
2.6.1 Purpose 60
2.6.2 Need 60
2.6.3 Scope of Work 60
2.6.4 Description of General EVSE Permitting Process 61
2.6.5 Current Practices for EVSE Permitting in the Upstate Region 67
2.6.6 Best Practice Examples from Other Communities 69
2.6.7 Recommendations for Streamlining EVSE Permitting in the Upstate Region 72
2.7 Plan for PEV Adoption in Fleets and Other Incentives 74
2.7.1 PEV Adoption in Fleets 74
2.7.2 Municipal Activities and Incentives to Promote PEVs 83
2.8 PEV Education and Outreach Activities 84
2.8.1 Media-Based Outreach 84
2.8.2 Outreach Events 85
2.9 Sharing Project Results 88
2.10 Upstate PEV Readiness Plan 88
CHAPTER 3: Conclusions and Recommendations 90
3.1 Assessment of Project Success 90

3.2 Conclusions and Lessons Learned..........91
3.3 Recommendations..........92
APPENDIX..........94
Acronyms..........95

EXECUTIVE SUMMARY

Siskiyou, Shasta and Tehama Counties make up the "Upstate Region of California" which is preparing for the rollout of Plug-In Electric Vehicles (PEV), in part due to California's commitment to zero emission vehicles (ZEV). In 2012, Governor Jerry Brown established aggressive PEV and infrastructure targets which call for *1.5 million* ZEVs and easy access to infrastructure for all of California by 2025. The early development of PEVs in California has focused mainly on population centers. However the goal of this project addresses the need to extend the network along primary highway corridors between metropolitan areas and by integrating the state's rural communities through education and planning.

The Upstate Region is a key participant in the expansion of the "West Coast Green Highway" through the leadership of the City of Mt. Shasta. The West Coast Green Highway is in concert with the EV Project, a $230 million US Department of Energy project to deploy electric vehicle charging infrastructure in multiple states including Washington, Oregon and California. Located at strategic points along I-5, the stations provide charging for EV from Vancouver, British Columbia to Baja, Mexico.

Working with the California Energy Commission and the City of Mt. Shasta, the Siskiyou County Economic Development Council, GHD, and Schatz Energy Research Center coordinated an effort to meet the state targets by identifying stakeholders, conducting educational outreach, composing written guides to streamline local adoption, conducting regionally specific transportation planning, and coordinating a regional advisory council. This coordinated effort has created an infrastructure deployment plan to connect electric vehicle drivers with fast charging stations between EV-friendly communities along Interstate 5 and other major roadways.

The conclusions of this planning project indicate that residents and jurisdictions in the California Upstate Region feel generally positive toward PEV infrastructure development, public charging station ownership, permitting guidelines, fleet incorporation, and future adoption. Further, local transportation commissions and regional transportation boards have embraced PEV planning strategies as a method for meeting the State of California's increasingly stringent air quality improvements and greenhouse gas reduction commitments. For every 1% increase in PEV adoption we estimate a corresponding 1% reduction in greenhouse gas production in our region. Interestingly, Upstate regional stakeholders predict a greater use of public charging stations by visiting tourists than by local residents in the near-term due to the "range-anxiety" inherent nature of commuting in a rural area. This perspective is also likely due to the initial experience of two Tesla charging stations in our region where Tesla PEV owners are primarily from the greater San Francisco bay area. The transportation planning models predict a robust adoption rate of PEVs (2% adoption or 3,500 PEVs in the Upstate region by 2020) that assumes a similar rate of adoption to that of hybrid electric vehicle growth in the consumer and fleet transportation sectors. With continued leadership from the City of Mt. Shasta, the Upstate is ready for planning implementation and PEV infrastructure development starting in 2015.

CHAPTER 1: Introduction

1.1 Problem Statement

Plug-in electric vehicles (PEVs) offer many transportation advantages over conventional petroleum fuel vehicles, however, because of fundamental differences in fueling infrastructure, the transition of adopting PEVs for transportation requires a significant investment in planning and infrastructure conversion to meet predicted future demand and prevent stranded assets. The Upstate California region represents many challenges to planning a PEV readiness project that are distinct from many metro region examples. These challenges include a relatively large and rural geographical area, a high number of vehicle miles traveled, low population density, and a high throughput of transitory vehicles along a major interstate highway corridor. To address these challenges the purpose of this project was to provide educational outreach, develop a regionally coordinated advisory team, and produce a strategic readiness plan to meet PEV transportation goals.

1.2 Goals and Objectives

As funded and outlined by the California Energy Commission, the five primary goals of the Upstate Plug-in Electric Vehicle Readiness Project are to:

- Cultivate stakeholders into a collaborative Plug-in Electric Vehicle Coordinating Council (PEVCC)
- Compose an infrastructure deployment plan
- Assess local permitting requirements for installing electric vehicle supply equipment (EVSE) and develop a plan to streamline those requirements
- Evaluate several local vehicle fleets and create a plan to accelerate plug-in electric vehicle adoption
- Plan educational outreach campaign efforts to improve plug-in electric vehicle adoption in Upstate communities and provide an example to other regions

1.3 Project Metrics

The following task-based metrics were used to evaluate project success.

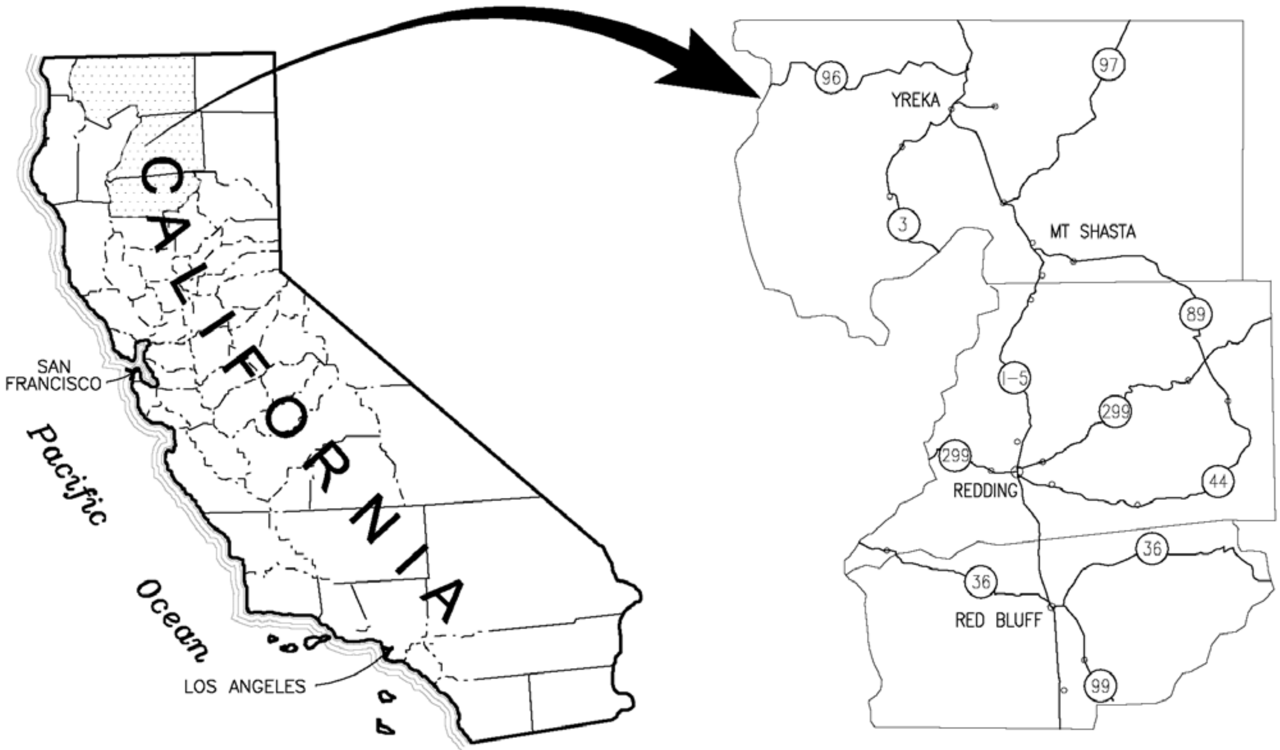
- The success of the Upstate Plug-in Electric Vehicle Coordinating Council (PEVCC) was measured by 1) adequate representation of stakeholders in the three different counties, Tehama, Shasta, and Siskiyou, that formed the Upstate region and 2) adequate representation from impacted sectors including electricity producers, local elected officials, non-profits, air quality management boards, and transportation boards. Progress was further measured through recording of meeting minutes, feedback from workgroups, and communication updates.

- The success of the Infrastructure Deployment Plan was measured based on 1) identification of candidate charging locations and 2) the likelihood that the candidate locations would address the predicted charging needs and 3) the candidate charging locations would have identified champions to own and maintain planned electric vehicle supply equipment (EVSE).
- The effectiveness of our efforts to streamline permitting were assessed based on how well we met the following objectives: 1) collaborate with OEMs, utilities, local planning and building department officials, and EVSE installers to develop guidelines for streamlining EVSE permitting and installation processes in the Upstate Region 2) collect information from other jurisdictions where PEV friendly permitting guidelines have already been developed 3) draw on work done by groups such as the California Plug-in Electric Vehicle Collaborative and Project Get Ready 4) work with the PEVCC and local participating jurisdictions (including the Cities of Yreka, Mt. Shasta, Redding and Red Bluff) to conduct mock EVSE permit evaluations and 5) hold an EV101 workshop to educate regional planning and building department officials in PEV charging infrastructure best practices.
- Our success in promoting PEV adoption in fleets was evaluated based on the following objectives: 1) create a list of public and private entities in the Upstate region with vehicle fleets 2) collaborate with the PEVCC to engage fleet managers and agency decision makers in fleet PEV-opportunity evaluations 3) evaluate two municipal vehicle fleets for PEV transition potential and 4) provide fleet managers with detailed information on the range of equipment options available to meet stakeholders' specific fleet needs.
- Education and Outreach metrics involved the development of an education and outreach plan, preparation of educational materials, and implementation of select education and outreach activities. The education and outreach effort was measured by work done in other communities, conferences attended, and adopting information developed by other organizations to the Upstate Region.

1.4 Geographic Scope

The Upstate region represents the gateway from Oregon and the Pacific Northwest into California along the major transportation corridors of Interstate-5 (I-5) and Highway 97 (Figure 1). Running North/South, the I-5 corridor is the largest transportation thoroughfare by vehicle count in the Upstate region and runs approximately 175 miles from the Oregon border in Siskiyou County through Shasta and Tehama Counties before continuing south to the border of Mexico. The Upstate regional roadway network of streets, roads, and highways (not including I-5) is approximately 5,600 centerline miles in length. Further, this roadway network does not include roads on public lands maintained by the United States Forest Service and Bureau of Land Management which represent approximately 60% of the land in Siskiyou County. In total, the Upstate region represents a large total surface area of approximately 13,000 square miles or 8% of California.

Figure 1: The Upstate Region's Counties and Major Highways



Source: GHD, 2014

1.5 Project Team

The California Energy Commission provided the funding for this project through its Alternative and Renewable Fuel and Vehicle Technology Program, which issued solicitation PON-10-602 to provide funding opportunities for California's diverse regions to develop regional plug-in electric vehicle strategic plans.

The City of Mt. Shasta is an alpine community located in the Shasta Cascade area of Northern California. Mt. Shasta is the tourism capital of Upstate California and residents prioritize quality of life, the environment, and a strong sense of community. Further, the city has been keenly interested and has worked diligently for many years on the development of "green" technologies, businesses and practices. The city conducts government affairs in an open and creative process, and encourages new sustainable energy developments to protect the pristine outdoors for which the city is reputably known. The City does not possess the internal staff capacity, nor is it chartered to work on a multi-county effort, thus they choose to use the Siskiyou County Economic Development Council as the program administrator for the entire project

The Siskiyou County Economic Development Council (SCEDC) is a private non-profit organization which has a long (25 year) history of working with local and regional jurisdictions through grant administration, infrastructure development, regional planning and other economic and community development activities. A short selection of past (and current) projects include Brownfield work with the Environmental Protection Agency (EPA), Energy Efficiency retrofits with the California Energy Commission (CEC), Infrastructure and Technical Assistance projects with Housing and Community Development (HCD), Regional Planning with the United States Department of Agriculture (USDA). The SCEDC collaborates frequently with other organizations such as the Upstate Economic Development Council, Superior California Economic Development and the Governor's Office of Economic Development. The SCEDC administered the award on behalf of the PEVCC and coordinated all efforts with local municipalities.

The Schatz Energy Research Center at Humboldt State University was the technical lead on this project. SERC was founded in 1989 with a mission to promote the use of clean and renewable energy resources. SERC recently finished acting as the technical lead on the North Coast Plug-in Electric Vehicle Readiness Project under Energy Commission Agreement Number ARV-11-006. Over the years SERC has been involved in extensive research, planning, design, and analysis activities for the development and implementation of sustainable energy systems, including energy efficiency, solar, wind, small hydro, biomass, and hydrogen and fuel cell technology for portable, stationary, and transportation applications.

More recently SERC partnered with the Redwood Coast Energy Authority to develop a strategic plan for renewable energy development in Humboldt County (Energy Commission Contract Number PIR-08-034). SERC guided all technical tasks.

GHD is an engineering consulting firm with offices located throughout the globe, including an office in Eureka, California. GHD is a key subcontractor in the North Coast Plug-in Electric Vehicle Readiness Project. GHD will provide technical consulting services, with a special focus on EVSE permitting, installation and inspection, engineering and cost estimating, and consumer charging behavior data collection, as well as contributions to the PEV infrastructure deployment plan. GHD is one of the world's leading engineering, architecture and consulting companies. Established in 1928, GHD employs more than 6500 people across five continents and serves clients in the global markets of water, energy and resources, environment, property and buildings and transportation. Staff in GHD's Eureka office have particular skills and interest in the deployment of PEVs and EVSE and have an established working relationship with SERC.

In addition to the primary team above there were project partners that committed match funding through in-kind cost sharing and staff time. These partners include: the County of Siskiyou, Upstate California Economic Development, and the regional investor-owned utilities, Pacific Power (PP), Pacific Gas and Electric Company (PG&E), and the Redding Electric Utility (REU). Pacific Power provides electrical power to Siskiyou and a portion of Shasta County; PG&E provides power to Tehama, Butte and the majority of Shasta County, and Redding Electric Utility provides power to the City of Redding. All three of these utilities are working to reduce their greenhouse gas emissions, green up their power mix, and provide cleaner, more efficient options for their customers. As electricity providers, they will each play a significant role in the successful promotion and adoption of PEVs. They are or can be actively involved in education and outreach and infrastructure planning activities. All utilities participated in the Upstate Region PEV project by providing technical data, assistance, guidance, and in-kind match funding.

1.6 Background

1.6.1 Plug-in Electric Vehicles and Associated Charging Equipment

Plug-in electric vehicles (PEVs) are propelled by electric motors powered by rechargeable battery packs. EVs first came into existence in the mid-19th century, when electricity was among the preferred methods for motor vehicle propulsion, providing a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. The internal combustion engine (ICE) has been the dominant propulsion method for motor vehicles for almost 100 years, but electric power has remained commonplace in other vehicle types, such as trains and smaller vehicles of all types. During the last few decades, environmental impact of the petroleum-based transportation infrastructure, along with the peak oil, has led to renewed interest in an electric transportation infrastructure. The plug-in electric vehicle (PEV) landscape of today is evolving at a rapid pace. Rising gas prices and heightened concerns over climate change have led to an increase in demand for more efficient, less polluting vehicles, while recent advances in technology have led to the ability to supply PEVs in volume. This convergence of supply and demand has created a growing marketplace for PEVs.

Electric vehicle configurations include; Hybrid Electric Vehicles (HEV), Plug-in Hybrid Electric Vehicles (PHEV), and Plug-in/All-Electric Vehicles (PEV). Plug-in hybrid electric vehicles (PHEVs) can be driven a certain distance on all-electric power (typically 10 to 40 miles), and then can be driven substantially further (e.g., 200 to 300 miles) in gasoline hybrid-electric mode. PHEVs can be plugged in to recharge their battery banks. Battery all-electric vehicles can be driven a certain range on all-electric power (typically 70 to 100 miles), and then they must be plugged in and recharged. This study addressed both types of PEVs.

The equipment needed to charge PEVs is referred to as electric vehicle supply equipment. EVSE are available at three different power levels that support three rates of charging.

- Level 1 charging provides alternating current (AC) to the PEV from a 120-Volt, 20-Amp circuit.
- Level 2 charging provides AC electricity to the PEV from a 240-Volt circuit with currents up to 80-Amps.
- Level 3 charging, also referred to as DC fast charging, provides direct current electricity to the PEV. The AC feeder capacity for Level 3 EVSE is typically 480-Volt, 3-phase with currents up to 400-Amps.

1.6.2 Regional Characteristics

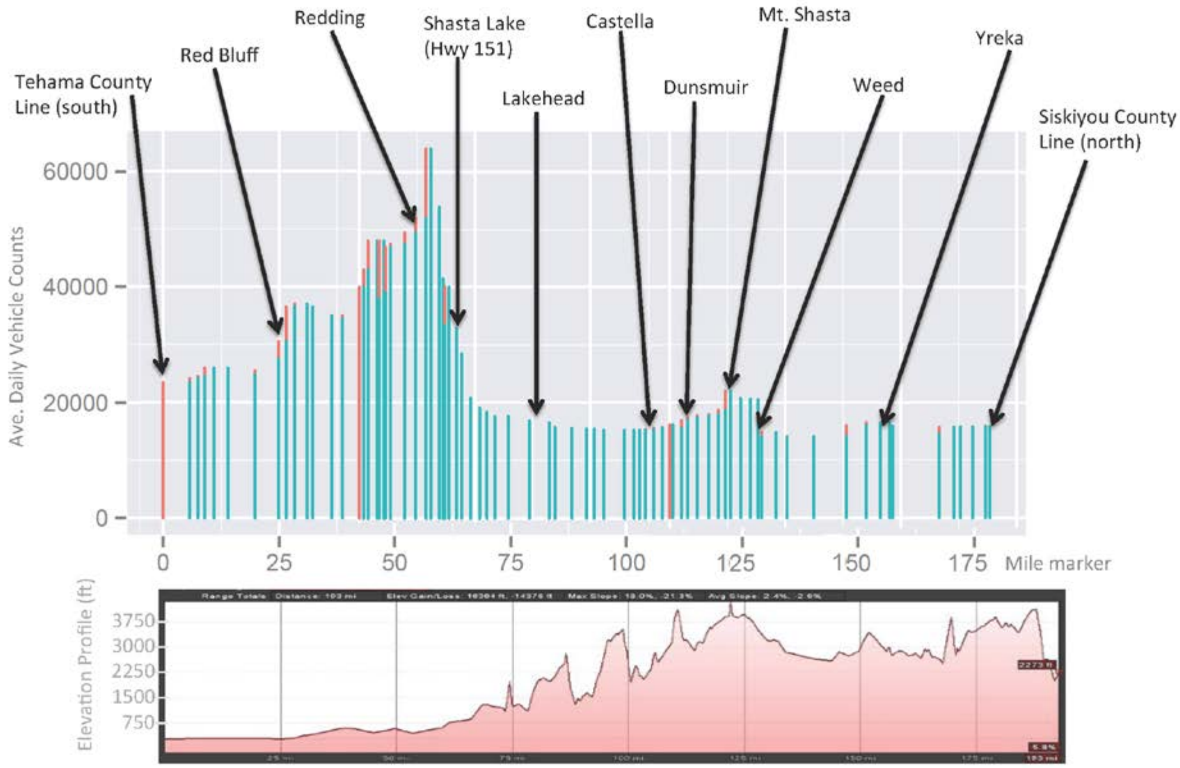
Siskiyou, Shasta, and Tehama Counties make up the "Upstate Region of California" which is a rural section of the state that faces unique PEV adoption issues compared to metropolitan areas. The three counties combined population is approximately 285,000. In context, this makes the Upstate region one of California's least populated areas, yet it represents a critical transportation corridor between California and Oregon via Interstate 5. Interstate 5 (I-5), a main travel corridor that runs from British Columbia through Washington, Oregon, and California, intersects the three counties, connecting south-bound travelers to California's largest population centers and makes the upstate region a key component in the West Coast Green Highway development.

The City of Redding (Shasta County) represents the region's largest population center with more than 62% of the Upstate's population based in the metro region. For that reason, Shasta County has a number of electric charging stations existing, while neighboring Siskiyou County (north) and Tehama County (south) have none (aside from private Tesla chargers).

Tehama County is a part of the Sacramento Valley known for its productive agricultural commodities. Shasta County has extensive forests, which cover over one half the land area with commercially productive forest systems. The southern two thirds of Shasta county is relatively low in elevation (sub 750ft) compared to the north part of the county that begins to climb in elevation, reaching over 3000ft in some areas. Upon entering Siskiyou County by I-5 near the city of Dunsmuir, the elevation continues to climb reaching high points over 3,750ft and lows around 2,250ft. From towering Mount Shasta (elev. 14,179 ft/(4,322 m)) near the center of the county, to lakes and dense forests, as well as desert, chaparral, and memorable waterfalls, the county is home to world-famous trout-fishing rivers and streams. Much of the county is densely forested with pine, fir, incense-cedar, oak, and madrone.

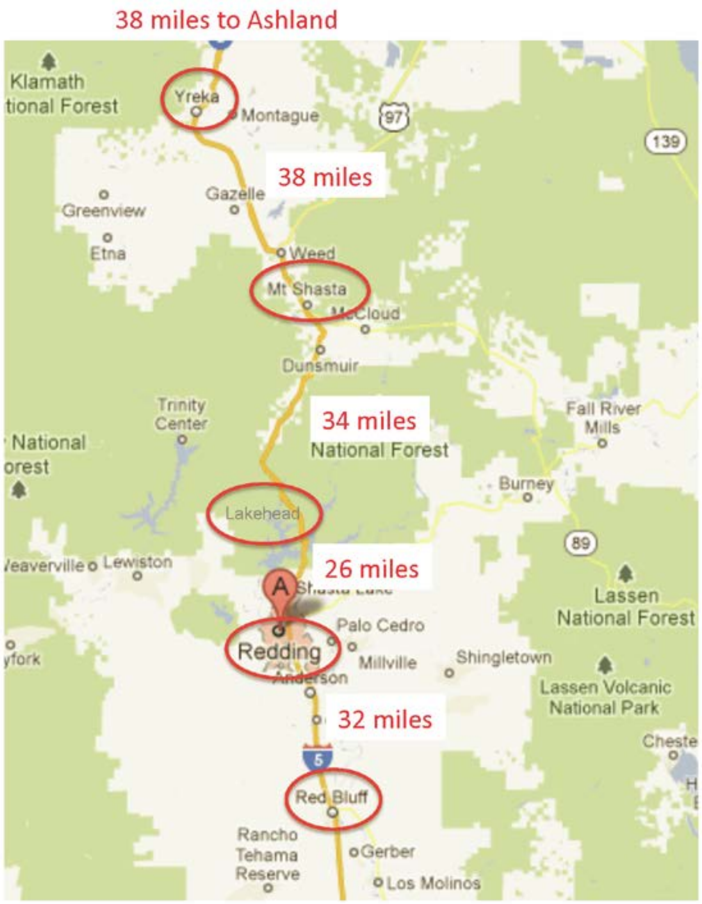
The major characteristic of the Upstate region along the I-5 corridor is a large change in elevation and traffic counts between Shasta County and Siskiyou County (Figure 2). In Shasta County, mountains to the east, north, and west surround the City of Redding. Fortunately, the relatively short distance between communities along I-5 may help mitigate the elevation challenges on electric vehicle range efficiency through the installation of public charging stations (Figure 3).

Figure 2: The Upstate Region Traffic Counts and Elevation Profile



Source: SERC, 2014

Figure 3: The Upstate Region Population Centers within <40 mile Plug-in Electric Vehicle Ranges



Source: Adapted from Google Maps by SCEDC, 2014

CHAPTER 2:
Project Approach, Methods, and Results

2.1 Plug-in Electric Vehicle Coordinating Council

2.1.1 Purpose of the Upstate Plug-in Electric Vehicle Coordinating Council

The Upstate Plug-in Electric Vehicle Coordinating Council (PEVCC) is comprised of the key project partners that were used to maintain clear and consistent communication amongst all local stakeholders and establish a permanent framework for ongoing regional PEV promotional efforts, including implementation of the readiness plan and strategies. As a part of the project, the PEVCC formed a brief funding and sustainability plan to maintain the PEVCC and to actively pursue the implementation of plans and strategies developed through the project after the grant period is completed.

Upstate Plug-in Electric Vehicle Coordinating Council Mission Statement: The members of the Upstate Region PEVCC will work together to promote and accelerate the local adoption of PEV technology as a key strategy for linking various parts of the West Coast and the State of California with PEV infrastructure and further develop the renewable energy resources in our region to meet our community's transportation needs.

2.1.1.1 Workgroups

The stated goals of the Upstate PEVCC are to participate in workgroups focused on project specific areas, suggest community points of contact, and provide feedback on contractor interim draft reports. Each workgroup was made up of appropriate representatives from relevant member entities and coordinated with topic experts from outside entities as needed. PEVCC workgroups included:

- **Fleet management:** Participants assisted in contacting local government and private vehicle fleet managers, as well as vehicle providers.
- **EVSE permitting, installation, and inspection:** Participants assisted in contacting local building officials, utilities, and building-trade and engineering professionals.
- **Publicly-accessible charging infrastructure:** Participants assisted in contacting local businesses, campus facility management staff, City and County public works and parking-management staff, and EVSE equipment vendors.
- **Technology evaluation and off-peak charging:** Participants included utilities and assisted in contacting educational institutions, research and engineering professionals, and vehicle and EVSE vendors.
- **Community education and outreach:** Participants included local community college and assisted in contacting non-profits, Rotary Clubs, local municipalities, and local media.

2.1.2 Upstate PEVCC Activities and Accomplishments

The Upstate PEVCC is made up of representatives from entities throughout the region including:

- Siskiyou County Local Transportation Commission
- Siskiyou County Board of Supervisors
- Tehama County Department of Transportation
- Tehama County Air Pollution Control
- Shasta Regional Transportation Authority (Shasta County)
- Upstate Economic Development (Redding, Shasta County)
- Superior California Economic Development (Redding, Shasta County)
- City of Redding (Shasta County)
- College of the Siskiyous (Siskiyou County)
- City of Yreka (Siskiyou County)
- City of Mt. Shasta (Siskiyou County)
- Caltrans (District 2)
- Pacific Power (Siskiyou County)
- Redding Electric Utility (Redding, Shasta County)
- Pacific Gas and Electric (Tehama County)

A complete list of the Upstate PEVCC members, in addition to the Upstate PEVCC Charter, can be found in Appendix A.

The first Upstate PEVCC kick-off meeting occurred on June 26th, 2013. The Upstate PEVCC met a total of seven times during the project period. Workgroups were scheduled to meet on an as needed basis. Project staff sent monthly progress updates and project highlights to the CEC and the PEVCC and other interested parties between PEVCC meetings. The project updates provided a brief status report on the project as a whole and also on the five workgroup topics. Meetings were scheduled to seek feedback from the PEVCC and create a greater discussion between individuals with diverse expertise and backgrounds relating to the Upstate PEV readiness project. The PEVCC provided key feedback on interim report drafts from the workgroup topics, considered fleet adoption in their respective organizations, and helped grow the membership of the Coordinating Council during the project period. More specifically, members of the Upstate PEVCC helped coordinate and facilitate the EV101 workshop on March 25th, 2014 and suggested including agencies such as transportation planning commission staff and air pollution control staff that shared similar goals as the PEVCC.

2.1.2.1 Funding and Sustainability Plan

A brief funding and sustainability plan was formed to continue the efforts of the Upstate PEVCC. More specifically this plan strategizes on how to actively pursue the implementation of planning assets developed through the Upstate PEV readiness project beyond the current California Energy Commission grant period. Funding and sustainability planning strategies include:

- Incorporating staff from alternatively funded agencies, and organizations that share similar goals and commitments. Examples these agencies and organizations include, but are not limited to, transportation commissions, utilities, air pollution control boards, and economic development non-profits. In this manner, the stakeholders are contributing in a professional capacity and can contribute staff time to sustain PEVCC goals through the ups and downs of granting cycles.

- Utilizing a cooperative or a business improvement financial district model, made up of charging station owners, to self-assess a fee to fund and sustain the PEVCC. This funding model could not only sustain the PEVCC but also help improve the greater Upstate charging network. Improvement examples may include sharing similar signage, EVSE types, maintenance costs, tourism opportunities, and future planning efforts.
- Encouraging other economic development organizations in the Upstate region to pursue PEVCC related grants, zero emission vehicle education, and energy resiliency goals.

2.2 Infrastructure Deployment Plan

2.2.1 Macro-Level EVSE Deployment Plan

The purpose of the Macro-Scale EVSE Deployment Plan is to develop guidelines for the number and type of electric vehicle chargers needed throughout the Upstate region to support a given penetration of plug-in electric vehicle s in the regional vehicle fleet. The macro-scale guidelines consider charger siting at the level of a city or a neighborhood. A subsequent section in this report (section ref) details the results of a micro-scale analysis, which builds on the macro-scale results and recommends placement of EVSE at the level of individual parking stalls.

2.2.1.1 Model Development

The challenge of the macro-scale siting task was to recommend the deployment of EVSE throughout the region for varying levels of PEV adoption. The project team accomplished this by answering the following key questions. How many chargers are needed for a given penetration of PEVs? Where should the chargers be located within the region? Should Level 2 chargers or Level 3 chargers (also known as DC fast chargers) be installed? How can the deployment be achieved in a cost-effective manner given limited resources for new infrastructure?

Answering these questions required that the following considerations all be taken into account:

- How many PEVs do we expect in our region?
- Where within the region will the PEV drivers live?
- When do PEV drivers make their daily trips? Where and how far do they go?
- How long do drivers spend at each stop in their tour?
- If drivers have a choice of EVSE to use, which will they choose?
- How do drivers impact each other’s access to EVSE?

- How will drivers who must charge (in order to complete their tour) be impacted by other drivers who elect to charge despite having no immediate need for the energy?
- How do drivers adapt to their circumstances (e.g. by seeking EVSE elsewhere)?
- How will a given deployment of EVSE improve the experience of drivers? Can we quantify the improvement (e.g. in terms of the number of hours of delay experienced by drivers)? If so, by how much does the EVSE improve their experience?

Building off work conducted for the North Coast Plug-in Electric Vehicle Readiness Project, the Upstate PEV (UPEV) research team managed the complexity of this problem by applying a detailed simulation model called PEVI, the PEV Infrastructure model. PEVI is capable of simultaneously balancing all of the above considerations. The approach is called "agent-based modeling", and it provides a flexible and powerful framework for evaluating the impact of infrastructure on PEV drivers' experiences.

Building any agent-based model consists of the following key steps:

- Step 1: Create a virtual environment.
- Step 2: Create virtual agents with a set of rules describing how to interact with the environment and with each other.
- Step 3: Place the agents in the environment and let the system evolve according to the rules.
- Step 4: Observe what happens.

In the case of PEVI, the environment is the Upstate regional road network, including any configuration of EVSE infrastructure we'd like to evaluate. The agents are the PEV drivers (drivers of conventional vehicles are not simulated). Drivers interact with the environment according to the following rules:

- Every driver is given a vehicle with configurable properties such as type (BEV vs. PHEV), battery capacity, and fuel economy.
- Each driver follows a unique daily itinerary composed of times and destinations defining when and where he or she will attempt to travel.
- If drivers need energy to complete their next trip (or, in some cases, to complete the remaining trips in their itinerary) then they attempt to charge. PHEV drivers are assumed to never need a charge because they have a gasoline backup with established refueling infrastructure.
- Both BEV and PHEV drivers also attempt to charge even if they don't need the energy; this occurs according to a random process.
- Drivers choose which EVSE to use based on minimizing their cost. If a driver must make an unplanned stop or is delayed, the driver's time is valued at a rate of \$12.50/hour[1].

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[1] The value of \$12.50/person-hour is based on the Caltrans Economic Analysis Branch and is used by the state of California to account for the economic value of delaying travelers. http://www.dot.ca.gov/hq/tpp/offices/eab/benefit_cost/LCBCA-economic_parameters.html

- Both BEV and PHEV drivers have a charger at home and elect to charge at the end of the day according to a random process.

The model simulates one day of driving and any delays or changes to driver itineraries are tracked[2]. At the end of a model run, the experience of individual drivers can be examined or the entire run can be summarized by a variety of metrics (e.g. the total number of drivers who experience delay in their itinerary).

PEVI is a stochastic model, meaning that a variety of processes and decisions within the model are based on random chance. The possible outcomes of these processes and decisions are described by probability distributions. The primary purpose of including stochastic processes in PEVI is to avoid reaching conclusions that are overly customized to suit one particular scenario. Instead, the model is run many times with the same set of initial conditions and the average benefit of a given EVSE infrastructure is calculated.

The UPEV team took great care to use the best available regional data sets to ensure that PEVI simulations were as realistic as possible. These data are described in the following section.

Data Driven Planning

The quality of the results of the PEVI model is inextricably tied to the quality of the inputs used to initialize the model. For example, the driver itineraries must be carefully developed to represent a realistic set of trips that follow known driving patterns specific to the Upstate Region. This section identifies several of the most important data sets and describes how they were used in this research.

Travel Demand

The most critical component to building a set of realistic driver itineraries for PEVI is determining where drivers go when they travel. Fortunately, regional travel demand data is available for Shasta County in the form of the four-step Shasta County Travel Model (SCTM). The SCTM has been developed and refined for the Shasta Regional Transportation Agency (SRTA) for use in a variety of transportation planning activities in Shasta County. The four-step model uses current and projected land-use, demographic data, and local traffic counts to forecast traffic trends to the years 2020 and 2040.

Staff at SRTA furnished travel demand counts from SCTM to the UPEV team. The SCTM model divides Shasta County into 732 travel analysis zones (TAZs) and provides a daily trip count between every pair of zones. Trips are further categorized by type (e.g. travel between home and work, home and other, etc.).

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[2] In PEVI, delay is defined as any late arrival to a destination in a PEV driver's itinerary. If a driver becomes stranded, an automatic delay penalty is added to the driver to account for the time needed to recover from the stranding event. A penalty of 4 hours is added if a chargers are accessible but in use and therefore unavailable; a penalty of 6 hours is added if the driver cannot access any chargers due to limited range.

Unfortunately, it was not possible to obtain travel demand data for the counties of Siskiyou and Tehama[3], therefore the UPEV team developed an adapted four-step travel demand model for these two counties that simultaneously integrated these two counties with Shasta County.

The major cities and towns in Siskiyou and Tehama were the basis for defining the new TAZs. The total daily productions and attractions for each TAZ were estimated based on a linear regression of productions in the SCTM, using population and employment as independent variables. The trip distribution step used friction factors based on the California Household Travel Survey and constrained the solution to observe the external-internal trip distributions passing through the gateways to the SCTM along the Shasta/Siskiyou and Shasta/Tehama borders. Additionally, trip counts from Caltrans along the major highways at eight screenline locations were used to further constrain the distribution step.

The end result of the travel demand modeling process was a region wide estimate of trips between every TAZ disaggregated by trip purpose and by time of day (peak vs. off-peak).

Travel Analysis Zones

The TAZs in the SCTM data set have an extremely high resolution; some TAZs are the size of a city block. For reasons of computational efficiency and simplicity of communicating results, the UPEV team chose to aggregate the original TAZs into 57 larger zones for use in the PEVI model. We based our aggregation decisions on two key criteria:

- The aggregated TAZs should follow municipal boundaries so that model recommendations and results can be easily communicated to city planners.
- The occurrence of popular, non-residential destinations (like places of work or retail buildings) within a given TAZ that are not within convenient walking distance of each other should be minimized. The purpose of this criterion was to mitigate the simplifying assumption that a PEV charger sited in a TAZ is equally accessible to anyone in that zone.

Once the 57 TAZs were geographically defined, the trip counts from the original SCTM data were aggregated into the new TAZs by summation. Then the TAZs based on 16 cities and towns in Siskiyou and Tehama were added to produce a final set of 73 TAZs. The final TAZs and a tabular listing of the TAZs can be found in Appendix B.

Household Travel Surveys

While regional travel demand data is necessary to build realistic driver itineraries, there are some critical missing components to this data set. It does not provide information about exactly when trips are made, how long drivers spend at their destinations, where the drivers live, or what trips are chained together into a daily tour. The National Household Travel Survey

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[3] A request was made to Doug MacIver at Caltrans for outputs from the statewide travel demand model. Caltrans denied our request due to their low degree of confidence in the model developed in 2005. The update to the 2005 model (for which they would have been willing to provide results) was still under development and therefore the UPEV team was unable to procure statewide travel demand data for this analysis.

(NHTS) and California Household Travel Survey (CHTS) can fill in many of these missing components.

The NHTS is a survey conducted by the U.S. Department of Transportation. The last survey year was 2009, when over 150,000 households participated. The CHTS was recently updated in 2012 and contains responses from over 40,000 California households. Every respondent provides a log of all travel in a day, including non-automotive modes. Each log details the time of departure, time of arrival, time spent at the destination (dwell time), distance traveled, and trip type (home to work, work to other, etc.).

The PEVI itineraries were generated by strategically blending the NHTS/CHTS and travel demand data sets. Respondents were drawn randomly from the NHTS/CHTS pool and their tour was fit into the Upstate road network in a manner consistent with the demand for trips as specified by the travel demand model.

PEV Adoption Projection

The historical adoption of HEVs is likely the best available indicator for the rate of adoption of PEVs over the next decade. We based our projection of PEV adoption for the Upstate region on a linear extrapolation of the rate of adoption of HEVs in California between 2007 and 2010, assuming that the Upstate share of statewide adoption is 0.1%[4]. PEV penetration in 2014 was assumed to correspond to HEV penetration in 2006, the year when HEVs reached penetration levels roughly equivalent to the current penetration of PEVs in the Upstate region[5]. Other PEV readiness projects in California have projected adoption using similar assumptions (Williams et al., 2012) and a study by Pike Research predicted penetration levels consistent with our forecast (Hurst & Gartner, 2012).

Figure 4 depicts our projection of PEV adoption for Upstate. The baseline projection follows the historical trend of HEV adoption. Two accelerated growth scenarios are also presented, representing increased rates of adoption: 10% and 25% faster than the baseline scenario. Three time intervals are emphasized in the figure near the horizontal axis. They are the intervals over which the baseline and 25% growth scenarios intersect key penetration levels (0.5%, 1%, and 2% penetrations into the vehicle fleet). In other words, we expect that PEV penetration will reach 0.5% by mid-2016, but it could occur in early 2016 if adoption rates are accelerated. Likewise we expect PEV penetration to reach 1% between 2017 and 2019 and 2% between 2020 and 2022. Note that the PEV penetration scenarios are relative to the total regional vehicle fleet, including light, medium, and heavy-duty vehicles. A 1% penetration into the total vehicle fleet corresponds to a 2.3% penetration into the light-duty fleet.

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[4] The share of statewide HEVs in Upstate is based on vehicle registration data summarized by Dr. Matthew Kahn of UCLA: http://www.environment.ucla.edu/reportcard/article2304.html

[5] The present number of PEVs in Upstate is based on data from the Clean Vehicle Rebate Project: http://energycenter.org/clean-vehicle-rebate-project

The three adoption levels from Figure 4 – 0.5%, 1%, and 2% – form the basis for the entire model analyses conducted for this study. In order to effectively support PEV drivers and encourage adoption, planners should target the deployment of EVSE infrastructure to be completed before adoption actually reaches these levels. Hence, the earlier end of each time interval should be interpreted as a target year for EVSE deployment. This would be 2016 for 0.5%, 2017 for 1% and 2020 for 2%.

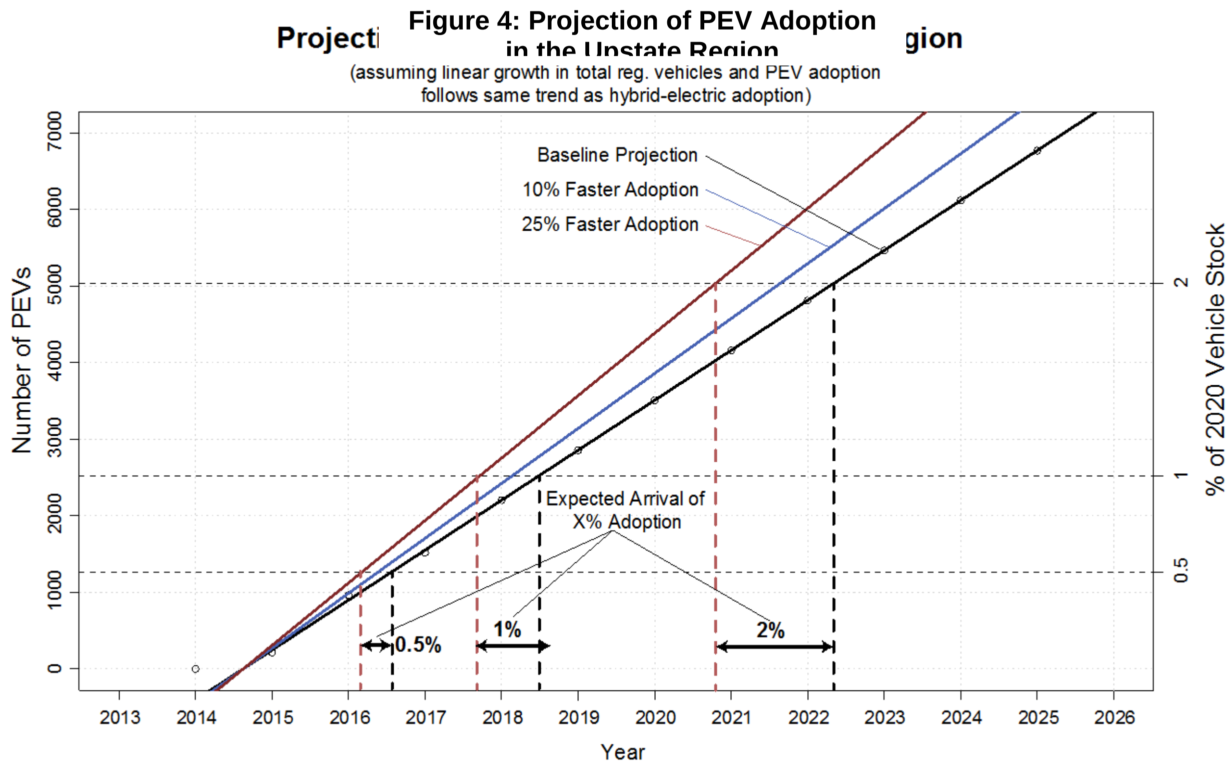
Adoption of BEVs vs. PHEVs

From the perspective of deploying EVSE infrastructure, the rate of adoption of battery electric vehicles (BEVs) compared to plug-in hybrid electric vehicles (PHEVs) is vitally important. BEVs require public EVSE in order to complete certain types of travel, whereas public chargers are entirely optional for PHEV drivers. There is clear evidence, however, that shows that PHEV drivers utilize public EVSE frequently in an effort to maximize the all-electric miles they travel[6]. The presence of PHEV drivers will therefore have an impact on the availability of infrastructure for use by BEV drivers who have the most compelling need for charging.

The market for PEVs is still in an early stage, but current trends are the best available indicator of future growth. As of September 2013, 57% of PEVs on the road were PHEVs[7]. As a wider variety of BEVs and PHEVs enter the market, these market trends could continue or change dramatically. The UPEV team has chosen a 50% / 50% split between BEVs and PHEVs in the PEVI model for the base scenario. This represents a conservative assumption, as we can be certain that EVSE infrastructure built to support a higher fraction of BEV owners will be adequate to support a lower fraction.

[6] Data collected by The EV Project show that Chevy Volt drivers routinely use public EVSE: http://www.theevproject.com/

[7] http://luskin.ucla.edu/blogs/public-policy/2013-pev-sales-will-soon-exceed-2010%E2%80%932012-total-sales-analysis-updated-through-2



Source: SERC, 2014

Figure 4: PEV adoption projected to 2025. The time periods over which we expect to achieve benchmark penetration levels are depicted near the horizontal axis. Penetration levels represent the percent penetration of PEVs into the total regional vehicle fleet including light, medium, and heavy-duty vehicles.

Cost of Installing and Using EVSE

Determining the cost of public chargers is highly site specific. Many factors contribute to the expense, such as equipment costs, permitting fees, and installation costs. For the PEVI model it was necessary to assume an average installed cost for each level of charging. Table 1 presents our cost assumptions alongside cost estimates from several recent studies.

Table 1: Cited Price Estimates of Public Charging Stations, by Source

Study Source	Level II	Level III
ICF International, 2013	$6,000-23,000	$73,000-141,000
Chang et al. 2012	$1,852	$40,000
Schroeder and Traber 2012	$6,600	$118,800
Peterson and Michalek 2013	$5,000	$20,000
Gogoana 2010	N/A	$50,000
PEVI Cost Assumptions	**$15,000**	**$75,000**

Source: SERC, 2014

In practice, the cost of installing the first Level II charger in a given location can be substantially higher (as much as 4 times higher) than the cost of subsequent chargers assuming that conduit and electric service upgrades are sized for future expansion. Because the PEVI model is designed to site EVSE at a macro scale, the savings from installing multiple chargers in one location are ignored and an average cost is assumed.

The PEVI model also requires the retail price of energy for charging at each type of EVSE. We conducted an economic analysis of operating a public charging station and chose pricing for the PEVI model that corresponds to the break-even price (i.e. investment and costs are paid for by station revenues on a lifecycle cost basis) for a charger that is used 10% of the time, or 2.4 hours per day (Table 2).

Table 2: Energy pricing assumed in the PEVI model.

Level	Price ($/kWh)
2	0.45
3	0.50

Source: SERC, 2014

2.2.1.2 Macro-Siting Results

The PEVI model provides a quantitative basis for evaluating the efficacy of a given deployment of EVSE throughout the region. We use an optimization algorithm to determine the set of chargers that provide the biggest benefit to PEV drivers at the least cost. The resulting EVSE infrastructure is presented in the next section. This section provides an overview of the optimization algorithm and lists key assumptions used in the analysis.

There are multiple metrics by which we can evaluate the benefit that a given EVSE deployment would provide to PEV drivers. We chose as our primary metric the degree to which a given EVSE deployment decreases the amount of delay experienced by drivers. Using a value for drivers' time of $12.50/hour, the delay is converted into a monetary value and – assuming constant conditions – projected over a 10-year time horizon. This allows us to compare the benefit of reducing driver delay with the cost of the EVSE infrastructure needed to reduce that delay.

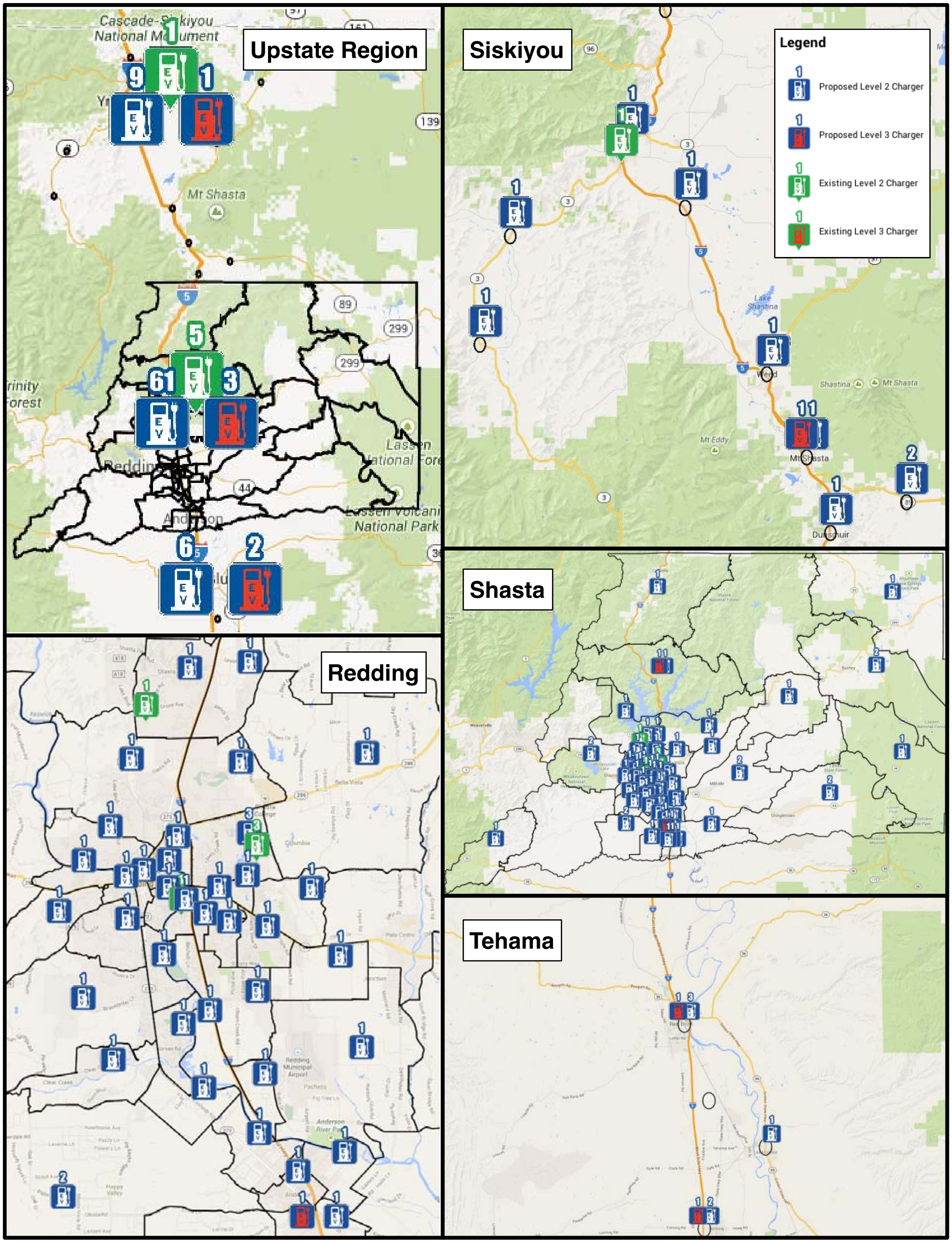
To optimize EVSE deployment for a given penetration of PEV drivers, we take the following steps:

- Step 1: Initialize the PEVI model with a PEV penetration of 0.5% and the present-day charging infrastructure in the Upstate Region (five chargers in and around Redding and one charger in Yreka). Call this the base scenario and run the model, storing the results.
- Step 2: For each of the 73 TAZs in the region systematically place a new Level 2 and then a Level 3 charger. Run the model each time and calculate the reduction from the base scenario in driver delay.
- Step 3: Select the TAZ and charger type that provides the maximum reduction in driver delay per dollar spent. Add this charger to the EVSE infrastructure and call this the new base scenario.
- Step 4: Repeat steps 2 and 3 until adding a new charger stops providing any significant benefit.
- Step 5: Increase the fleet penetration of PEV drivers from 0.5% to 1% (or from 1% to 2%) and repeat steps 2-4.

This algorithm is automated to produce a set of charger locations and charger levels that aims to provide the highest benefit to drivers at the least cost. In addition, the order in which chargers are added is tracked, which provides useful insight into which locations should be prioritized for EVSE deployment in the near term. Because PEVI is stochastic, the entire process is repeated a number of times (at least 5) and the various distributions of chargers are averaged together to form a final set of deployment guidelines.

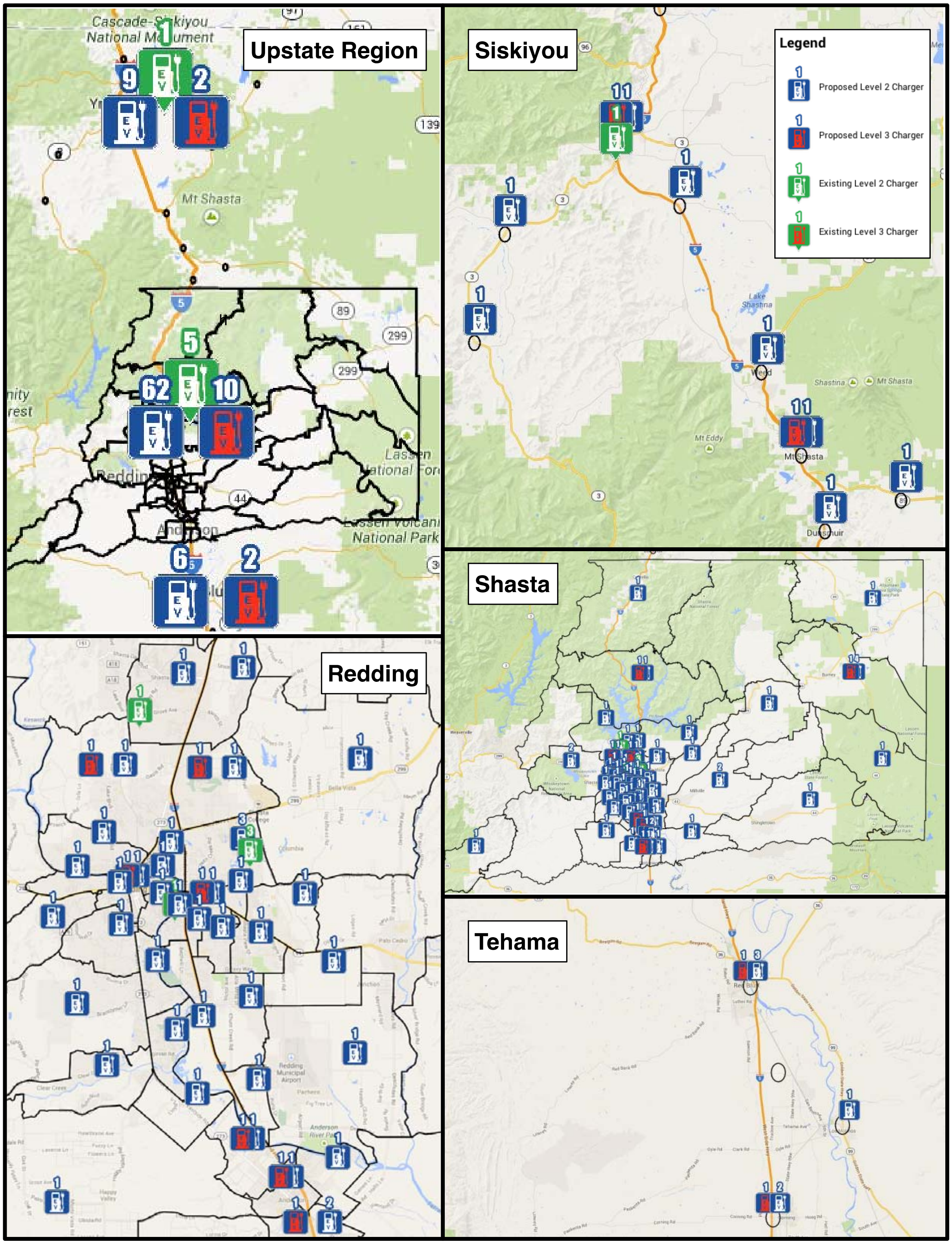
In Figures 5 through 7, we present the results of using the PEVI model to site EVSE infrastructure for the three PEV penetrations of 0.5%, 1%, and 2%. Each figure contains three maps: a full map of the Upstate Region, a detail of the counties of Siskiyou, Tehama, and Shasta, and a detail of the greater Redding Area. On the maps are icons labeled with the number of Level 2 (blue and white icons) and Level 3 (blue and red icons) chargers recommended for the penetration level. In addition, the green icons indicate the number of existing chargers in the region.

Figure 5: EVSE deployment guidelines for 0.5% penetration (Target Year: 2016)



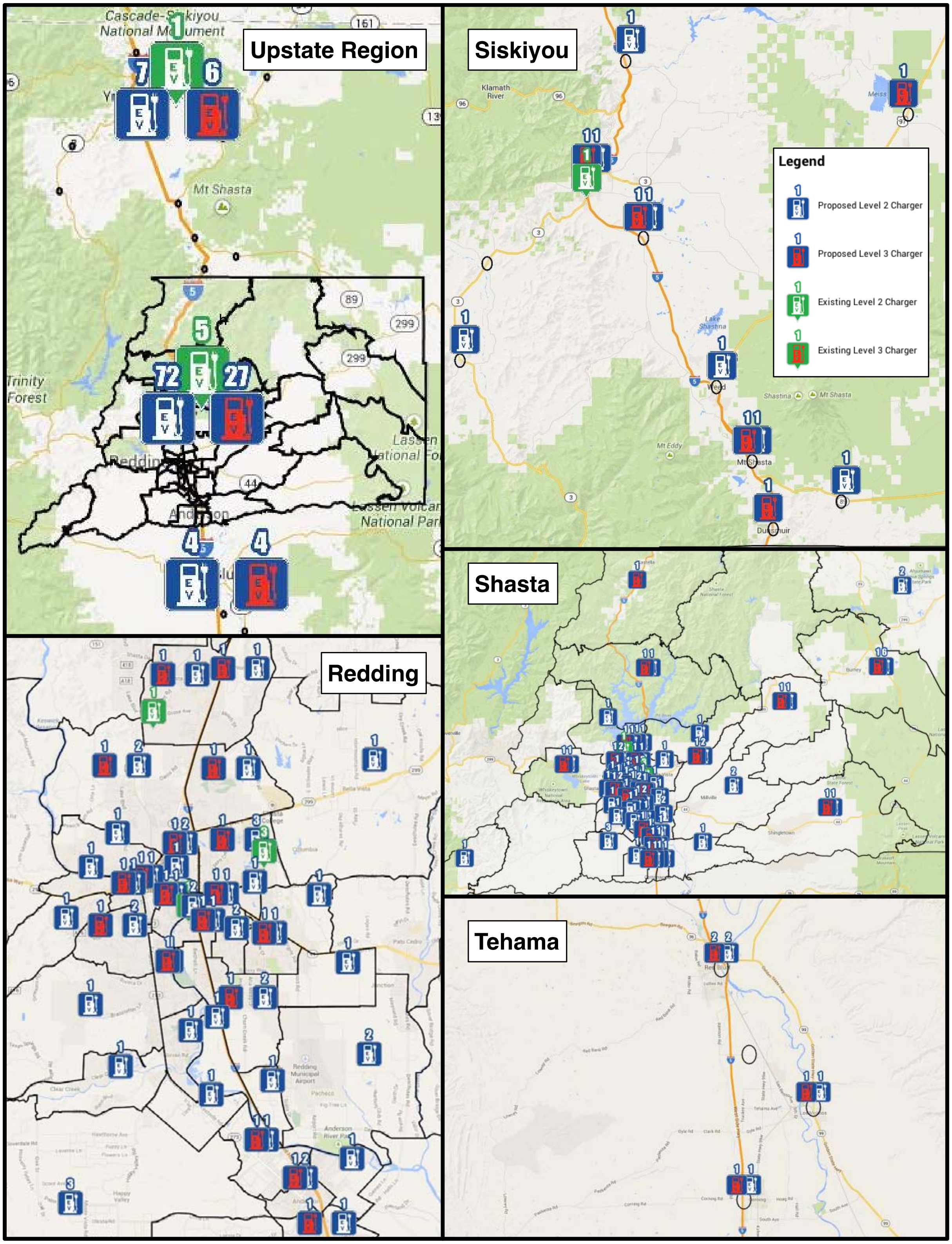
Source: SERC, adapted from Google Maps, 2014

Figure 6: EVSE deployment guidelines for 1% penetration (Target Year: 2017)



Source: SERC, adapted from Google Maps, 2014

Figure 7: EVSE deployment guidelines for 2% penetration (Target Year: 2020)



Source: SERC, adapted from Google Maps, 2014

The entire set of results is also presented in tabular form in the Appendix B. In these tables, the number of chargers sited in each TAZ has a decimal value. This is a consequence of the stochastic nature of PEVI. As described above, we conducted the optimization multiple times and calculated the average number of chargers sited at each location. The column labeled "priority" in Appendix B represents the order in which each combination of TAZ and charger level were sited during the optimization process. Note that the order only corresponds to the first charger sited in the TAZ; the order for subsequent chargers is not reported in these tables. Finally, the map is available as an interactive Google Map, which can be explored in detail online[8].

Table 3 presents the costs associated with the recommended EVSE infrastructure summarized by county and charger level. In addition, the column titled "Mitigated Delay Value" contains an estimate of the 10-year present value of the driver delay that is reduced due to the presence of the ESVE. For the Upstate region overall, the recommendations would cost approximately $1.5M for a penetration of 0.5%, $2M for 1%, and $4.2M for 2%. These investments are substantially less than the value of the drivers' time that is saved by installing public EVSE. The value of the delays mitigated by the recommended infrastructure is approximately $25M for the 0.5% penetration, $51M for 1%, and $110M for 2%.

Table 3: Approximate cost of recommended EVSE infrastructure by charger type and county for three PEV penetration scenarios.

	Level 2	DC Fast	Total Cost*	Mitigated Delay Value
0.5% Fleet Penetration				
Shasta	$849,000	$285,000	$1,134,000	
Siskiyou	$123,000	$45,000	$168,000	
Tehama	$87,000	$105,000	$192,000	
	$1,059,000	**$435,000**	**$1,494,000**	**$25,000,000**
1% Fleet Penetration				
Shasta	$876,000	$600,000	$1,476,000	
Siskiyou	$135,000	$120,000	$255,000	
Tehama	$93,000	$195,000	$288,000	
	$1,104,000	**$915,000**	**$2,019,000**	**$50,600,000**
2% Fleet Penetration				
Shasta	$1,161,000	$2,085,000	$3,246,000	
Siskiyou	$111,000	$435,000	$546,000	
Tehama	$69,000	$375,000	$444,000	
	$1,341,000	**$2,895,000**	**$4,236,000**	**$110,400,000**

*For each penetration, total regional costs are listed in bold. These costs are cumulative. For example, the infrastructure in the 0.5% scenario is also contained in the costs for the 1% and 2% scenarios.

Source: SERC, 2014

[8] http://www.schatzlab.org/projects/policyanalysis/pev/upstate/charger-map.html

2.2.2 Conclusions about Macro Level EVSE Deployment

Based on the results of the PEVI modeling analysis, we can draw some useful conclusions about the siting of EVSE in the Upstate Region.

- Overall, relatively few chargers are needed to support a large number of PEV drivers. Approximately 120 chargers were sufficient to support ~5000 drivers in the 2% penetration scenario. The total estimated cost to install these chargers is $4.2M, which is an investment of $850 per driver, a value commensurate with incentives already in place at the state and federal levels for subsidizing vehicle purchases.
- Both Level 2 and Level 3 chargers play an important role in supporting PEV drivers. Generally, Level 2 chargers are distributed throughout the region in rough proportion to traffic intensity and Level 3 chargers are concentrated along the I5 corridor and, to a lesser extent, along other principal arterials.
- The order in which EVSE is sited is meaningful. At 0.5% penetration, the algorithm sited Level 2 chargers early with Level 3 chargers being added later. At higher penetrations, Level 3 chargers played a much more prominent role, reaching 30% of the total number of recommended chargers at the 2% PEV penetration level.
- In California, 88% of Nissan Leaf owners have installed a Level 2 charger in their home[9]. Fewer PHEV drivers have Level 2 chargers but due to the smaller battery capacity in these vehicles, the difference between Level 1 and Level 2 is negligible for overnight charging. We therefore assume in the PEVI model that every PEV driver has access to a Level 2 charger at his or her residence. If fewer future BEV owners choose to install Level 2 chargers at home, the need for publicly available EVSE infrastructure will increase.
- It is recommended that EVSE infrastructure be installed in phases. While an initial level of infrastructure will be important from the outset in order to provide geographic coverage, reduce range anxiety, and promote PEV adoption, full EVSE deployment can be accomplished over time as the penetration of PEVs increases. In fact, it is recommended that following each phase of EVSE deployment data be collected and evaluated to assess EVSE usage rates. In addition, PEV drivers in the region can be surveyed to assess where additional charging is needed. These types of information can then be used to refine plans for future EVSE deployment.

2.2.3 EVSE Micro-Siting

Previously we presented a map showing the number of charging stations recommended for each Transportation Analysis Zone (TAZ) in the Redding area based on a 0.5% plug-in electric (PEV) penetration rate. Those “macro-siting” results were generated by the Plug-In Electric Vehicle Infrastructure (PEVI) computer model developed by SERC. Each TAZ covers a large geographic area and additional “micro-siting” work was required to identify the apparent best parking spaces within each TAZ for installing EV charging stations.

On March 24, 25, and 26, 2014 we conducted field work assessing 95 candidate sites for EV charging stations in Siskiyou, Shasta, and Tehama Counties. Forty nine of these sites were in the City of Redding.

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[9] http://energycenter.org/clean-vehicle-rebate-project/vehicle-owner-survey/feb-2014-survey

Each site was scored using a rubric that was developed with input from the Upstate Plug-In Electric Vehicle Coordinating Council, whose membership includes REU. Candidate sites were scored according to our judgment regarding a scored rubric of objectives such as: proximity to apparently suitable electrical connection, minimal trenching required through paved areas, public visibility, and proximity to basic services, among others.

2.2.3.1 Micro-Siting Rubric

Using the results of the macro-scale EVSE deployment plan, a micro-siting rubric tool was used to rank candidate EVCS sites. The rubric was developed collaboratively by the project team with input from the Plug-In Electric Vehicle Coordinating Council (PEVCC) for the purpose of ranking candidate sites based on criteria important to the community. The candidate sites were identified through a public outreach process, local knowledge, and on-the ground site surveys.

A total of 99 candidate sites for EVCS were identified in the planning area and assessed on the ground using the rubric. The sites were assessed for L1, and/or L2, and/or L3 EVCS as appropriate based on site specific characteristics and engineering judgment. After ranking the sites, owner consultations were initiated on 29 of the sites to determine which sites had interested owners who would likely provide a letter of support for a subsequent grant application for installing EVCS. As a result of these conversations a list of nine highly ranked sites with owners who committed to hosting an EVSE were selected for further evaluation, including development of preliminary site plans and cost estimates. These sites, which are shown in Table 4 below, will be shovel-ready upon completion of site-specific project permitting and final engineering work. A combination of L2 and L3 EVCS are proposed for the sites listed in Table 4 as part of the first phase of implementing the Upstate Plug-In Electric Vehicle Charging Network (Network).

To put these results into context, the macro-siting analysis indicated that for the 2% PEV penetration rate, approximately 120 EVCS would be sufficient to support approximately 5,000 PEV drivers in the Upstate Region (see Task 3.2 Interim Report for details).

Table 4: List of Recommended Stations for Phase 1 of Upstate Plug-In Electric Vehicle Charging Network

	County	City	Description
1	Siskiyou	Yreka	Junction Shopping Center
2		Mt. Shasta	Public Parking Lot on W. Lake St.
3		Mt. Shasta	Tri Counties Bank
4	Shasta	Redding	McConnell Arboretum
5		Redding	Sundial Bridge Parking Lot
6		Redding	City Hall
7	Tehama	Red Bluff	Tehama County Visitor Center
8		Red Bluff	River Park
9		Red Bluff	Public Parking on Pine Street Downtown

Source: GHD, 2014

In addition to the ten sites listed above, Phase 1 of the Upstate Plug-In Electric Vehicle Charging Network should include an L3 station along Interstate 5 between Redding and the City of Mt. Shasta. This is important so that PEVs travelling north can charge in Redding and then have an interim charging option on the route to Mt. Shasta, which involves a change in elevation of approximately 3,000 feet. The apparent best location identified during the micro-siting analysis was the Shell station at Lakehead CA. The project team was unable to make a connection with the owner of this particular Shell franchise by the time of this writing to gauge their interest in hosting an L3 station. This outreach should be conducted as an important preliminary action during the implementation of Phase 1.

Also note that an alternate location for a combined L2 and L3 in Mt. Shasta was identified in the public parking lot on Chestnut Street. This location has an existing commercial meter pedestal that is only used on July 4th for festivities, which could be used in a low cost L2 EVCS installation. Pacific Power was contacted about a L3 EVCS in this location and indicated that there is the possibility of providing a pole mounted 480V 3 phase transformer for a L3 EVCS at this location.

2.2.3.2 Methodology

The macro-siting analysis provided the following results that were used to guide the process of selecting on-the-ground locations for EVCS within the planning area:

- Optimal number of Level 2 and Level 3 EVSE in each Transportation Analysis Zone (TAZ) in Siskiyou, Shasta, and Tehama Counties for 0.5%, 1% and 2% PEV market penetration scenarios
- The priority ranking for installing the specified number of EVCS in each TAZ

- The priority ranking was arrived at by testing which locations had the greatest potential to reduce PEV driver inconvenience on aggregate through repeated agent based computer simulations

The results from the macro-siting analysis were used to set the target number of sites that needed to be identified for each TAZ in the Upstate Region on aggregate. A list of candidate sites was then developed for each jurisdiction in the study area.

A micro-siting rubric was developed with input from the PEVCC to rank each candidate site. Then, field work was conducted to fill in the rubric for most of the candidate sites identified. Due to the geographic size of the planning area and limitations with the scope and budget available for this study, candidate sites could not be identified in all of the TAZs where EVCS were called for in the macro-siting analysis.

Please refer to Appendix C for the specific micro siting scoring rubric template, rationale, and ranked location context.

2.2.3.3 Micro-Siting Results

The preliminary site plans were prepared by a licensed civil engineer for the stations selected for the first phase of building out the Network. The purpose of this step was to provide a conceptual layout of the potential configuration and to assist in the development of the opinion of cost. The preliminary plans consist of two plan sheets for each site. The first plan sheet shows a vicinity map locating the station within California and a neighborhood scale site plan. The second sheet is an enlargement showing the layout of the EVCS within the parking lot, the preliminary conduit alignment between the apparent best electrical connection and the EVCS, location of signage, proposed parking lot re-striping and lettering, and other details. Note that electrical load studies were not conducted under the micro-siting analysis and the interior of existing electrical service panels were not opened. Final engineering design and permitting is required to make the sites shovel-ready.

Guidance from the California Governor's Office of Planning and Research regarding EVSE accessibility was followed during preparation of the preliminary site plans. Once the preliminary site plans were prepared to the level of detail described above, an Engineer's Opinion of Probable Cost was prepared.

Engineer's Opinion of Probable Construction Costs

The Engineer's Opinion of Probable Construction Costs were prepared by a licensed civil engineer using RS Means Site Work and Landscape Cost Data, cost data from vendors and utilities, and bid results from recent projects. The purpose of this opinion of probable cost is to provide an order of magnitude estimate of potential costs for the preliminary concepts. A cost line item was included for each major item of work identified as part of the preliminary site plans. The quantities of needed construction materials were measured from the preliminary site plans. Additional items included in the cost estimate were: sales tax, General Contractor Requirements, General Contractor Overhead and Profit, a 25% Estimating Contingency, Cost of Bonds and a Location Adjustment Factor to adjust nationwide cost data to the economy in the Upstate Region.

Note that the Engineer's Opinion of Probable Construction Costs should be updated with each future design iteration as the preliminary site plans are refined from their current state to final construction documents stamped by a registered professional engineer with responsible charge over the design. It should be noted that actual construction costs depend not only on the final design, but also how contractors actually bid the projects. Only after bidding and construction are the actual total construction costs known. Refining the opinion of probable costs throughout the process increases the confidence that the bid results will fall within the project budget, but does not guarantee it.

Results and Discussion

The work products generated under Task 3.3 include:

- A completed micro-siting rubric that includes a listing of 99 candidate sites for EVSE in the planning area.
    - All of the candidate sites were assessed on the ground using the rubric and site owner consultations we initiated on 29 sites.
    - A short list of nine highly ranked sites with owners who were open to discussing the concept of hosting a station were selected for further evaluation.
- A set of preliminary engineering plans were prepared for sites on the shortlist
- Engineer's Opinion of Probable Construction Costs prepared with RS Means Site Work and Landscape Cost Data, cost data from vendors and utilities, and bid results from recent projects for the sites on the shortlist including sales tax, General Contractor Requirements, General Contractor Overhead and Profit, a 25% Estimating Contingency, Cost of Bonds, and a Location Adjustment Factor to adjust nationwide cost data to the economy in the Upstate Region

The final micro-siting rubric spreadsheet includes a summary page for L1, L2, and L3 micrositing results listing all of the candidate sites, their TAZ, their final ranking score, and a description of the parking space that was evaluated. Following this are rubric spreadsheets for the following areas: Anderson, Corning, Dunsmuir, Mt. Shasta, Redding, Red Bluff, Weed, Yreka, and Miscellaneous TAZs Compiled. Copies of the completed rubric are included in Appendix C1. An electronic copy of the micro-siting rubric spreadsheet has been provided to the SCEDC.

The preliminary designs for the shortlist of selected sites were compiled into a plan set under a cover page to facilitate review by the California Energy Commission, local building departments and permitting officials, and community leaders. This plan set is included in Appendix C2 to this report.

The intent is for the preliminary plan set to be developed into a biddable set of construction plans under a separate project. Construction specifications for the civil and electrical work will then be appended to the plan set and the project will be released for public bid under a set of general conditions that adhere to the public contract code. In this way the first EVCS in the Network can be implemented as a result of the work completed in this Plan.

Subsequent stations can be implemented following a similar methodology as described above by selecting sites based on the ranking from the rubric, taking into account geographic and political considerations, and the willingness of site hosts.

The Engineer's Opinions of Probable Construction Costs for each site were compiled into a single spreadsheet. The cost spreadsheet includes pages with cost estimates for each of the sites noted in **Error! Reference source not found.**. Copies of the cost spreadsheet are included in Appendix C3. A summary of the preliminary engineer's opinions of probable construction costs for the shortlist of stations is presented in Table 5 below.

Upon review of on the micro-siting process, the following observations are noted:

- The collaborative process for developing the rubric went relatively well with quality input received from project team members and from members of the PEVCC.
    - There was some redundancy in the objectives that created extra work for evaluators however this was accepted as a result of the consensus based process used by the PEVCC for developing the rubric.
- The amount of time and personnel required to develop the list of candidate sites and rank them with the rubric was significant and candidate sites were not identified outside of major population centers and travel corridors in the region.
- A significant amount of public outreach and education occurred during the micro-siting process as local government officials and business owners and operators were contacted and engaged in conversations about EVCS and PEVs. These efforts generated interest in the community around the idea of a local Network and PEV transportation in general.
- The micro-siting rubric is a useful tool that could be used by other communities to derive a list of potential EVCS sites in a collaborative manner. If necessary the post processing step using the PEVI model results could be omitted if PEVI model results are not available for the subject area.

Table 5: Summary of Preliminary Engineer's Opinion of Probable Construction Costs

#	County	City	Description	Installation Type	Preliminary Engineer's Opinion of Probable Costs
1	Siskiyou	Yreka	Junction Shopping Center	One L2 EVCS One L3 EVCS Three stub outs	$ 121,000
2	Siskiyou	Mt. Shasta	Public Parking Lot on W. Lake St.	One L2 EVCS Three stub outs	$ 20,000
3	Siskiyou	Mt. Shasta	Tri Counties Bank	One L2 EVCS One L3 EVCS	$ 119,000
4	Shasta	Redding	McConnell Arboretum	One L2 EVCS One L3 EVCS Three stub outs	$ 106,000
5	Shasta	Redding	Sundial Bridge Parking Lot	One L2 EVCS Four stub outs	$ 24,000
6	Shasta	Redding	City Hall	One L2 EVCS Three stub outs	$ 18,000
7	Tehama	Red Bluff	Tehama County Visitor Center	One L2 EVCS One L3 EVCS One stub out	$ 125,000
8	Tehama	Red Bluff	River Park	One L2 EVCS One stub out	$ 20,000
9	Tehama	Red Bluff	Public Parking on Pine Street Downtown	One L2 EVCS Three stub outs	$ 21,000
				Total Estimated Construction Costs for Aggregated Project	**$ 574,000**

Note: Stub out refers to a conduit run to another parking space or parking spaces adjacent to proposed EVCS where the conduit system is designed to accommodate multiple EVCS circuits for future expansion. See preliminary design plans and detailed engineer's opinion of probable costs for more detail.

Source: GHD, 2014

Note that the costs presented in Table 5 do not include the following additional project implementation costs:

- Engineering design
- Permitting
- Bid period services
- Construction management
- Project administration
- Finalization of host/owner agreements

Recommendations

As a result of the work completed under Task 3.3, the following recommendations are offered for consideration by the SCDEC and PEVCC:

- Consider using the preliminary site plans and cost estimates included in Appendix C2 to initiate an aggregated project to implement the shortlist of EVCS installations.
- Consider using the data in the micro-siting rubric included in Appendix C1 to plan the rollout of subsequent stations in the Network.
    - The ranking score associated with each site is the result of field assessments guided by the objectives, weights, and criteria developed with the PEVCC
    - The PEVI model prioritization is incorporated into the final ranking score for each site which brings the benefits of the data-driven macro-siting analysis into the decision of where EVCS are sited.
    - The rubric should be viewed as a working tool that is being updated as new information comes in and progress is made towards developing new EVCS sites in the Network.
    - Additional candidate sites can be added to the rubric for areas that were not covered under this analysis due to budget constraints and the size of the geographic region encompassed by the study.

2.3 Plan to Collect Data on Consumer Charging Behavior

The purpose of this report is to present a plan to collect consumer charging data in California's Upstate Region that is based on what is currently understood about consumer charging behaviour and what technologies and methods have the potential to collect consumer charging behaviour.

2.3.1 Need

In recent years, modern, mass produced plug-in electric vehicles have entered the consumer marketplace. Federal and State governments have enacted policies that incentivize the production, sale, and use of these vehicles as part of a strategy to reduce greenhouse gas emissions from the transportation sector.

Since Plug-In Electric Vehicles (PEV) transportation and publically available electric vehicle support equipment (EVSE or charging stations) are in their nascent stages, there is some uncertainty about how best to roll-out the EVSE infrastructure so as to support PEV drivers, promote PEV adoption, and minimize stranded assets. Collecting consumer charge behavior data can be used to inform charging network administrators, transportation planners, and State officials about the efficacy of investments made to support publically available EVSE.

Collecting consumer charging behavior data can also be used in the process of identifying barriers to PEV adoption and develop strategies to remove them. One barrier to widespread PEV adoption is that the driving public is accustomed to the gas station model for vehicle fueling. Under this model, drivers can obtain hundreds of miles of driving range during a brief stop at a gas station. Gas stations are ubiquitous and a driver running out of gas is a relatively rare occurrence. Drivers of PEVs experience a different paradigm.

Charging PEVs takes longer and if additional range is needed when travelling, the number of publically available charging stations is low compared to the number of gas stations. Additionally, the distance that PEVs can travel on electric drive is typically about 1/3 of the range of a conventional vehicle. These generalizations speak to the paradigm shift faced by drivers who choose a PEV yet sales are currently exceeding the rates seen for hybrid cars when they were first introduced.

PEV sales data speak to a number of satisfying aspects to PEV transportation such as reduced emissions, less road noise, less maintenance, lower cost per mile for fuel, the potential for renewably powered transportation, freedom from the gas station, tax credits, rebates, and the ability to fuel your car at home, to name a few. Reinforcing the current level of satisfaction experienced by PEV drivers is one way to encourage adoption.

By collecting consumer charging behavior data and using it to inform strategies for installing, operating, and maintaining publically accessible charging infrastructure, the satisfaction that current PEV drivers feel can be maximized within the constraints of existing PEV and EVSE technologies. This satisfaction will be evident during the course of a PEV driver's life and through social interaction the idea that PEV transportation is satisfying will grow, which will in turn encourage adoption. The opposite effect could occur if the publically available charging infrastructure is poorly planned, operated, and maintained. In this case, PEV adoption rates could slow because public perception is that PEV transportation is associated with negative experiences.

2.3.2 Scope of Work

The scope of work for this report is to analyze the available technology and the effectiveness of that technology to collect consumer charging behavior data. The emphasis is on developing a consumer-friendly approach to data acquisition and to provide recommendations to stakeholders regarding the need for, value, and availability of various levels of data acquisition technology. The scope of work also includes the following activities:

- Develop a rollout plan for integrating data acquisition with the planned EVSE
- Providing recommendations for aggregating data acquisition with planned EVSE.
- Develop a consumer survey form

2.3.3 Uses for Consumer Charging Behavior

Consumer charging behavior data can be used to better understand the charging habits of PEV drivers in order to guide charging infrastructure rollout and encourage adoption. By understanding peoples charging habits, infrastructure can be placed more strategically, for example:

- Stranded assets can be reduced by learning what types of locations are unpopular for charging and then avoiding installing charging stations in those types of locations unless they are needed for safety purposes.
- PEV adoption can be encouraged by learning what types of locations are popular and installing more EVSE in those locations.

Consumer charging behavior data can show how sensitive PEV drivers are to pricing at publically owned stations when deciding where and when to charge. Network planners and administrators, and analysts can use consumer charging behavior data to learn whether or not pricing at publically accessible stations can support a for-profit charging station owner business model, or if a non-profit station owner business model or charge price subsidies are most effective in encouraging adoption. Consumer charging behavior data can be used to help funding agencies decide if available funds are best directed towards:

- Vehicle rebates to lower the cost of PEVs,
- Grants to install publically accessible charging stations,
- Subsidies to reduce the cost of charging at publically available charging stations,
- Or some combination of the above.

Consumer charging behavior data can also be used in the development of parking policies that promote fair use of parking and charging real estate in environment of parking scarcity.

2.3.4 Types of Consumer Charging Behavior Data

The following types of consumer charging behavior data are of interest for the uses described above:

- Number of charge events per day
- Energy transferred per charge event
- Duration of charge event
- Duration of transaction (can be different than charge duration)
- State of charge (SOC) upon arrival
- SOC upon departure
- Time of day each charge event occurs
- Price of electricity from the utility during the charge event
- Pricing structure of station (can vary with time and/or by user group)
- Number of events per week or month by specific vehicles
- Availability (percentage of time station is operable)
- Number of occurrences where charging station was occupied by conventional vehicle
- Number of occurrences where a driver was not able to charge because the charging station was occupied by another PEV
- Number of occurrences where a driver attempted to use a charging station but it was unavailable due to equipment failure

Some of these data can be collected by existing technologies; others can be collected by survey. Some of the data listed above may not be able to be collected with currently available technologies and methods.

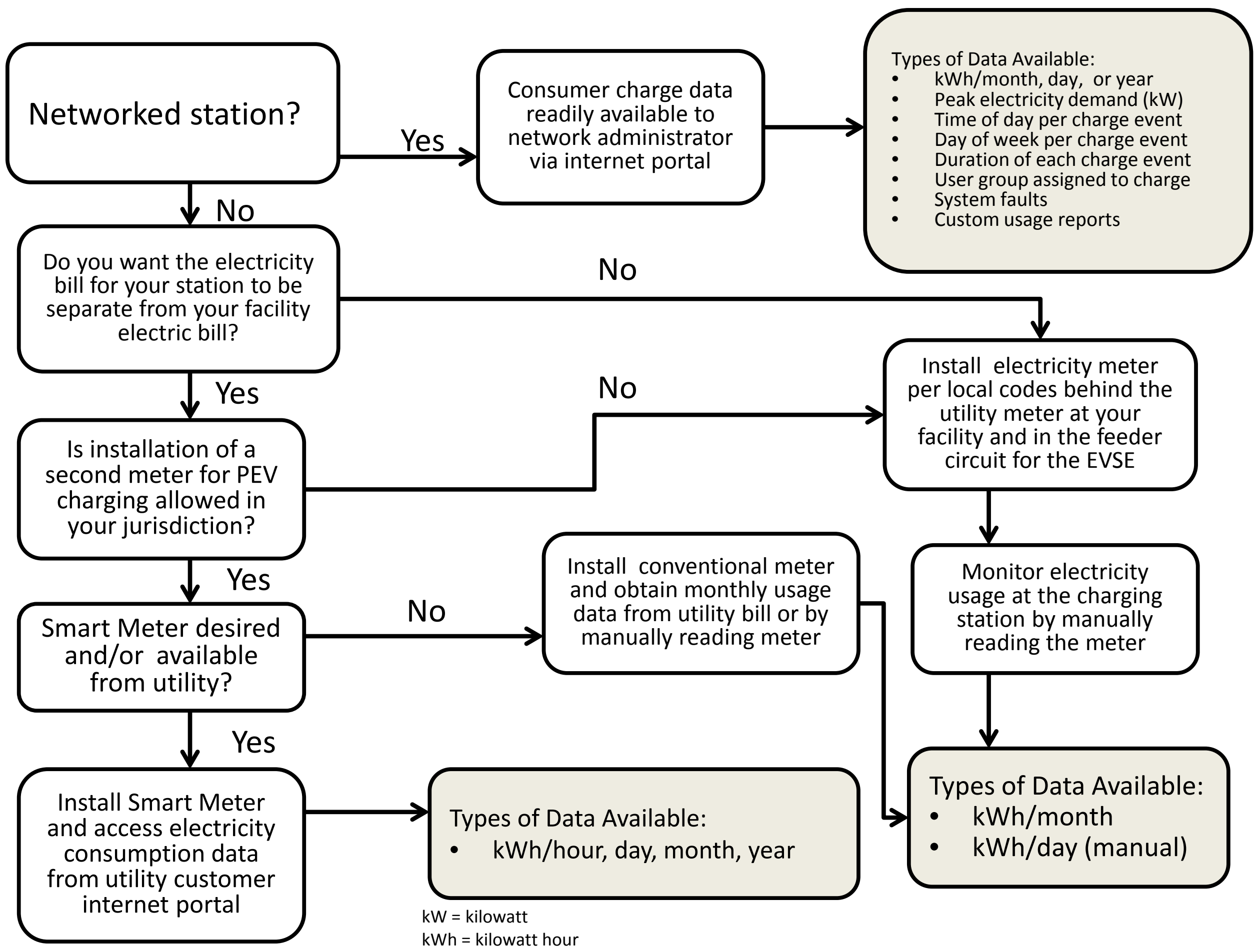
2.3.5 Review of Available Data Collection Technology

Technology for collecting consumer charge behavior is built in too many mass produced EVSE. A wide range of manufacturers offer networked systems that are capable of transmitting and receiving data to and from the internet via cell phone signal. This enables EV drivers to pay for charging and station administrators to manage the charger over the internet to set charging cost, monitor usage, download custom reports, and detect system faults.

2.3.5.1 Networked Versus Non-Networked Systems

Non-networked EVSE are also available with the most basic type being a smart relay box, a cord, and a plug configured to charge vehicles for free following safety and communication protocols contained in the Society of Automotive Engineers Standard (SAE) J1772. In order to monitor usage from this type of station additional metering hardware would need to be installed. Figure 8 below provides an overview of consumer charge data collection options from modern EVSE.

Figure 8: Hardware Options for Collecting Consumer Charge Data



Source: GHD, 2014

As can be seen in the figure above, the most convenient method to collect consumer charging data is by choosing networked EVSE. Networked EVSE also provide the highest level of detail about consumer charge behavior because these systems are designed for the purpose of monitoring and administering networks of charging stations.

A utility smart meter that is installed as a dedicated meter for a single EVSE can provide kilowatt hour usage for the station by the hour, day, month, and year through an online web portal. The data can be downloaded in spreadsheet format for reporting and analysis. A utility smart meter installed for a bank of charging stations can provide usage data for the bank of chargers but will not be able to provide information about individual EVSE usage within the bank.

Pacific Gas and Electric allows a dedicated meter to be installed for PEV charging and has a specific rate set up for EV charging. Jurisdictions in the Upstate planning area generally allow separate meters to be installed for electric vehicle chargers with one known exception being Humboldt County. Humboldt County does not allow a separate meter to be installed for PEV charging in residential applications; however, separate meters for non-residential applications are allowed.

If a separate conventional electricity meter is installed for the EVSE then data, in units of kilowatt hours (kWh) per month, will be provided by PG&E on the monthly bill. To obtain data in terms of kWh per day, the meter would have to be read manually on a daily basis.

If a conventional meter was installed in the charging station circuit behind the facility's main meter, the data in units of kWh per month could be read manually over a time interval of choice.

Customized electricity metering and data logging hardware is available to allow more comprehensive and convenient metering of non-network charging stations. These types of systems would be most applicable for remote stations that are out of range of cellular network signals. In this scenario, the same parameters that are monitored by networked stations could be monitored and the data would be collected manually by swapping a data logging module or connecting a laptop computer and downloading the data on a regular basis.

2.3.5.2 Networked EVSE and Open Charge Point Protocol

Open Charge Point Protocol (OCPP) is a standard that applies to data transfer and communications for EVSE. The OCPP was implemented to address the challenge of interoperability of PEV charging across the diverse landscape of EVSE. EVSE that are OCPP compliant can be accessed by any PEV driver regardless of what charging networks they may or may not belong to and what network the EVSE is associated with. The OCPP also allows EVSE owners and administrators to reconfigure the software on the EVSE to support their particular business/operations model. Currently, EVSE that are installed using funding from the State of California are required to be OCPP compliant.

Available Data Acquisition Technology

There is a wide range of EVSE available on the commercial market and the technology is rapidly evolving. This section presents a summary of the most common types of EVSE available at the time of this writing.

Level 1, Level 2, and Level 3 EVSE

EVSE are available with different power ratings. Level 1 EVSE utilize a 120 volt, 20 amp, single-phase branch circuit. Level 2 EVSE utilize a 240 volt, up to 80 amp, single phase circuit. Level 3 EVSE utilize either a 208 volt or 480 volt three-phase circuit with a current rating up to 400 amps. Level 3 EVSE are also referred to as DC fast charge stations because there is a rectifier in the EVSE that converts alternating current to direct current, which is then supplied directly to the Battery.

Networked Level 2 EVSE

As described above, networked EVSE provide the most convenient means of collecting consumer charging behavior. EVSE wired to a network can be managed, monitored, and its usage can be tracked and reported on. Furthermore, as electric utility rates change, the EVSE owner can adjust the price of consumer charging. Networked EVSE facilitates versatility of use for both the owners and the consumers. Networked EVSE allows PEV drivers to readily access charging stations via a service plan, credit card, or a smart phone. Additionally, networked EVSE facilitates data collection and reporting of consumer charge behavior. This section highlights the most common networked EVSE available at the time of this writing. Since the technology is rapidly evolving, the reader will find that there are networked EVSE available in the commercial marketplace that are not summarized here.

To collect consumer charging behavior data, the EVSE must be supported by a management network. Many manufacturers pair their EVSE with a web-based network for management, monitoring, and control of their charging stations. Charging stations that currently use, or have the option to use, a web-based management network include AeroVironment, Blink, ChargePoint, ChargePro, ClipperCreek, and Eaton. The network associated each charging station is listed in Table 6.

Table 6: Charging station and associated management network.

EVSE	Management Network/Software
AeroVironment	AeroVironment, Liberty PlugIns
Blink	Blink
ChargePoint	ChargePoint
ChargePro	SemaCharge
Clipper Creek	PowerDash, Liberty PlugIns
Eaton	Sky Network (Greenlots), Liberty PlugIns,
General Electric WattStation	WattStation Connect

Source: GHD, 2014

Networked EVSE allows the owner, host, or even in some cases the local utility company to manage their charging stations. The network is primarily accessible via internet access, but some networks also include smart phone access. On most EVSE networks, access to the web-based network allows an operator to set pricing, manage EV driver accounts of subscription plans, monitor the station, notify drivers of charge status, troubleshoot problems remotely, produce environmental reports (e.g. GHG reduction, fossil fuel displacement, etc.), track usage, and export data as available. When a utility company has access to the network, additional management may include assigning shedding groups, demand response, and blackout response.

2.3.6 EVSE Charge Ratings

The most common Level 2 EVSE charge rating is only slightly larger than the capacity of the on-board charges in most PEVs. If not carefully considered, EVSE could fall behind the charging capabilities of electric vehicles. The charge ratings for current EVSE ranges between 5.8 kW and 18 kW, as noted in comparison in Table 7. It is important to note that the leading EVSE manufacturers only offer 7.2 kW Level 2 chargers, while a many of the electric vehicles on the market are capable of charging at 6.6 kW. Furthermore, the Toyota RAV4 and Tesla Model S are capable of charging at 10 kW. Thus, if more PEV manufacturers follow the trend and move towards the capability of charging at 10 kW or greater, the EVSE that offer charging at or below 7.2 kW will limit their ability to minimize PEV driver charging time and therefore decrease driver satisfaction, which may discourage PEV adoption. Consequently, any EVSE infrastructure rated to 7.2 kW may need to be upgraded. Alternatively, if EVSE with a rating of at least 10 kW were selected initially, along with its supporting electrical infrastructure, increases in PEV charge ratings will be better supported. Stations that can charge at 19.2 kW would ensure that future increases in the capacity of on-board chargers would be support up to the limit of the allowable Level 2 charging current under the SAE J1772 standard.

Table 7: Comparison of EVSE models and their charging rates

EVSE Brand	Level 2 EVSE Model	Charge Ratings
Blink	Single Pedestal	7.2 kW
ChargePoint	CT4011-GW Single Pedestal	7.2 kW
ChargePro	Single Pedestal	7.2 kW
Clipper Creek	CS-Series Single Pedestal	5.8, 7.2, 9.6, 11.5, 13.4, 15.4, 17.3, or 18.0 kW
Eaton	Single Pedestal	7.2, 9.6, or 16.8 kW

Source: GHD, 2014

2.3.6.1 EVSE Data Access

For independent agencies to obtain consumer charging data from EVSE owners, it is recommended that the owners sign a Disclosure Agreement with the entity seeking to collect the data. The agreement would permit the entity to periodically access the networked EVSE from a web-terminal and export consumer charging data that does not violate consumer privacy rights. The simplest approach to obtaining approval from the owner would be by presenting the agreement to the owner when he or she applies for an EVSE installation permit, for tax incentives, or during other application EVSE processes.

2.3.6.2 Other Sources of Relevant Data

Consumer Outreach

Data exported from charging stations represents only a subset of data available for use in analyzing consumer charging behavior. Charging station data indicates how an existing set of charging stations were utilized. However, it does not indicate consumer preference and/or response to the existing infrastructure. Another subset of behavior data could come from consumer outreach. Consumer outreach in the form of a survey could complement the data exported from charging stations and could explain what cannot be interpreted from raw data. For example, a survey might indicate that a majority of consumers want a charging station at a nearby recreation area. This information wouldn't be gleaned from charge data alone. Furthermore, a survey could indicate whether or not a DC Fast Charger should be implemented instead of additional Level 2 chargers at a particular location.

To obtain consumer data via a survey, the survey could be presented through the vehicle registration renewal process, at a charging station, at the dealership, or in via a public outreach project. Ideally, the target demographic for consumer outreach would be drivers who have had time to get comfortable with their EV driving habits. Ideally, they have also had time to consider how and where the EVSE infrastructure might be improved. Vehicle registration renewal is typically performed via the USPS mail, and since it occurs after one year of EV ownership it would be an ideal avenue for obtaining information via a consumer survey. For those EV drivers within each county, the DMV could enclose a simple flyer within the renewal letter requesting consumer responses via a web-survey. Another avenue for outreach could be through an advertisement on the charging stations themselves. A station owner could offer, for a limited time, a discounted charging cost for those drivers who participate in a web-survey. In order for the latter approach to be effective, private EVSE owners may have to receive subsidies from the State or another agency accounting for the difference in lost charging revenue so that they are willing to offer this discount without incurring any losses.

To obtain consumer usage data via a survey, a both web-survey and hardcopy version were created for the EV drivers in the Upstate region (Appendix D). The Electric Vehicle Driver Survey that was prepared seeks driver experience and feedback on the existing EVSE infrastructure in the region. The survey asks EV drivers to respond to questions such as where they charge, are there enough publicly accessible EVSE, how much they are willing to pay for a charge event, and their general opinion and satisfaction about their EV charging experience. The goal of this survey is to determine how the utilization might be affected by location, pricing, and equipment, which cannot be obtained from the charge data alone.

Vehicle Telemetry

Additional charging behaviour can be obtained through vehicle telemetry. Useful telemetry data from a vehicle may include:

- GPS route information including start and stop times and locations
- Number of trips per day
- Battery state of charge (SOC) at the beginning and end of trip

The data is useful because, for example, it may indicate where numerous drivers have depleted their batteries in attempts to make trips, but have been limited by insufficient public EVSE infrastructure. Hence, indicating where consumers need additional public EVSE. Additionally, inferences could be made from SOC at trip start and stop, which could be used to infer consumer confidence in their regional EVSE infrastructure. A major hindrance in obtaining telemetry from consumers is that it requires a PEV driver to allow the installation of a telemetry module in his or her electric vehicle and to allow the release of the driver’s behaviour to a third-party. Drivers may be sensitive to third-parties having knowledge of their whereabouts. Thus, drivers would need an incentive to be willing to release their potentially private driving information. The module may need to be subsidized by the State or other agency, and a Disclosure Agreement would be required so that the agency would be permitted to periodically export the driver’s vehicle behaviour data.

Some electric vehicle manufacturers have already set up telemetry web-interface systems as optional purchasing features. The telemetry systems allow drivers to monitor their energy usage, check SOC, remotely start and stop vehicle charging, track GHG reductions, and produce usage reports.

One example is that Nissan offers an optional telematics service through CARWINGS for vehicles that are equipped with navigational equipment. To use the service, an additional module is installed on the PEV and vehicle data is exported to a server. The data can be accessed via a web-terminal or smart phone. The data logged by the telematics system and includes (CARWINGS, 2013):

- Daily trip number
- Total electricity used
- Electricity used from consumption
- Electricity used from regeneration
- Distance travelled
- Energy economy in mi/kWh
- CO_2 tailpipe emission reduction

Currently, drivers of the Chevrolet Volt and the Honda Fit PEV have access to remote charge management via a web terminal or smart phone, but as of yet do not have the capability to log and export vehicle usage data.

The types of data that can be obtained from networked EVSE do not vary significantly between manufacturers. Thus, in order to obtain the largest set of consumer charge data from EVSE, the most cost effective EVSE should be considered. Table 8 lists the costs of 7.2 kW Level 2 that were available at the time of this report. As a result of the capital lower costs, more business owners and stakeholders may be willing to invest their capital into adopting the new technology. Additionally, the costs to the PEV driver should also be considered because they could impact the revenue associated with the EVSE ownership model. This section addresses the costs associated with investment of EVSE.

Table 8: Equipment costs for networked 7.2 kW EVSE including one year of service fees

EVSE	EVSE Model (Level 2)	Cost
Blink	Blink Pedestal Single	$ 4,755
ChargePoint	CT4011-GW Single Pedestal	$ 5,666
ChargePro	ChargePro Charging Station	$ 4,895
Clipper Creek	CS-40 (Pole mount)	$ 5,730

Source: GHD, 2014

2.3.7 Plan for Data Acquisition

The information presented above was used to develop a recommended rollout plan for collection consumer charge behavior data. The plan is consists of the following elements:

- Select OCPP compliant, networked EVSE
- Distribute a PEV Driver Feedback Survey
- Create Database
- Update Database on a quarterly basis
- Report out to the stakeholders on an annual basis

Selecting OCPP compliant, networked EVSE will enable the collection of the following data:

- Number of charge events per day
- Energy transferred per charge event
- Duration of charge
- Duration of transaction
- Time of day each charge event occurs
- Cost to EV driver to charge
- Availability (percentage of installed time that station is operational)

These data will allow the network administrator to determine:

- Station Utilization
  - This will help determine what types of locations are popular and when it is time to install another station at a popular location
- Frequency of PEVs remaining plugged in after their battery has been completely charged
  - This will help determine when it may be advantageous to implement a charging policy that requires PEVs drivers to move their vehicles within a certain period after their battery has been fully charged, which will free up the EVSE for another PEV to charge.
- Frequency of overnight charging
  - This will help administrators understand demand for overnight charging opportunities for residents that do not have access to a dedicate parking space such as urban apartment and multifamily housing development dwellers
- The relationship between charging price and station utilization
  - This will help administrators understand how effective their marketing campaign is in explaining the actual costs of operating and maintaining the network and the justification for the pricing structure
  - This will also help administrators balance pricing and utilization by providing a feedback mechanism from PEV drivers
- The reliability of various types of EVSE
  - If availability of a particular brand of EVSE is low and externalities such as vandalism have not occurred then the administrator will be able to avoid that brand of EVSE for subsequent charging station installations
- The prevalence of vandalism in particular locations
  - From recent experience in the Upstate region, certain locations are more prone to vandalism than others. Vandalism can affect the availability of stations and it will be useful for the administrator to know which areas are more prone to vandalism.
  - If utilization of stations in vandalism prone areas is low then the administrator may elect to remove the EVSE to avoid incurring repeated expenses associated with repairs.

- If the location is highly utilized or important for safety reasons then the administrator can either harden the existing EVSE or install a new vandal resistant EVSE, if one becomes commercially available

Distributing a PEV Driver Feedback Survey and managing the data received will provide the network administrator with data that cannot be obtained from EVSE directly. A survey form was developed for the Upstate PEV Readiness Plan project and a copy is included in Appendix D of this report. The survey form was created using Google Forms, a free online tool that allows users to create surveys, create links to the survey for use on websites and in documents, and analyze survey results. The survey can be distributed by embedding a link on the websites of stakeholder organizations, by including the web address of the survey on printed promotional materials associated with the Upstate PEV Readiness Plan and the Upstate Plug-In Electric Vehicle Charging Network. Partnering with local auto dealers to provide handouts or business cards with each purchase of a PEV would make PEV drivers aware of the survey and the local charging station network, which could result in valuable feedback. The types of data that can be collected with the survey include the following:

- Frequency of use for each station in the network by individual drivers
- Additional locations where drivers would like to see EVSE
- Frequency of occurrences where a driver was not able to charge because the charging station was occupied by another PEV
- Frequency of occurrences where a driver attempted to use a charging station but it was unavailable due to equipment failure
- Frequency of occurrences where charging station was occupied by conventional vehicle

Once the type of EVSE to be purchase has been selected and the consumer survey has been finalized, the network administrator can design a database to store the data to be collected in a way that will facilitate analysis and reporting. A Microsoft Excel template can be created for monthly or quarterly data download/input from the EVSE and survey result tracking spreadsheet. The template can include graphs and tables to be used in reporting out to stakeholders the results of the consumer charge behavior data acquisition program. The results can be used for public outreach and to guide procurement and management decisions by the network administrator to maximize quality, value, and convenience to the PEV driver within the constraints of a non-profit cost recovery business model.

2.3.7.1 EVSE Recommendations

Networked EVSE that are OCPP compliant and capable of payment by credit card should be selected for deployment. In areas where vandalism is a concern, EVSE that are hardened with features such as a locking cord retraction system should be considered, if and when such units become commercially available.

For Level 2 EVSE, units with the highest power rating should be selected where practical so as to prevent the need for future upgrades as onboard PEV battery charger capacities increase over time towards the 1819.2 kW limit as per the SAE J1772 standard. However, the highest charge rate is not necessarily the most feasible option for all situations because this choice may trigger service upgrades that could make the project economically infeasible. SCEDC should consider installing the largest capacity Level 2 EVSE possible in a given location without triggering service upgrades. If a service upgrade is unavoidable, consider upgrading the service to support a high power Level 2 EVSE to support growth in vehicle on-board chargers in the coming years.

ClipperCreek Level 2 EVSE with the Liberty PlugIns add on seems to provide the most flexibility for installing high power, networked, OCPP compliant charging stations across a wide variety of electrical service sizes. This configuration also lends itself to development of hardened EVSE through the addition of a cord retraction system or automated locker/kiosk arrangement that could be triggered by the Liberty PlugIns system.

For Level 3 EVSE, units with both CHAdeMO and J1772 Combo plugs should be deployed on each unit to accommodate all PEVs with DC fast charge capability, except for Tesla, which has its own DC Fast Charge network specific to its cars. The additional cost to include both cords will likely be small compared to the overall project cost to install the EVSE. The voltage of the closest three-phase power connection should be considered when selecting the EVSE. Installation costs can be reduced if the EVSE input voltage and the voltage of the nearest three-phase power connection are matched. Additionally, care should be taken to deploy EVSE designed for the altitude and temperatures at the site.

2.4 Greenhouse Gas Reduction Estimates

The Upstate PEV (UPEV) research team conducted an analysis of the greenhouse gas (GHG) reductions that are achievable in the Upstate region through adoption of PEVs and deployment of public EVSE infrastructure.

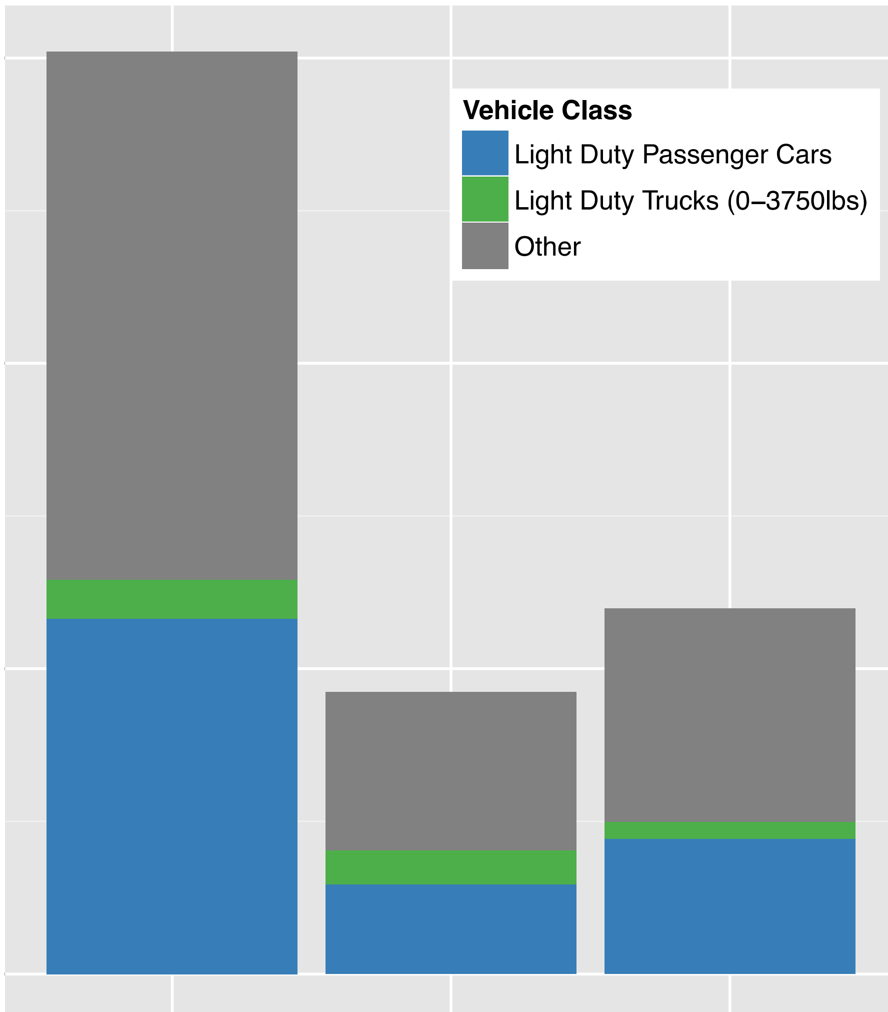
2.4.1 Greenhouse Gas Reduction Estimates - Methodology

The UPEV leveraged several sources of data to estimate the impact of PEV adoption on region-wide GHG emission in the year 2020. The first was modeled output from the PEVI simulation model (see Section 2.2.1.1), which provides an estimate of the number of electric vehicle miles traveled given three hypothetical penetration levels into the vehicle fleet of the Upstate region. The second data was from the California Air Resources Board EMFAC 2011 model, which was used to quantify the reduction in GHG emissions associated with the displacement of conventional vehicle miles traveled with electric vehicle miles. The GREET emissions model by Argonne National Labs was used to quantify upstream emissions associated with conventional vehicles and plug-in hybrid electric vehicles (PHEVs). Finally, the GHG emissions associated with the electricity needed to charge PEVs were based upon data gathered from the three electric utilities in the Upstate region (Pacific Gas & Electric, Redding Electric Utility, and Pacific Power).

2.4.1.1 Regional Fleet Composition

The EMFAC 2011 model output used in this analysis includes an estimate of vehicle population, VMT, and GHG emissions rates in the year 2020. These values are disaggregated by county, vehicle class, fuel type, and model year. A summary of the light duty fleet composition is provided in Figure 9. Note that the fleet penetration scenarios throughout this report were developed relative to the full vehicle fleet in each county. A 1% fleet penetration actually corresponds to a 2.3% penetration into the light duty vehicle fleet.

Figure 9: Vehicle population in Shasta, Siskiyou, and Tehama counties



Source: SERC, 2014

2.4.1.2 PEV Fleet Composition

Three fleet penetration levels were simulated in the PEVI simulation model: 0.5%, 1%, and 2%. These levels represent the percentage of total vehicles that were replaced by with plug-in electric vehicles. PEVs are assumed to be 50% battery electric and 50% plug-in hybrid electric. PEVs are also assumed to be 99% light duty passenger cars and 1% light duty trucks. The conventional vehicles replaced by the PEVs are assumed to the same class of vehicle (i.e. 99% / 1% light duty cars / trucks). Vehicle adoption is assumed to be spatially distributed throughout the Upstate Region in proportion to present day population.

2.4.1.3 Estimating Emissions

The PEVI model was used to simulate a workday of travel and charging behavior in the region for the three penetration levels and two scenarios. The first scenario included no new public electric vehicle supply (EVSE) infrastructure, and the second included the EVSE infrastructure recommended in this report (Section 2.2.2). These scenarios allow one to distinguish between benefits associated with PEV adoption alone and adoption coupled with public EVSE.

PEVI produces estimates of the total number of electric miles and gas miles traveled on a typical weekday. These were totaled and used to adjust VMT from the EMFAC model for vehicles of class LDA and LDT1 (light duty auto and light duty truck 1, respectively) that use gasoline. Then two new "fuels" were added to the analysis, "BEV" and "PHEV", to account for emissions associated with these two kinds of PEVs. The VMT for BEV and PHEV were distributed based on the distribution of electric and gas miles traveled from the PEVI model with all of the gasoline miles traveled going to PHEV and all of the electric miles traveled going to BEV (in reality, PHEV's have a mixture of both but for GHG accounting it is simpler to separate). The emissions rate for operating a PHEV on a per mile basis is based on the emissions rate of a gasoline vehicle but scaled in proportion to the ratio of fuel economy between a typical PHEV (50 mpg) and a conventional light duty vehicle from the EMFAC model (18-23 mpg).

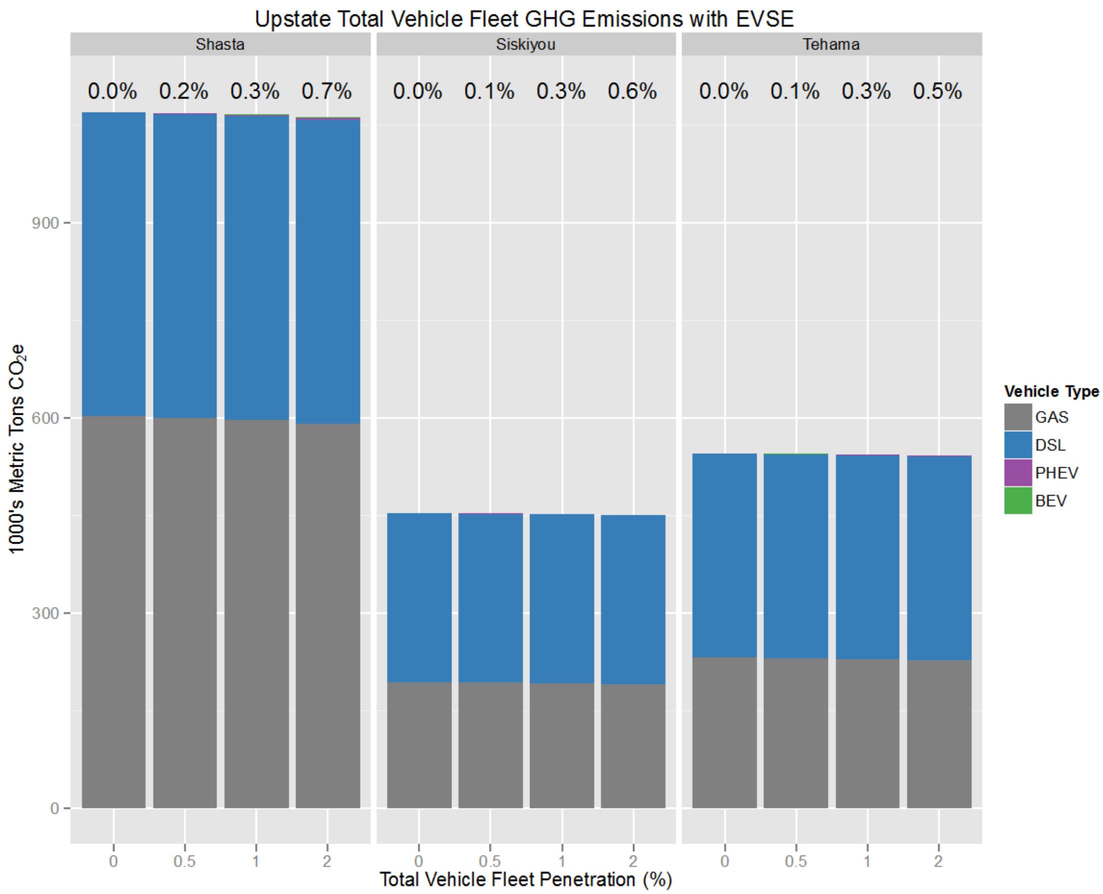
Upstream emissions for gasoline and diesel were based on the Argonne GREET model (1.31 kg CO_{2e}/gal of gasoline and 0.784 kg CO_{2e}/gal of diesel) and for electricity were based on a population-weighted average of the three primary electric utilities in the upstate region (0.20 tons CO_{2e}/MWh electricity). Finally, the EMFAC2011 emissions estimates are representative of a typical weekday, so we used a factor of 347.5, which is based on the conversion factors used by EMFAC, to convert weekday emissions to annual emissions.

2.4.2 Greenhouse Gas Reduction Estimates - Results

Figure 10 shows the impact of PEV penetration into the total vehicle fleet on total fleet emissions. The labels near the top of each plot annotate the percent reduction in GHG emissions associated with each scenario. For all three counties, a 1% penetration into the total vehicle fleet results in a 0.3% reduction in total fleet GHG emissions. Figure 11 presents the same result but the emissions quantities are restricted to just light duty vehicles. So a 1% penetration into the total vehicle fleet (which is a 2.3% penetration into the light duty fleet) results in a 1.5% reduction in light duty vehicle emissions.

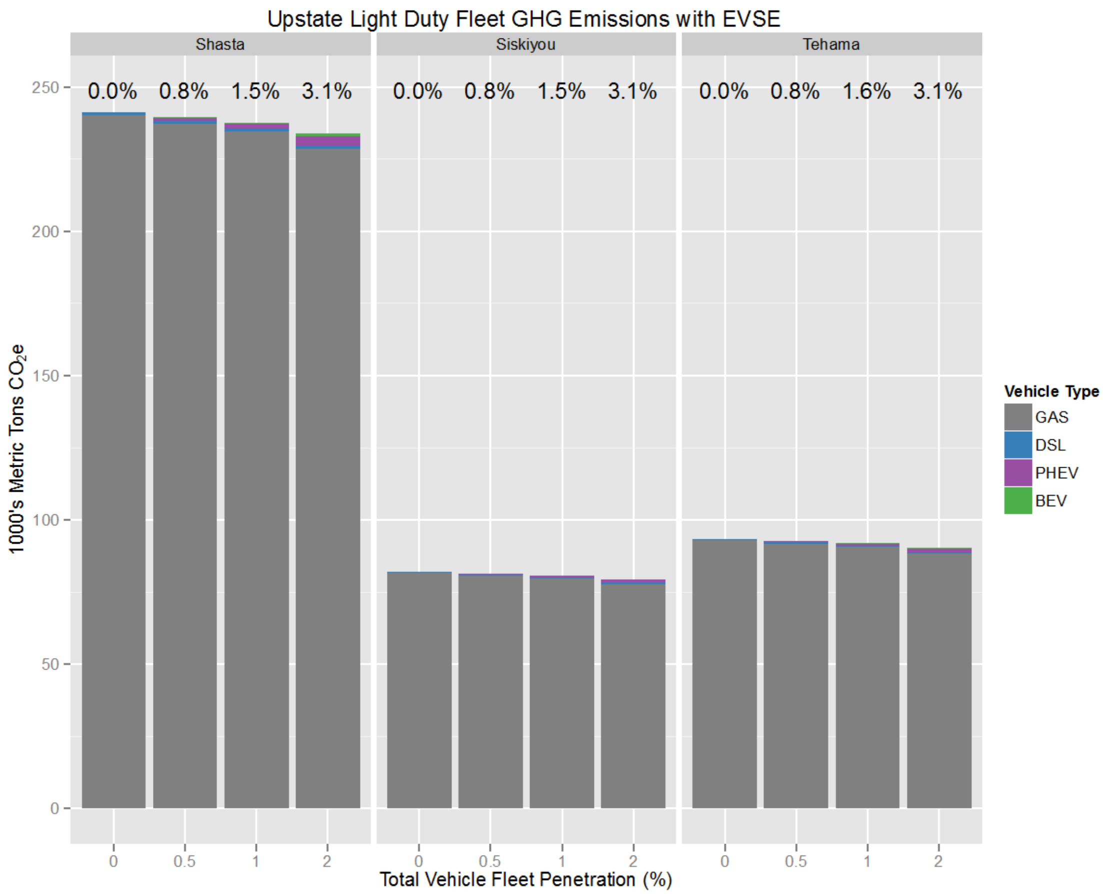
The impact of public EVSE on emissions is relatively small, for all counties the emissions reduction achieved by installing public charging infrastructure is approximately 3% greater than what is achieved from PEV adoption alone. Despite this modest benefit in terms of emissions, there is a substantial benefit to BEV drivers from having public EVSE installed in their region. As Figure 12 demonstrates, hundreds of drivers simulated in the PEVI model avoid becoming stranded when they have access to public EVSE. The public chargers make a substantial amount of travel possible that wouldn't otherwise be feasible in a BEV with approximately 70 miles of range. For this reason, it is reasonable to conclude that installing public EVSE is an essential component to the uptake of PEVs and the emissions benefits from adoption alone can be partially credited to the development of a public charging network.

Figure 10: The impact of PEV adoption in the Upstate region on total vehicle fleet GHG emissions by vehicle type. The black percentage labels indicate the percent reduction in emissions for each scenario



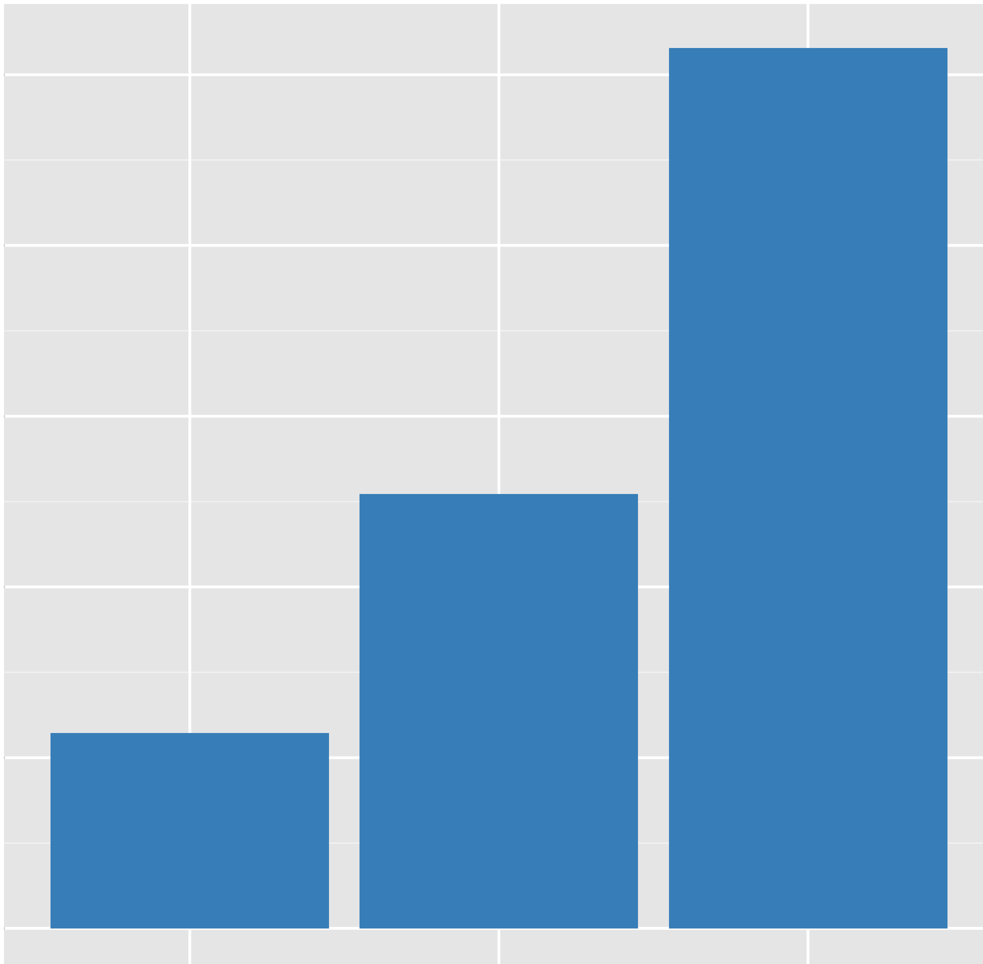
Source: SERC, 2014

Figure 11: The impact of PEV adoption in the Upstate region on light duty fleet GHG emissions by vehicle type. The black percentage labels indicate the percent reduction in emissions for each scenario



Source: SERC, 2014

Figure 12: The number of BEV drivers who avoid stranding during PEVI simulation runs when public EVSE is added to the road network according to the siting recommendations from the Upstate PEV Readiness Plan.



Source: SERC, 2014

2.5 Plan to Mitigate On-Peak PEV Charging

The Upstate Plug-in Electric Vehicle (UPEV) team assessed impacts and identified mitigation measures for on-peak plug-in electric vehicle (PEV) charging. The analysis found that even at a 2% penetration of PEVs into the light duty vehicle fleet, the increase in peak demand – while not negligible – is nevertheless within the range of natural load growth that utilities already account for in the course of normal system planning and upgrading activities. This explains why PEV charging is not a cause of significant concern for utility service planners at this point in time. Mitigation measures for on-peak charging consist of a combination of economic and technical measures. Economic measures include peak period pricing structures that can discourage on-peak charging. Technical measures include load-shedding algorithms available in some EVSE and onsite renewable energy generation and battery storage systems integrated with EVSE.

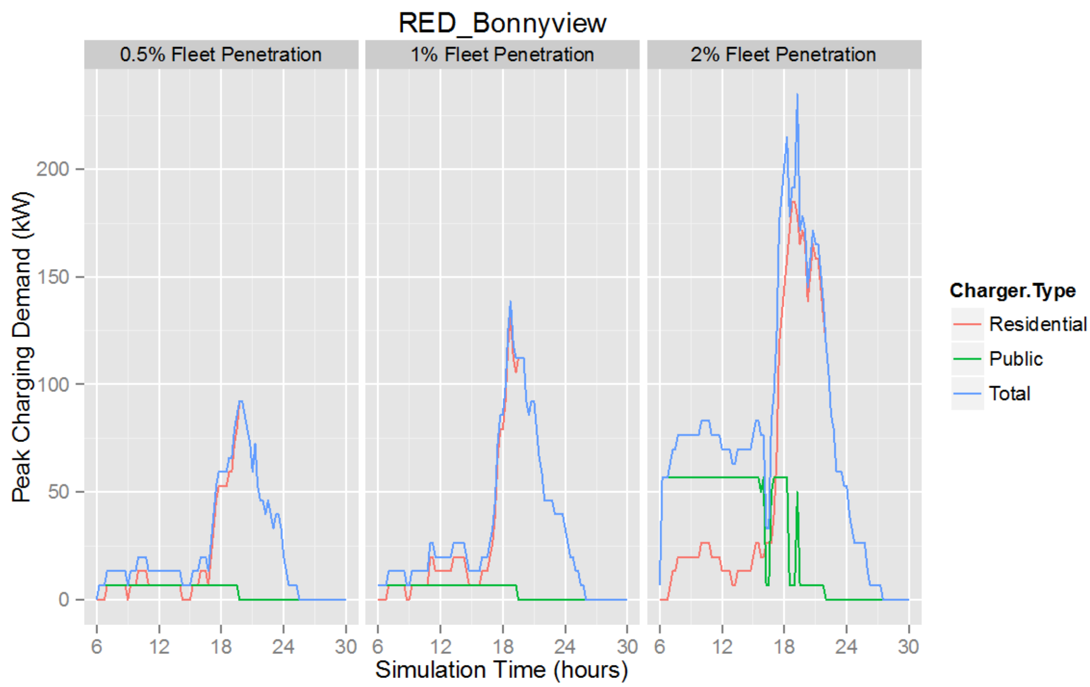
2.5.1 Distribution Level Peak Demand Analysis

The UPEV team obtained distribution grid infrastructure data from Pacific Gas & Electric for 23 circuits in Shasta County (which do not cover Redding Electric or Pacific Power service territories) and 13 circuits in Tehama County. The infrastructure data were used to compare the spatial extent of each distribution circuit to the size of the travel analysis zones (TAZs) used in the plug-in electric vehicle infrastructure model (PEVI). It was determined that the sizes of the TAZs are approximately the same as the size of a single distribution circuit in both rural and urban regions of Shasta and Tehama Counties. Based on this result, the peak demand impact analysis was conducted at the spatial resolution of the TAZ.

Unfortunately, the UPEV team was unable to procure load data from PG&E or the other utilities at the distribution circuit level. So the analysis of peak demand consists of conducting five replicate simulations with the PEVI model for each penetration scenario and summarizing the PEV charging demand by TAZ. The results of these simulations were then presented to regional utility managers at Redding Electric Utility and Pacific Power.

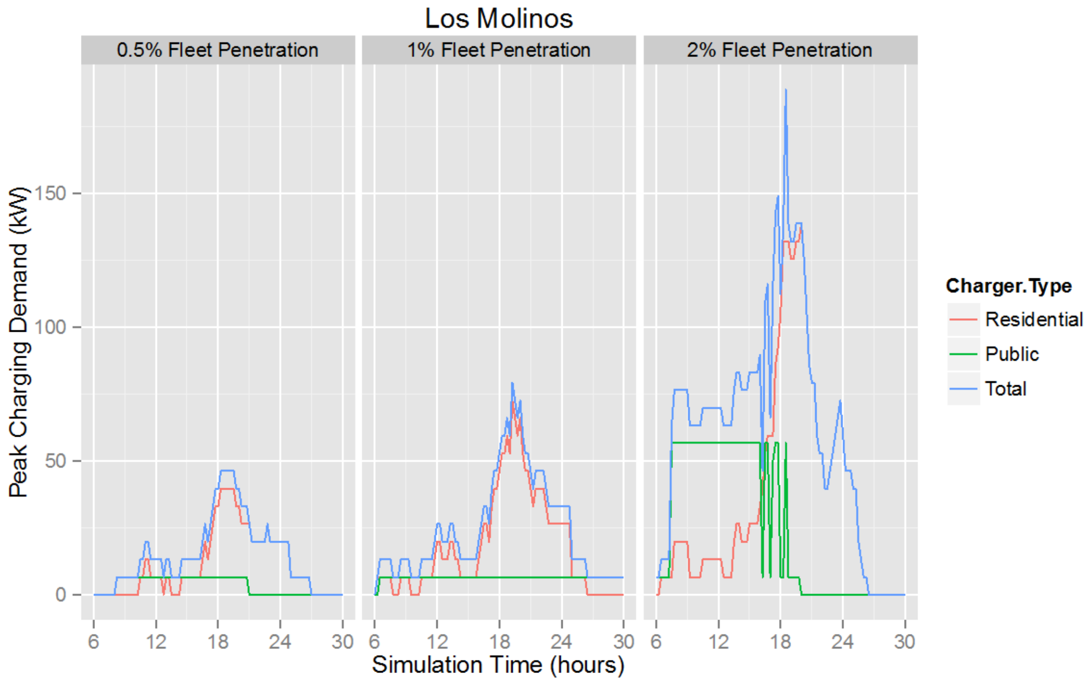
Figures 13, 14, and 15 present the simulated peak demand for power due to PEV charging in a TAZ in Redding, Los Molinos, and Etna in order to show, respectively, demand curves for urban, semi-urban, and rural areas of the Upstate Region. Model runs started at 6 AM and went through 6 AM the following day (hour 30 on the plot). Figure 16 presents a summary over all TAZs in the region categorized into urban, semi-urban, and rural groupings. Five curves are plotted showing the 0^{th}, 25^{th}, 50^{th}, 75^{th}, and 100^{th} percentile peak demand that occurred over all of the TAZs in that category and over all five replicate simulations performed with the PEVI model.

Figure 13: Peak demand projections for the Bonnyview TAZ in Redding, an example of an urban TAZ.



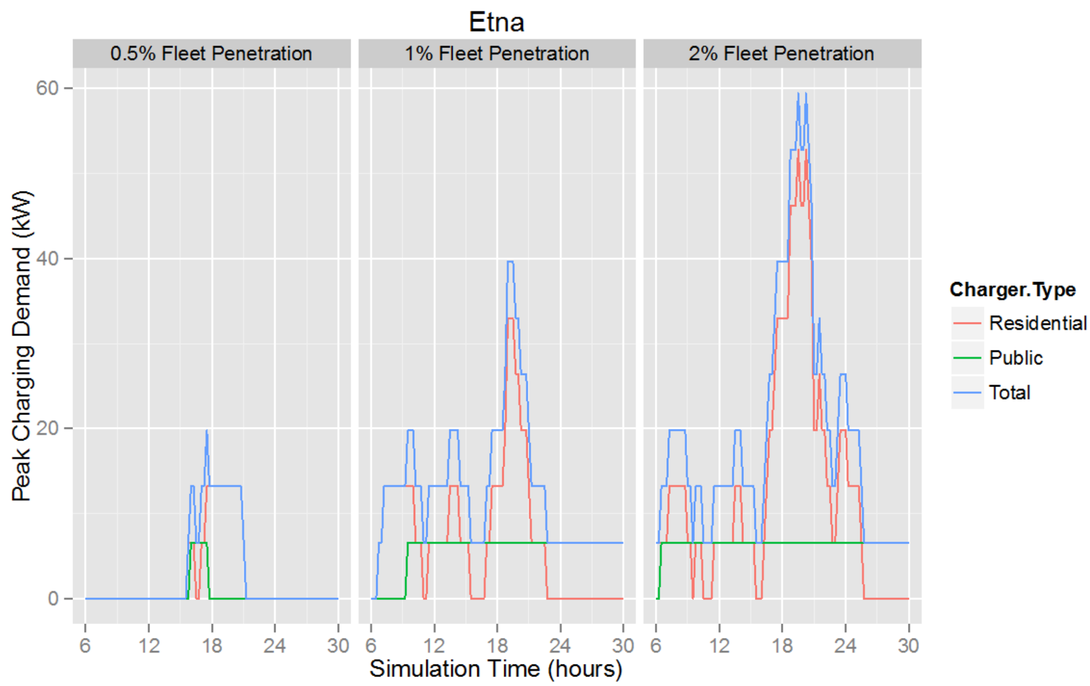
Source: SERC, 2014

Figure 14: Peak demand projections for the Los Molinos TAZ in Tehama, an example of a semi-urban TAZ



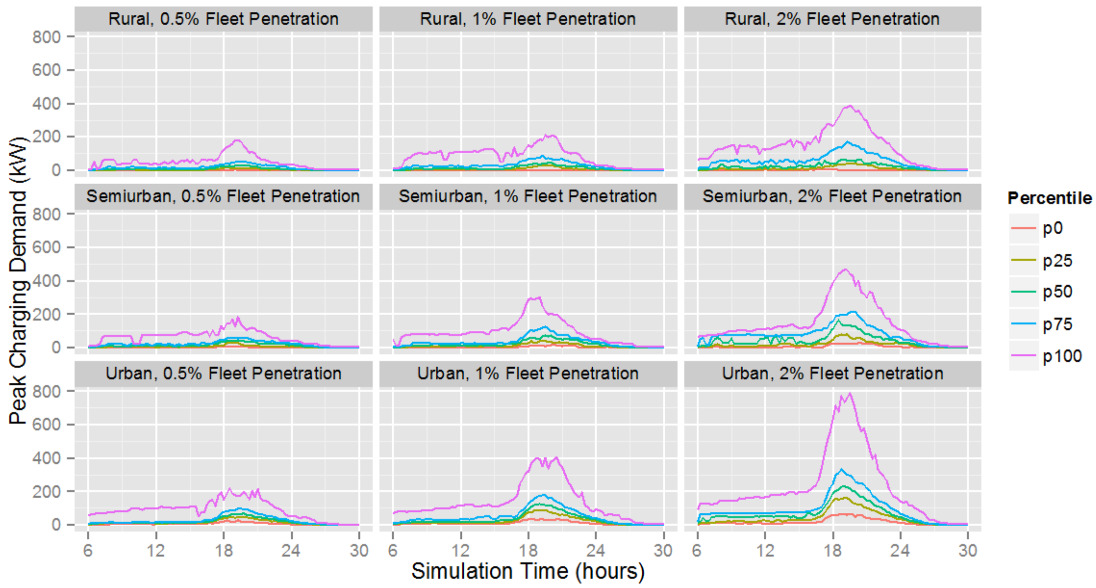
Source: SERC, 2014

Figure 15: Peak demand projections for the Etna TAZ in Siskiyou, an example of a rural TAZ



Source: SERC, 2014

Figure 16: Peak PEV charging demand percentile projections over all TAZs by category (Urban, Semi-urban, Rural) and PEV fleet penetration.



Source: SERC, 2014

For all penetrations and locations, the peak demand for charging occurs in the early to mid-evening (6-9 pm), driven primarily by the arrival of PEV drivers to their home at the end of the day. Generally, the peak summertime loads driven by air conditioning demand occur before 6pm. Therefore, the PEV peak is unlikely to directly exacerbate feeder-level peak load; however, the ramp down period from air conditioning loads may overlap to some degree with the ramp up period from PEV. This could potentially prolong the duration of the afternoon peak event and may eventually require mitigation measures.

The worst-case peak demand occurred at 2% penetration in an urban TAZ and had a magnitude of ~800kW. For a feeder with an existing peak of 5MVA, the additional peak load from PEV charging over a 10 year time horizon represents an annual growth rate of ~1.5%. This rate is commensurate with "natural" load growth due to population and other demographic drivers. This implies that the worst impacts from PEV charging – while not negligible – will occur on a time horizon that allows the utilities to anticipate and mitigate through their regular process of system planning and upgrading. The more typical impacts from charging will fall substantially below the worst-case scenario. Over 75% of peak demand in the 2% penetration and urban scenario was below 350kW.

Finally, through direct conversations with utility planners from Redding Electric and Pacific Power, the UPEV team was reassured that the load growth projections from PEV charging fall well within typical rates of growth already accounted for by their regular processes.

2.5.2 Site Level Peak Demand Analysis

In cases where the electrical service for an existing facility has to be expanded to accommodate installation of an EVSE, the utility will typically cover the cost of the service upgrade upstream of the customer's meter and the customer will cover the costs of upgrades downstream of the meter. For cases where a new service is required for the EVSE installation, a cost share arrangement is typical between the customer and the utility for the new service drop from the nearest transformer with appropriate voltage. The specifics of the cost share arrangement depend on the estimated revenue that can be expected from the new service and is evaluated on a case-by-case basis. In general, the cost share requirements in these cases will tend to comprise a significant portion of the overall cost of the EVSE installation.

All three utilities in the Upstate region impose monthly demand charges. If PEV charging occurs coincident with a facility's existing peak electric load, then it will directly add to that facility's monthly demand charge. The severity of this impact is largely dependent on the demand charge level imposed by the utility and can vary substantially between the three utilities that serve the region. Table 9 shows typical demand charges levied by each of the utilities, as well as an estimate of the monthly bill impacts that would be experienced during the summer period if electric vehicle charging took place coincident with the host facility's existing peak demand period.

Table 9 Electric bill demand charge impacts for summer peak coincident charging events

Utility	*Rate Schedule*	*Summer Demand Charge ($/kW/mo)*	*Cost with coincident 6.6 kW Level 2 charge event ($/mo)*	*Cost with coincident 50 kW DC fast charge event ($/mo)*
Pacific Gas & Electric	A-10*	$18.37	$121	$918
	E-19*	$14.28	$94	$714
Pacific Power	A-32	$3.26	$22	$163
	A-36	$7.28	$48	$364
	AT-48	$5.28	$35	$264
Redding Electric	E7, E8	Up to $29.65	$196	$1,483

* Assumes secondary voltage electric service.

Source: SERC, 2014

These potential demand charges could be a serious deterrent to a potential site host who might be considering installing an EV charging station or to a fleet operator who is considering adding PEVs to their fleet. One potential mitigation measure is to place the EVSE on an electric service that is not subjected to demand charges (i.e., a service on a small commercial rate). If such a service is not available, it may be possible to request a new small commercial service just to serve the EVSE, but this would need to be worked out with the local utility. Other potential mitigation measures include charging higher rates for PEV charging during a facility's peak demand period in order to discourage charging during that time and to help recoup demand charges, and installing technical solutions such as those mentioned above (i.e., smart EVSE that can shed load during peak demand events, battery storage, and solar electric systems). This issue of demand charges should be discussed with the utility prior to installing EVSE.

2.5.3 Methods for Mitigating or Deterring On-Peak Charging

As mentioned previously, on-peak charging generally does not appear to be an issue in the Upstate Region. However, there are several methods that could be used to deter on-peak charging if there were a desire to do so.

Mitigation measures for on-peak charging consist of a combination of economic and technical measures. Economic measures include peak period pricing structures that will discourage on-peak charging. PG&E rate schedules include peak period energy pricing and demand charges that make electricity consumption during peak periods more costly. These measures can act to discourage on-peak charging when real-time electricity costs are passed through to the PEV drivers. Redding Electric Utility and Pacific Power and

Light do not currently have time-differentiated pricing structures. However, both of these utilities do impose demand charges that could impact the cost of providing electricity for EV charging purposes.

For these pricing mechanisms to work, the EVSE network administrator must set up a pricing schedule that corresponds to the peak energy and demand charge schedules that pertain to the site. Modern networked EVSE allow pricing to vary according to a schedule; however, the amount of effort to set up a varied pricing schedule is not insignificant. In addition, demand charges pose unique challenges. Determining whether or not demand charges will be triggered for a PEV charging event depends on what other loads are present at the host facility at the time of the charging event, and on the customer's overall load profile. Demand charges are difficult to pass through to PEV drivers in real-time because these charges are not determined nor incurred until the end of an electric utility's monthly billing period.

Technical measures include load shedding algorithms available in some EVSE and onsite renewable energy generation and battery storage systems integrated with EVSE. Certain EVSE, such as the Liberty Plug-In System, provide a means for the charging load to be shed if the utility sends out a curtailment signal. In this case, the PEV driver will not notice that a curtailment event has occurred unless they are denied a consequential amount of energy during the event. Using this technology and specific signaling, the utility can limit the extent to which PEV charging occurs during extreme peak periods. It may be possible to configure this type of system to shed the PEV charging load if the facility load is nearing the point where demand charges will be incurred.

Another technical solution is offered by a company called EV For Oregon; they offer a high power EVSE that is integrated into a photovoltaic system with a 30 kilowatt-hour battery pack. This type of system helps mitigate peak demand because the energy for charging is provided through the battery pack which allows for a reduced demand from the electricity grid. The photovoltaic system is beneficial in providing renewable energy to recharge the battery pack, which again reduces the load experienced by the electricity grid for PEV charging. Similar systems without the photovoltaic system are available from specialty manufacturers allowing peak demands to be mitigated using a battery pack and inverter coupled to the EVSE.

2.5.4 Plan for Mitigating or Deterring On-Peak Charging

Discussions with PG&E, REU and PP&L staff regarding peak impacts from EV charging at a 1-2% penetration of PEVs indicate there will be no significant issues on their respective distribution systems. For this reason, mitigation of on-peak charging impacts in the Upstate Region may be considered a low priority. However, there could be site level issues associated with demand charges. This could be a deterrent to the installation of EVSE and the adoption of PEVs and will likely need to be addressed.

PEV and EVSE technologies are still in their early stages, and new features and capabilities will certainly make their way into the market place. As the market evolves it will be important for PEV stakeholders to keep themselves informed about the following topics:

- Stay informed about utility electric rate options and how they relate to peak charging (time-of-use rates, peak demand charges, rules on second meters, etc.). Advocate for fair and effective policies for PEV drivers and EVSE site hosts.

- Stay informed about EVSE features regarding pricing schedules and demand response features. Examine how the true costs of PEV charging can be passed through to the consumers who are charging their PEVs?
- Examine methods for dealing with demand charges. What impact does PEV charging have on EVSE host site demand charges? How can demand charges be tracked and then passed through to consumers? What sort of pricing structures can be used in place of demand charges for accounts that serve EVSE loads? Can EVSE be placed on an electric service that will not be subjected to demand charges?
- Stay informed about EVSE systems that incorporate battery storage, renewable energy generation, and/or demand response features as a means to mitigate peak charging impacts.

2.6 Plan for Streamlining EVSE Permitting, Installation and Inspection

Plug-in electric vehicles and the associated infrastructure require attention from planning and building departments in every city and at a county level. Currently, some of the biggest barriers in quick PEV and EVSE adoption are found in the permitting process, as PEVs and EVSE are relatively new to the market and planning and building department staff are often unfamiliar with the technology. The challenges associated with PEVs include the process of issuing permits for PEV charging units and managing the demand on the electricity grid, particularly at the local level.

This plan summarizes the EVCS permitting process, describes the roles of the various authorities involved in the approval process, describes the current practices in the Upstate Region, summarizes best practices from the experiences of other communities, and provides recommendations for streamlining EVCS permitting processes.

For reference, EVCS are available at three different power levels that support different rates of plug-in electric (PEV) charging. The permitting requirements for the three different charging levels vary due to differences in the character of the required electrical service. The three charging levels are defined as follows:

- Level 1 (L1) charging provides alternating current (AC) electricity to the PEV from a 120 volt (V), 20 amp (A) circuit.
- Level 2 (L2) charging provides AC electricity to the PEV from a 240 V circuit with currents up to 80 amp[10].
- Level 3 (L3) charging is also referred to as DC fast charging, provides direct current electricity to the PEV and the AC feeder capacity to the EVCS is typically 208 or 480 V, 3 phase with currents up to 400 amp.

These three charge levels are referred to throughout this document.

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[10] Typically Level 2 charging occurs at 30 A; however, up to 80 A is allowed under the Society of Automotive Engineers J1772 Standard

2.6.1 Purpose

The purpose of this report is to present a plan to streamline EVCS permitting, installation and inspection in the Upstate Region that is based on an assessment of current practices in the region and lessons learned from other communities.

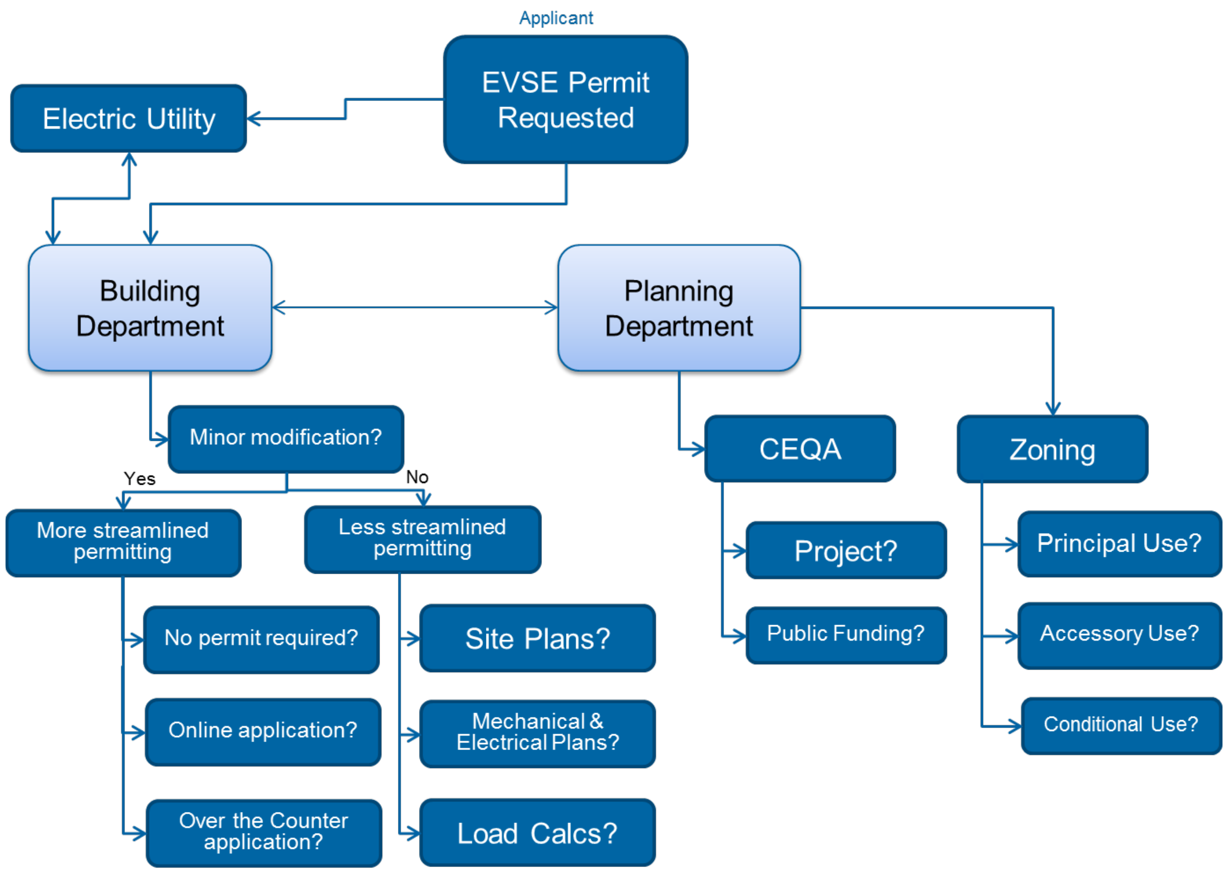
2.6.2 Need

In recent years, modern, mass produced plug-in electric vehicles have entered the consumer marketplace. Federal and State governments have enacted policies that incentivize the production, sale, and use of these vehicles as part of a strategy to reduce greenhouse gas emissions from the transportation sector. Since PEV transportation and EVCS are relatively new to the mass market, local planning and building department staff are often unfamiliar with the technology, which can lead to delays and increased costs for permitting EVCS. These delays and increased costs can constitute a barrier to PEV adoption as potential PEV and EVCS owners could become discouraged by unnecessarily difficult permitting and installation processes and elect to stay with the internal combustion vehicle and fueling paradigm. In order to help meet Federal and State PEV adoption targets, it is important to streamline the ECVS installation process and reduce disincentives to consumers as much as is practical.

2.6.3 Scope of Work

The scope of work for this report is to review the current status of EVCS permitting in the major jurisdictions within the Upstate Region, provide a summary of model EVCS permitting practices from communities outside the region, and develop a plan to streamline EVCS permitting in the Upstate Region. The general process of EVCS permitting involves numerous steps illustrated in the flowchart Figure 17.

Figure 17 Flow chart for EVSE permitting and planning approval



Source: GHD, 2014

2.6.4 Description of General EVSE Permitting Process

As shown in Figure 17, the permitting process starts with the applicant notifying the building department and the electric utility (EU). Notifying the EU may be overlooked by the applicant because the building department will involve the EU as appropriate for the type of EVCS installation under consideration. The building department will guide the applicant through the process and determine to what extent the planning department needs to be involved in the process. Ideally, for simple installations, the permit may be issued over the counter without involvement of other entities. In practice, building department staff may have difficulty guiding consumers through the process because they are unfamiliar with the technology. The roles of the entities shown in Figure 17 are described in further detail below.

2.6.4.1 Electric Utility

The EU will become involved in the permitting process anytime there are modifications required upstream of a given customer's meter to support the EVCS and, generally speaking, the EU needs to be informed when a customer's load changes significantly. This can occur when the addition of EVCS at a given facility triggers a need for a service upgrade to accommodate the increased load, or when a new service is requested at a specific location to support the installation of EVCS. In the former case, the EU may upgrade their electrical infrastructure as needed to support the expanded service requirements at no cost to the customer or cost share participation may be required. In the latter case, the EU will typically evaluate the request and estimate the potential revenue from the new load. If the potential revenue to the EU is high, the cost to the owner of the new load is low. If the potential revenue to the EU is low, the cost to the owner is higher. If the EU is involved in a given EVCS installation, the building department will not close the permit until all of the checks and inspections required by the EU have been completed.

2.6.4.2 Building Department

The building department is responsible for issuing a permit for the EVCS installation after verification that all applicable requirements have been met. For private commercial and residential installation of L1 and L2 EVCS, the character of the work is analogous to installing an additional electrical outlet. The primary purpose of the permitting process in this case to verify that the existing electrical service has the capacity to safely support additional load from the EVCS as per the National Electric Code and any local codes that are applicable.

For publically accessible L2 EVCS additional considerations can arise such as land use zoning, environmental impacts of construction, encroachment on required dimensions for sidewalks and parking stalls, accessibility guidelines, and illumination requirements among others. For L3 EVCS, the EU is typically involved throughout the permitting process due to the intensity and character of the new electrical load.

As shown in Figure 17, the key differentiator is whether or not the EVCS can be considered a "minor modification" by the building department. If this is the case then it becomes relatively easy to streamline the permitting process for the applicant. Examples of permitting processes in other communities where installation of EVCS is considered minor work are provided in a subsequent section below.

If a given EVCS installation involves an electrical service upgrade or significant site work, for example, then the building department may not consider the installation to be "minor work" and a more complex and costly permitting process could result. Site plans, electrical plans, load calculations and zoning reviews could be required to allow the building department to fully evaluate a permit application for certain installation. For residential load calculations, Article 220 of the California Electric Code (CEC) is used to determine if the addition of the EVCS installation will result in an increase in service capacity for the host facility.

A summary of the electrical codes applicable to EVCS installations are shown in Table 10 below.

Table 10: Summary of Electrical Codes Applicable to EVCS Installations

CEC Section #	Summary of Requirements
625.13	Cords and plugs may not have exposed parts
625.24	Cords and plugs must be grounded
625.9	EV connectors shall not be interchangeable with other receptacles and shall have a grounding pole that connects first and disconnects last
625.15	EVSE[1] shall be marked "For use with Electric Vehicles"
625.23	If the EVSE is 60 A or larger and greater than 150 V to ground, then a disconnect must be installed within site of the EVSE and be capable of being locked in the open position.
625.30	EVSE connector shall be mounted at least 2 feet but not more than 4 feet above ground
625.17	EVSE cable shall not be longer than 25 feet unless equipped with a cable management system that is part of the listed EVSE

Source: GHD, 2014

A building department may request a mechanical plan as part of the permit application. Such a request would reflect a historic need to provide mechanical venting for interior spaces used for PEV charging when battery chemistries allowed venting of explosive gases during charging. Due to advances in battery technology, venting is very rarely required for interior spaces used for charging commercially available PEVs. In general, building department staff are aware that requiring mechanical venting plans is not applicable to modern EVCS installations.

2.6.4.3 Planning Department

The planning department will become involved in the EVCS permitting process upon request of the building department. This typically occurs when the proposed installation may cause environmental impacts or conflict with zoning ordinances.

2.6.4.4 CEQA

In California, the environmental review is conducted under the CEQA framework and the first step is to determine whether or not the proposed installation is a "project." Jurisdictions often consider typical EVCS installations to be minor modifications and therefore not "projects" under CEQA, in which case no further environmental analysis is required. However, if public funding is being used for the installation, then the CEQA process must be followed regardless of whether or not the installation is considered a project.

The next step in the process is to determine whether or not the installation is exempt from further analysis under CEQA. A reviewer may consider a given installation a "project" under CEQA and then determine that it qualifies for one of several possible exemptions such as: The project is ministerial in nature, there is no possible significant effect from the project, or the project qualifies for either a statutory or categorical exemption. Commonly filed exemptions for EVCS are:

- 15301 (Class 1) for Existing Facilities
- 15303 (Class 3) for Small Structures
- 15304 (Class 4) for Minor Alterations to Land

If a given installation is considered a non-exempt project then there is the potential for a significant environmental impact and a CEQA document is required. An initial study would be prepared to determine whether a mitigated negative declaration or an environmental impact report would be required.

2.6.4.5 Zoning

Zoning ordinances describe what types of uses are permissible on a given real property based on the community's general plan document. Zoning ordinances will list principal uses for each type of land use zone in the community. If the proposed use is not listed as a principal use then, it may be considered an accessory use to a listed principally permitted use, or a conditional use permit would typically be required to allow the proposed use. As an alternative to the conditional use permit, the project proponent can request that the zoning type for the property in question be changed to a zoning type that includes the intended use among its principally permitted uses. Obtaining a conditional use permit is significantly less involved than re-zoning a property; however both processes are lengthy and costly in most cases.

Since PEV transportation and EVCS are new to the mass market, electric vehicle charging is rarely listed as a principally permitted use in zoning ordinances. Common best practice is for EVCS to be considered an accessory or similar use to a variety of principally permitted uses, whenever possible. This is reasonable because any use that involves vehicle traffic through the site is supported by EVCS when vehicular traffic is comprised of both conventional vehicles and PEVs. EVCS support the principally permitted use by enabling PEV drivers to use the site. PEVs generally require longer "fuelling" times at destination locations as opposed to the current gasoline station model for conventional vehicles. EVCS can be considered an accessory to the principally permitted use of the destination.

In the event where the sole purpose of a given property becomes PEV charging, for example a niche commercial facility catering specifically to charging needs of PEV drivers, a conditional use permit would likely be required since PEV charging is too new to be listed as a principally permitted use under any zoning classification.

2.6.4.6 General Plan Considerations

A community's general plan can play an important role in streamlining EVCS permitting processes. If the general plan includes policies to promote the adoption of PEVs then it is more likely that PEV charging will be listed as a principally permitted use across a wide range of zoning types. Also, the building and planning departments have a stronger foundation for making the permitting process as fast and inexpensive as possible.

Incidence of Language Supporting PEV Transportation in Local General Plans

A review of the general plans for the jurisdictions in the Upstate Region was conducted and the results are presented below.

Table 11: Electric Vehicle Inclusion in Local General Planning Documents

Jurisdiction	EVs or alternative fueled vehicles mentioned in General Plan?
Siskiyou County	Yes
Shasta County	Yes
Tehama County	Yes
City of Yreka	No
City of Weed	No
City of Mt. Shasta	No
City of Dunsmuir	No
City of Redding	Yes
City of Red Bluff	No
City of Corning	No

Source: GHD, 2014

As can be seen in Table 11, the general plans for four jurisdictions in in the Upstate Region contain mention of PEVs or alternative fueled vehicles. Table 12 through Table 15 provide summaries for these instances.

Table 12: Summary of language supporting PEVs from Siskiyou County Community Planning Documents

Section	Summary
Energy Element, pp 66	Efficiency Potentials, Transportation. Opportunity identified for increasing the efficiency of transportation fuel use and shifting to cost-effective alternative fuels.

Source: GHD, 2014

Table 13: Summary of language supporting PEVs from Shasta County Community Planning Documents

Section	Summary
Climate Action Plan	Reference to State Low Carbon Fuel Standard
Energy Section of General Plan	Role of Government: As a large consumer of energy, government can use its own actions as models for energy conservation and planning. Through its actions local government may elect to act as a provider of incentives that encourage energy conservation. For example, conversion of an agency's vehicle fleet to alternative fuels could stimulate other firms to do the same.
Policy 6.4.4, E-j	The County should continue to implement plans to convert more of its vehicle fleet to hybrid or alternative fuels that meet or exceed air quality standards.

Source: GHD, 2014

Table 14: Summary of language supporting PEVs from Tehama County Community Planning Documents

Section	Summary
Air Quality Impact Mitigations	Promote Transportation Alternatives, Support Green Fuels, and Reduce GHG emissions from transportation. Consider model clean vehicle requirements.
Implementation Measure OS-2.6g	Support vehicle improvements and the use of clean vehicles that reduce emissions and improve air quality.
Implementation Measure OS-2.6h	Replace the County's fleet vehicles with new vehicles that utilize the lowest emission technology available, whenever economically feasible.

Source: GHD, 2014

Table 15: Summary of language supporting PEVs from City of Redding Community Planning Documents

Section	Summary
Air Quality Element	While the electrical car has the greatest potential for addressing air quality issues, its omnipresence on the roads and general public acceptance parallel to that of the combustion vehicle is probably many years away.
Policy 13	New Transportation Technology, Implementation Strategy: The City will monitor advancements in new technology regarding electric vehicles and cleaner burning combustion vehicles to ensure that future land-use and transportation systems can easily interface with technology when it is available and where reasonable. The City will pursue the development of Joint Venture projects involved in new technology.
Policy 15	The City should adopt a schedule to replace or convert conventional fuel vehicles with alternative fuel vehicles as rapidly as feasible based on available funds.
Section F. Level B measures, Item 4:	Convert fleet vehicles to clean-burning fuel as appropriate

Source: GHD, 2014

This supporting language in local community planning documents is valuable for use in encourage policy development to streamline the EVCS permitting processes in these communities.

2.6.5 Current Practices for EVSE Permitting in the Upstate Region

Current EVCS permitting practices for jurisdictions in the Upstate Region were reviewed and the results are summarized in this section. None of the jurisdictions in the region have permitting processes specific to EVCS installations.

2.6.5.1 Siskiyou County, Yreka, Weed, Mt. Shasta, and Dunsmuir

Richard Kinsman, the Planning Director, was contacted to discuss EVCS permitting in Siskiyou County. Mr. Kinsman indicated that he was making a list of code revisions and that revisions for EVCS permitting could be included such as including them as a conditionally permitted use for some commercial zoning classifications. Currently EVCS would be allowed by right in the highway commercial zoning classification.

Mr. Kinsman also spoke with building official Mike Crawford, who related that he hadn't had any applications for electrical service upgrades to accommodate in-home EV charging, though he also acknowledged that these types of minor service upgrades don't typically result in permit requests. Mr. Crawford indicated that he hasn't had any inquiries regarding commercial charging stations yet.

Mr. Crawford subsequently called the City of Yreka's building official and a contract building official for the cities of Mount Shasta, Dunsmuir, and Weed and they reported that the only EV-related permits they've issued were for the one L2 Tesla charging station in Yreka at the Comfort Inn and the four Tesla charging stations at the Tree House Inn in Mount Shasta. The contract building official also reported that there have been no permit requests for residential EV charging stations in Yreka, Mt. Shasta, Dunsmuir, and Weed.

2.6.5.2 Shasta County

Building Division Manager Dale Fletcher was contacted to discuss EVCS permitting in Shasta County. Mr. Fletcher indicated that no commercial permits have crossed his desk yet and he has completed "a couple of residential permits." Mr. Fletcher related that for typical EVCS installation the process would be "over the counter" with a plan review and the permit fee would be on the order of $200. The process would include a quick zone review where the particular parcel would be reviewed. Shasta county has a policy that requires a property to be brought up to code if are any code violations are noted during the permitting and inspection processes. Mr. Fletcher did not see any additional permitting requirements for L3 installations but noted that each permit application would be reviewed on a case by case basis.

2.6.5.3 Tehama County

Bob Halpin of the Tehama County Planning Department and John Stover, the Building Official for Tehama County were consulted regarding EVCS permitting processes in Tehama County. Neither Mr. Halpin nor Mr. Stover has had an EVCS permit application come to their attention.

2.6.5.4 City of Redding

Development Services Supervisor, Erich Mayne, was contacted regarding EVCS permitting in the City of Redding. Mr. Mayne indicated that to his knowledge his department had not processed any permit applications for EVCS. Mr. Mayne indicated that permitting a typical residential EVCS installation should be a routine over the counter process and that permit fees would depend on the cost of the project and would follow the department's fee schedule. Since the City of Redding has its own electric utility, Redding Electric Utility, there is some streamlining for EVCS built into the process. The EU will, by default, be involved in the permitting process and their input on a given permit application will under one jurisdiction rather than two. As for new measures to streamline the permitting process, some experience processing permits for EVCS within the department would be helpful in identifying potential opportunities.

2.6.5.5 City of Red Bluff

The City of Red Bluff Building Department was contacted and staff recommended talking to Eduardo Griego (surname not provided), the counter technician. Mr. Griego related that the department had not had any commercial or residential EVCS permit applications to date. After a discussion regarding the technology, Mr. Griego related that it sounded like the permitting process for L2 EVCS would be routine. For L3 EVCS it may be more involved due the higher operating voltage. For both L2 and L3 EVCS Mr. Griego indicated that they would likely need to process a few permits before opportunities for streamlining could be discussed.

The City of Red Bluff Planning Department Director, Scot Timboe was contacted to discuss EVCS permitting from a planning perspective. Mr. Timboe indicated that he would likely handle the zoning review using a “similar use” finding unless the subject project involved exclusive use of a property for EV charging. Mr. Timboe indicated that the Community Development Director can make the decision to issue a similar use finding or, if an application is controversial, then they could put it on the Planning Commission’s agenda, in which case the City Manager would also be consulted. Mr. Timboe stated that he did not see a reason to create a new regulation adding to the complexity of the process because, based on his understanding, EVCS are not radically different than other technology currently being permitted and it would be more efficient to use the existing regulatory framework.

2.6.5.6 City of Corning

Efforts were made to contact Terry Hooford and John Stoufer of the City of Corning to discuss EVCS permitting from both planning and building department perspectives however no contact had been made at the time of this writing.

2.6.6 Best Practice Examples from Other Communities

There are several communities throughout the United States that have taken steps to streamline their EVCS permitting processes. This section presents a number of examples of such efforts beginning with examples where the installation of EVCS is considered minor work.

2.6.6.1 Minor Work Designation

The following two examples demonstrate cases where EVCS permitting was streamlined by categorizing certain installations as “minor work.”

- In the state of New Jersey, the installation of residential EVCS is considered “minor work.” The applicant is required to provide verbal notification to the code enforcement agency prior to commencing installation. Then a permit application must be filed within five days of the notification.
- The state of Oregon has expanded its “minor label” program to include EVCS installations. Licensed electricians can purchase a booklet of 10 minor installation labels for EVCS.
    - Certain design restrictions apply.
    - The cost is approximately 10% of the cost for a standard permit.
    - One tenth of the minor installations get inspected.

2.6.6.2 Online Permitting

Allowing permits for EVCS installations to be issued through an online process is a recent development that speeds up the process and reduces costs. The following examples demonstrate online permitting process being used in other communities.

- The city of Houston Texas offers online express permitting for EVCS installations. Online permits are issued automatically and instantaneously for standard EVCS installations and inspection typically occurs on the day of installation.
- The city of Los Angeles California offers online permitting for EVCS installations. Owners are allowed to start using their EVCS immediately upon installation and inspection typically occurs within 24 hours after installation.
- In San Francisco California, electricians that are registered with the building department can obtain permits for EVCS installation instantly online.

- In Charlotte North Carolina, there are two options for online EVCS permits; one for homeowners and one for contractors. The introduction of these processes has reduced the turnaround time for permits to between one and two days.

2.6.6.3 Over the Counter Permitting

Providing over-the-counter permits for EVCS installations is common practice in many communities across the United States. In this process, the applicant is typically walked through the permitting process by building department staff and the permit can be issued in about one hour. Inspections are then scheduled to coincide with the installation. The following examples demonstrate over the counter EVCS permitting processes used in other communities.

- Raleigh North Carolina applied its existing "stand alone" permitting process to EVCS permitting. The applicant is walked through the process at the counter and the process typically takes approximately one hour. Inspection can occur as early as the following day.
- The San Francisco building department issues same-day over the counter permits for residential EVCS
- The City of Irvine has developed an over the counter permit worksheet. The worksheet provides a streamlined permitting process for residential EVCS installations where the sub panel servicing the installation is rate at 100 A or more. The worksheet requires that the applicant have basic knowledge of the size of the electrical service panel, the nameplate rating of the EVCS they wish to install, the square footage of their home, and the number and type of lighting circuits and major appliances in their home. The City of Irvine EVCS permitting worksheet is included in the Appendix E1.

2.6.6.4 Plan Check

In the case where some aspect of the EVCS installation causes the need for a more thorough review of the proposed work, a more involved process involving a plan check is typically required. This process will typically include the following requirements:

- Building permit application
- Site Plan
- Electrical Plan
- Load Calculations
- Inspection

The building permit application itself is similar to what would be filled out under the online and over the counter permitting scenarios however it will be less specific to EVCS installations. The site plan will show the property boundary, outlines of structures, locations of existing utilities, dimensions, and location of proposed EVCS and feeder circuit. The electrical plan will include a single line diagram, a panel schedule, load calculations, and a plan showing the circuit layout, conduit and wire size and type, and any details relevant to the installation. Depending on the requirements of a given building department, it may be required to have an appropriately licensed professional prepare the electrical plan for the EVCS installation

Examples of specific permitting processes for EVCS installations that have been specified by other jurisdictions are summarized below.

2.6.6.5 City of Sebastopol

The City of Sebastopol provides some guidance to the permitting process for installation of EVCS. The steps they suggest are:

- Determine level of service required (level 1 or 2 charging station).
- Evaluate existing electrical service, include load and circuit size, and determine if upgrade is required.
- Produce wiring plan.
- Determine if second meter will be required.
- Determine installation location.
- Obtain Permit.
- Perform installation.
- Inspect installation.
    - A copy of the manufacturers installation guide is required on site for inspector.

2.6.6.6 City of Sacramento

The City of Sacramento has a guide to EVCS permitting. The following steps are provided by the streamline guide:

- Determine level of charging required.
- Have an electrical contractor evaluate the load of the place of installation.
- Determine if a new meter or sub-meter will be required.
    - Time-of-Use rates apply in the City based on Sacramento Municipal Utility District "Residential Time-of-Use Electric Vehicle (RTEV) rates. In order to receive these rates a separate meter or a sub-meter must be installed which requires a building permit.
- Submit application, fees and required documents to the City Permit Center.
    - Required documents include: load check/evaluation, electrical plans (wiring), specifications of EVCS to be installed, and mechanical plans (if required for ventilation).
- Obtain building permit.
- Complete installation.
- Schedule and complete installation inspection.
- Connect to existing utility.

2.6.6.7 City of San Diego

The City of San Diego issued an Information Bulletin providing guidance to how to obtain proper permitting for EVCS. The City also provides a general idea of the cost of the permitting and inspection process in the bulletin. The process they suggest is:

- Complete general application.
- Gather necessary documents and plans.
    - Site plan, floor plan, electrical plan and load calculations are required.

    - If in publicly accessible area, disabled accessibility plans are required.
- Obtain electrical/building permit(s).
- Install EVCS.
- Complete inspection.

2.6.6.8 Atlanta Permitting Process

The City of Atlanta has a permitting process in place for installation of EVCS. The City does not require a permit for the standard level 1 charging station, as the standard 120 volt outlet will not require modifications to the electrical system. Level 2 charging stations that require wiring to the electrical system require a permit for installation, and the following steps have been outlined to streamline the permitting process.

- Select licensed electrical contractor to make installation.
- The party fills out "Atlanta's Electrical Permit Form" along with the contractor.
- Contractor submits the completed from and fees to the Office of Buildings.
- Applications will then be reviewed and permits issued.
- Electrical contractor can then perform the installation.
- Installation is inspected by the Office of Buildings.
    - Failed inspections can be re-inspected at a fee of $50, for up to three times.

2.6.7 Recommendations for Streamlining EVSE Permitting in the Upstate Region

The follow actions are recommended to streamline the EVCS Permitting process in the Upstate Region:

- Include policies to encourage PEV transportation in community planning documents as part of document update cycles
- List PEV charging as a permitted use across a broad range of zoning classifications
- If a zoning review is triggered, consider the EVCS as an accessory or similar use to another permitted use whenever possible.
- Develop a standard EVCS permitting process that can be used across the Upstate Region for typical residential installations that meet the following criteria:
    - EVCS is not accessible to the public
    - EVCS is located within 25 feet of main electrical panel
    - Results of load calculation worksheet indicates that the existing main electrical panel for the building is adequate
        - A sample load calculation worksheet developed by the Governor's Office of Planning and Research (OPR) is included in Appendix E2.
    - Advertise the standardized process for residential permits at car dealerships, building department counters and websites.
    - Allow the standardized process to be completed using an over-the-counter permitting approach
- Establish a permit fee structure specifically for EVCS installations making fees as low as possible for each jurisdiction

- Allow second meters for EVCS to enable PEV driver access to lower rates for PEV charging provided by utilities

Note that implementing an online permitting process for EVCS installations does not appear to be a practical goal in the Upstate Region because online permitting is not currently used in the region and establishing such a system solely for EVCS permitting is not warranted.

2.6.7.1 Recommended EVCS Permitting and Installation Guide

The following brief guide summarizes the recommended steps for installing EVCS in residential, multifamily, and publicly accessible commercial settings.

Residential Installations

- Determine specifics of vehicle charging requirements from manufacturer of your specific vehicle
- Check with Electric Utility regarding rate schedules, metering, and electrical service requirements
- Check with your building department to:
  - Determine what the permitting requirements for your EVCS installation
  - Determine whether or not a second electricity meter is allowed for your vehicle
- Decide where you want to place your EVCS at your residence
  - If you decide on an outdoor location, make sure that you select an EVCS that is rated for outdoor service
- Determine whether or not your home's existing electrical service is adequate to supply the selected EVCS
  - EVCS are considered continuous duty loads so circuit breaker must be rated for 125% of nameplate rating on EVCS
- Select an electrical contractor if required or desired
  - Check to make sure their license for electrical work is current
- Develop installation plans if required by building department for your installation
  - Site plan, electrical plan with single line diagram and panel schedule, and specification sheet for your EVCS are typically required
- Apply for building permit
- Order EVCS and any additional required materials
- Install EVCS
- Notify building department that you are ready for an inspection
  - Make any required changes as a result of the inspection
  - Building department will notify electric utility when the installation has passed inspection

Multifamily Residential Installations

There are additional considerations for EVCS installations at multifamily unit (MFU) dwellings. If the owner of the MFU decides to install the EVCS as part of the infrastructure offered to tenants, then the process above can be followed. While the property owner will not know the specifics of the types of vehicles that will be use the EVCS, the connections between today's commercially available PEVs and EVCS are standardized to allow interoperability.

If a tenant living in the MFU wishes to install EVCS to support a PEV they have purchased or intend to purchase, then they must obtain permission of the owner of the facility. If the owner will not finance the installation and the tenant obtains approval and proceeds with the installation, then the tenant will need to accept that when they move away from the MFU, the electrical circuit installed to support the EVCS will remain the property of the owner. Level 1 chargers are most applicable in this situation since they are inexpensive to install and can be used for other purposes besides PEV charging.

Publically Accessible Installations

Commercial businesses, municipalities, and institutions may desire to install publically accessible charging stations to increase patronage or as a public service. These types of installations follow a similar process as described above for residential EVCS. However, the following additional considerations are likely to apply:

- Determine whether or not you want to the PEV drivers using the station to pay for use or not.
    - If yes, then select EVCS that has pay by credit card capability
    - If no, then any EVCS can be used
- Determine whether to install Level 2 or Level 3 chargers
- Determine where in parking lot to install the EVCS accounting for accessibility guidelines as published by the OPR
    - The first of 25 publically accessible EVCS installed in a given parking lot should be designed for accessibility, including a parking space and access aisle with specific dimensions
    - Complete details are available in the OPR's guidelines entitled "Plug-in Electric Vehicles: Universal Charging Access Guidelines and Best Practices", which is attached in Appendix E3.
- Develop site plan with civil engineer, contractor, or other appropriately licensed entity
    - Include way finding signage at ingress to parking lot
- Develop electrical plan with electrical engineer, electrical contractor, or other appropriately licensed entity
    - EVCS are considered continuous duty loads so circuit breaker must be rated for 125% of nameplate rating on EVCS.
- Apply for permit
- Make any changes to plans required upon review of permit application by building department
- Obtain permit
- Construct project

2.7 Plan for PEV Adoption in Fleets and Other Incentives

2.7.1 PEV Adoption in Fleets

In today's alternative energy market, there are a number of opportunities available to the fleet decision maker to reduce carbon and energy consumption. These include technologies such as biofuel, gaseous fuels, liquefied fuels, improvements to ICEs and hybridization, as well as more fundamental improvements to fleet processes. Specifically, the adoption of plug-in electric vehicles by fleets is one opportunity that will not only offer organizations many benefits under the right circumstances, but will also prove to be a critical catalyst in reaching Governor Brown's goal of having 1.5 million electric vehicles on the road by 2025.

Revenue growth, reduced energy spend, increased market share and improved corporate reputation are all benefits that can be brought about by putting in place strategies to minimize energy consumption and carbon emissions.

In the right circumstances EVs can offer multiple benefits for an organization. These range from financial, operational and environmental benefits, and include:

- Whole life cost savings
- Reduction in air pollution and carbon emissions
- A smoother, quieter and more pleasant driving experience

Through detailed analysis, it is possible to identify the benefits that EVs can bring to a vehicle fleet. The scale of these opportunities will increase as the number and variety of car and commercial vehicle models escalate over time.

With the intention of increasing awareness of EV opportunities, options, and benefits among fleet decision makers as well as helping guide them through fleet specific considerations (such as whole life cost modeling) that are necessary to successfully introduce EV's in their fleets, the project team executed the following activities:

- Identified fleets in the Upstate region
- Compiled resources for fleet decision makers
- Developed a methodology and spreadsheet tool for evaluating EV fleet opportunities
- Contacted local fleet decision makers
- Conducted fleet evaluations for the City of Mt. Shasta and the City of Redding (See Appendices F2 & F3, respectively).
- Prepared a plan to accelerate EV adoption in fleets

The project team worked closely with fleet managers to assess PEV opportunities within their fleets, taking into consideration fleet vehicle types, duty cycles, procurement schedules, life-cycle operational costs, and local-government environmental targets, such as climate action plans, that can be addressed through PEV adoption. The project team coordinated with vehicle and EVSE manufacturers and vendors to provide fleet decision makers with detailed information on the range of equipment options available to meet stakeholders' specific fleet needs. Using this information, the project team assisted fleet managers in developing and implementing individualized procurement strategies and timelines to acquire and integrate PEVs and install supporting EVSE.

2.7.1.1 Fleets in the Region

A list of public and private fleet operators in the region was compiled. Below are the fleet categories that were identified.

- Local Government
- Siskiyou County
- Shasta County
- Tehama County

- Anderson
- Corning
- Dorris
- Dunsmuir
- Etna
- Fort Jones
- Montague
- Mount Shasta
- Red Bluff
- Redding
- Shasta Lake
- Tulelake
- Weed
- Yreka

State Agencies

- California Department of Fish and Wildlife
- California Highway Patrol
- California Department of Social Services
- California Department of Rehabilitation
- California Department of Motor Vehicles
- Department of Water Resources
- State Water Resources Control Board

Federal Agencies

- The U.S. Forest Service
- Bureau of Land Management
- U.S. Fish and Wildlife Service
- U.S. Department of Agriculture - Natural Resources Conservation Service
- U.S. Postal Service
- The U.S. Social Security Administration
- National Park Service (Lassen National Park and Whiskeytown National Recreation Area)

Upstate Tribes

- Karuk Tribe
- Pit River Tribe
- Quartz Valley Indian Reservation
- Redding Rancheria

Schools / Colleges

- College of the Siskiyous
- Institute of Technology
- Lake College
- National University

- Shasta Bible College
- Shasta College
- Simpson College
- University of California Cooperative Extension

Private Fleets

- Delivery services (Federal Express, United Parcel Service)
- Building contractors (general, electrical, HVAC, plumbing, security systems)
- Professional services (engineering, land surveyors, home health care)
- Rental car companies (Avis, Budget, Dollar, Enterprise, Hertz)
- Retail delivery/distribution (florists, bakeries, catering, auto parts)
- Retail repair services (appliance repair, office equipment repair)
- Taxicabs (ABC Cab Company)
- Telecommunications (Charter Communications, Sisqtel)

2.7.1.2 Resources for Fleet Managers

Below is a listing of resources and tools that offer important information to fleet operators who are considering adopting PEVs for their fleets. Information provided includes: general information sources, listings of available PEVs, cost and environmental footprint calculators, EV charging station maps/locators, information on incentives (i.e., tax credits and rebates), and resources for developing green fleet policies.

General Information Sources to Support PEV Adoption in Fleets

- Plug-in Electric Vehicle Handbook for Fleet Managers, USDOE/Clean Cities
- Alternative Fuels Data Center, USDOE (http://www.afdc.energy.gov/)
- Plug-In Electric Vehicle Resource Center, California Air Resources Board (http://www.driveclean.ca.gov/pev)
- California Governor's Office of Planning and Research, Zero-Emission Vehicles web page (http://www.opr.ca.gov/s_zero-emissionvehicles.php)
- Institute for Local Government Greening Agency Fleets Resource Center (http://www.ca-ilg.org/greening-agency-fleets-resource-center)
- Listings and Information for Currently Available PEVs
- Clean Cities 2014 Buyer's Guide (http://www.afdc.energy.gov/uploads/publication/60448.pdf)
- Clean Cities Guide to Alternative Fuel and Advanced Medium- and Heavy-Duty Vehicles (http://www.afdc.energy.gov/uploads/publication/medium_heavy_duty_guide.pdf)
- Light-Duty Alternative Fuel Vehicle Search (http://www.afdc.energy.gov/vehicles/search/light/)
- Heavy-Duty Alternative Fuel Vehicle and Engine Search (http://www.afdc.energy.gov/vehicles/search/heavy)
- Find and Compare Cars (http://fueleconomy.gov/feg/findacar.shtml)
- DriveClean Buying Guide for Clean and Efficient Vehicles, California Air Resources Board (http://www.driveclean.ca.gov/)
- California Air Resources Board Clean Vehicle Rebate Project (https://energycenter.org/clean-vehicle-rebate-project)
- Plug-in Cars (http://www.plugincars.com/cars)

- Fleet Cost and Environmental Footprint Calculators
- Vehicle Cost Calculator (http://www.afdc.energy.gov/calc/)
- Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Fleet Footprint Calculator (http://greet.es.anl.gov/carbon_footprint_calculator)
- Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool (https://greet.es.anl.gov/afleet)
- Petroleum Reduction Planning Tool (http://www.afdc.energy.gov/prep/)

EV Charging Station Maps/ Locators

- Alternative Fueling Station Locator, USDOE (http://www.afdc.energy.gov/locator/stations/)
- Car Stations (http://carstations.com/)
- PlugShare (http://www.plugshare.com/)
- ChargePoint (https://na.chargepoint.com/charge_point) – lists only ChargePoint stations

2.7.1.3 PEV Incentives (rebates, tax credits, grants)

Federal Tax Credits for PEVs

Federal tax credits of up to $7500 per vehicle, depending on battery capacity, have been available for the last few years for eligible PEVs (see Internal Revenue Service Form 8936). The credit must be used in the year it is claimed and cannot be carried over to subsequent tax years. The credits will be phased out as sales increase. Specifically, credits will be phased out as each manufacture reaches 200,000 in eligible PEV sales. Through 2012 the largest cumulative PEV sales in the US is for the Chevrolet Volt, totaling about 31,000 vehicles in 2011-2012. For further information see http://www.fueleconomy.gov/feg/taxcenter.shtml.

State PEV Rebates

The Clean Vehicle Rebate Project (CVRP) offers vehicle rebates ranging from $1500 to $2500, depending on the all-electric range of the PEV. Funding for this program is expected to last through 2015, though rebate levels may drop with time. Over the last two years nearly 17,000 rebates have been awarded totaling about $39 million. For more information see http://energycenter.org/clean-vehicle-rebate-project.

Another state program, the Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP), offers vouchers ranging from about $8,000 to $45,000 per eligible vehicle. These vouchers are geared toward fleet vehicle operators and amounts vary depending on the type of truck (hybrid versus zero emission) and the gross weight of the vehicle (heavier vehicles getting larger vouchers). Recent funding levels have been $18 to $19 million annually, and funds are expected to continue through 2015 or 2016. For more information see http://www.californiahvip.org/default.aspx.

State Grants for Electric Vehicle Charging Stations

The California Energy Commission, under their Alternative and Renewable Fuel and Vehicle Technology Program, is offering grants to support the installation of electric vehicle charging stations. Each year an investment plan is adopted, and over the last three years approximately $7 million per year (out of $90 to $100 million total) has been allocated for this purpose. Note that this program funded the Upstate Plug-In Electric Vehicle Project. Funding for this program is expected to continue through 2016. For more information see http://www.energy.ca.gov/drive/index.html.

Department of General Services Master Vehicle Contracts

The California Department of General Services (DGS) maintains master contracts for vehicles that local agencies can use to purchase fuel efficient and alternative fuel vehicles at lower prices than may be available otherwise. DGS awards master vehicle contracts to individual dealerships for specific models of vehicles within a general class of vehicles, such as hybrid sedans. Local agencies can order vehicles directly from selected dealerships under the DGS master vehicle contracts. The DGS website contains all the information necessary for local agencies to find vehicles and dealerships that are included in the contracts. Information about using the DGS website to purchase vehicles can be found at the link below. http://www.ca-ilg.org/sites/main/files/file-attachments/resources__Using_DGS_Master_Vehicle_Contracts_FINAL_0.pdf

2.7.1.4 Resources for Developing Green Fleet Policies

- Model ordinance for local governments regarding the adoption of zero emission vehicles and the greening of municipal fleets, California Governor's Office of Planning and Research (http://opr.ca.gov/docs/Fleet_model_resolution.docx)
- Example green fleet policies (http://www.garfieldcleanenergy.org/trans-fleets-policies.html)
- Green fleet case studies for CA local government fleets (http://www.ca-ilg.org/post/greening-agency-fleets-community-stories-and-snapshots)
- Evaluating green fleet options for CA local government (http://www.ca-ilg.org/post/information-help-evaluate-green-fleet-options)
- Greening Fleets – A roadmap to lower costs and cleaner corporate fleets (http://business.edf.org/files/2014/03/greening-fleets.pdf)

2.7.1.5 Fleet Evaluation Tool

A fleet vehicle assessment requires identification of vehicles that might be suitable for replacement with a PEV. For those vehicles that are deemed potentially suitable, an economic analysis can be performed to evaluate the cost-effectiveness of switching to a PEV. In addition, the greenhouse gas (GHG) emission impacts can also be assessed. PEV adoption will typically result in reduced GHG emissions and can thereby help a municipality or other organization meet its GHG reduction goals.

Fleet electrification will also require the installation of electric vehicle charging equipment, also known as electric vehicle supply equipment (EVSE). The capabilities and capacities of various EVSE units should be researched and considered. Level 2 chargers will typically be suitable for charging vehicles overnight, whereas Level 3 fast chargers can be used for quick charging (i.e., 20 minutes), though at a much greater cost. Also, some EVSE units can charge multiple vehicles at one time. Based on the number of electric vehicles and their charging needs, an assessment of required EVSE must be made.

To conduct a PEV fleet vehicle assessment a set of information must be compiled to characterize the existing fleet vehicles as well as the potential PEV replacements. Information required for the existing, conventional fleet vehicles is listed below. The Appendix F1 includes a form for collecting the necessary input data for the PEV FleET model.

- Average and maximum miles traveled per day
- Average annual mileage
- Percent city driving

- Annual maintenance costs
- Characteristics of the likely conventional replacement vehicle (purchase cost, fuel economy)
- Cost of fuel

For potential PEV replacement vehicles, the following information is necessary:

- PEV characteristics (range in miles per full charge, efficiency in miles per kWh)
- PEV purchase cost and expected PEV maintenance costs
- PEV incentives (applicable rebates, tax credits, etc.)
- Estimated installed cost of electric vehicle charging equipment
- Cost of electricity (including time of use aspects and demand charges)

To facilitate the evaluation of PEV adoptions for fleet applications the Plug-In Electric Vehicle Fleet Evaluation Tool (PEV FleET) was developed. An Excel spreadsheet-based tool, PEV FleET is intended to be used by fleet operators or others who desire to perform fleet evaluations. Users are prompted to input necessary data and then choose the vehicles they want to evaluate. Outputs from the tool include:

- Incremental initial cost
- Simple payback
- Discounted payback
- Internal rate of return
- Net present value (over a 10 year life-cycle)
- Avoided downstream tons of CO2 per year

This tool can be used to calculate the costs and benefits in a vehicle fleet when replacing conventional internal combustion engine (ICE) vehicles with plug-in electric vehicles (PEVs). PEVs can include both battery all-electric vehicles (BEVs) and/or plug-in hybrid electric vehicles (PHEVs). Note that the PEV_FleET model assumes vehicles are being replaced at the end of their useful lives. Therefore, comparisons are between a new conventional ICE replacement vehicle and a new PEV. Costs and specifications (like fuel economy) are based on the new vehicles. Annual mileage figures, however, should typically be based on the usage characteristics of the old vehicle being replaced.

Features of the PEV FleET model are:

- Includes compiled information on currently available PEVs, including cost, range, fuel economy, tax credits and California state rebates
- Includes compiled information on a sampling of available EVSE, including cost, input power, and associated annual fees
- Includes compiled information on typical EVSE installation costs
- Includes compiled information on utility electric rates for commercial customers, including Pacific Gas and Electric, Redding Electric and Pacific Power and Light
- Allows individual and aggregate PEV assessment for fleet applications
- Allows evaluation of individual vehicles or a fleet of vehicles
- Allows inclusion or exclusion of the cost of electric vehicle charging infrastructure
- Allows use of State-negotiated fleet vehicle rates where applicable
- Please see the complete PEV FleET evaluation tool in Appendix F

2.7.1.6 Fleet Assessments

Outreach to fleet managers included communications with local municipalities. Two municipalities, the Cities of Mount Shasta and Redding, expressed interest in participating in fleet evaluations. The project team worked with city staff from these two jurisdictions to conduct an evaluation of their fleets and assess opportunities for PEV deployment (see below). Information about PEVs and access to the PEV FleET tool was also available to other local municipalities upon request.

2.7.1.7 Important Criteria for Fleet Evaluations

The PEV market is in its early stages of development. Currently there are only about 25 light-duty PEVs available, and they are primarily passenger sedans, coupes, and hatchbacks. There is one small sport utility battery electric vehicle, the Toyota RAV4. There is also one manufacturer who is offering a PHEV range-extender in a full-size truck, van, or sport utility vehicle format. These vehicles are supposed to be available in the 2014/2015 timeframe.

Because of this limited menu of offerings and because battery all-electric vehicles have limited range, it is important to make sure that available PEVs can meet the requirements of the application being considered. In addition, the initial cost of PEVs is often greater than comparable conventional counterparts, but they can pay for themselves over time because they operating costs are substantially lower. Key pre-screening criteria that should be considered before conducting a full economic analysis include:

- The required vehicle range (miles driven per trip) is compatible with PEV characteristics. Battery all-electric vehicles typically have a 60 to 100 mile range on a full charge. Plug-in hybrid electric vehicles typically have a 10 to 40 mile all-electric range, but can be driven longer distances (e.g., > 300 miles) using the gasoline-powered drive train.
- PEVs can meet the needs of the application. Currently PEVs are primarily available as light duty passenger vehicles. Passenger and cargo capacities should be evaluated to make sure they are appropriate. Hatchback models with fold-down rear seats can offer added utility and cargo hauling opportunities.
- The vehicle being considered is to be replaced in the next couple of years.
- The vehicle being considered has relatively high annual miles driven. Annual miles driven have a big effect on economic payback. In general, more miles driven results in a quicker payback.

2.7.1.8 Evaluation of PEV Opportunities in Local Fleets

The PEV FleET was used to evaluate opportunities for PEV adoption in two municipal fleets in the cities of Mount Shasta and Redding. In both cases, the project team worked with city staff to identify vehicle applications that were most likely to be suitable for PEV adoption. City staff provided required input data for the model. PEV adoption opportunities were first evaluated for specific vehicles on a one-for-one replacement basis without the inclusion of EVSE costs. Numerous PEVs were evaluated for each application and simple paybacks were evaluated. A combined fleet analysis was then performed where multiple PEV adoptions were considered along with the purchase and installation of EVSE infrastructure. Finally, a sensitivity analysis was conducted to assess the impact to the model results caused by changes in various input parameters.

In both cases model results showed there were multiple cost-effective opportunities for adoption of PEVs. Appendices B and C include summary results of the example fleet evaluations for the cities of Mount Shasta and Redding.

2.7.1.9 Lessons Learned

The following are some key lessons learned while working to promote the adoption of PEVs in Upstate region municipal vehicle fleets.

- There is a mixed level of interest from fleet managers. Some may be very interested in PEV opportunities, while others may have little to no interest.
- Fleet managers have limited time available to assess fleet opportunities for PEVs. They must see value in the effort, such as the potential to reduce fleet operating costs. They may be averse to taking risks with new technologies that are not fully proven and that may not meet their needs.
- While we attempted to develop a fairly user friendly spreadsheet tool for evaluating PEVs in a vehicle fleet, the likelihood that a fleet operator will have the time and resources required to utilize the PEV FleET tool is probably rather low. It is more likely they would need the assistance of an outside analyst to help them utilize the tool.
- There are limited options in terms of PEV range and size, and very limited PEV options for heavy-duty vehicles like trucks and vans. These limitations limit adoption opportunities.
- There is a need for light duty plug-in electric trucks and vans.
- Fleets that have already adopted fuel-efficient vehicles may find it more difficult to identify cost-effective opportunities for PEVs.
- Fleet operators may have a desire to consider all alternative fuel vehicle fleet options, not just PEVs.
- Some municipal fleet vehicles have low annual miles driven – this lengthens payback times for PEVs and can make it hard to meet cost effectiveness criteria.
- The higher initial cost of PEVs and the high cost of EVSE can be barriers.
- Parking enforcement can be a good niche application for a PEV, though there are limited offerings with regard to plug-in electric parking enforcement vehicles.
- It is important to pre-screen fleet vehicles to make sure that available PEVs can meet the requirements of the application being considered. There is no point spending time and resources evaluating PEVs for an unsuitable application.
- In order to conduct a reliable evaluation it is important to have access to accurate vehicle travel data, such as maximum trip length, average trip length, annual mileage, and annual maintenance costs. This information may not always be readily available.
- For PHEVs, it is important to be able to estimate how many miles will be driven in all-electric mode for a given application. This can be difficult to accurately estimate and may significantly impact the economic analysis. The possibility of collecting travel data for fleet vehicles using cell phone data, GPS data, or other tracking devices can be very valuable in enabling an accurate fleet assessment.
- There is minimal information available on the likely maintenance costs associated with PEVs. One source estimates that PEV maintenance costs will be only half as much as their conventional ICE vehicle counterparts. This annual maintenance cost savings can have a very significant impact on the cost effectiveness of PEV adoption. More reliable information is needed on this topic.

- Electricity demand charges can have a negative impact on the cost effective adoption of PEVs into fleets, especially where demand charges are high. This issue should be discussed with the local electric utility and strategies should be explored for mitigating excessive demand charges. One option may be to place the EVSE on a separate, non-demand metered electric account.

2.7.1.10 Plan to Accelerate PEV Adoption in Fleets

The Siskiyou County Economic Development Council has administered the Upstate Plug-in Electric Vehicle Readiness Project, and many other governmental and non-governmental entities in the region have participated in the project, either through participation on the Upstate PEVCC or by attending project meetings. Below is a list of actions that these entities can take to help promote PEV adoption in fleets in the Upstate region:

- Make presentations to elected officials and city staff
- Provide the "Upstate Plan to Accelerate PEV Adoption in Fleets" to fleet operators
- Share the wealth of information and resources that have been assembled as a part of the Upstate Plug-in Electric Vehicle Readiness Project
- Make the PEV FleET tool available to fleet operators
- Offer guidance and assistance to fleet operators in evaluating green fleet options
- Encourage municipalities to adopt green fleet policies
- Encourage municipalities to include green fleet activities in their climate action plans
- Encourage local businesses to adopt green fleet policies
- Publicize and promote local green fleet activities
- Document and share successful local case studies where PEVs have been introduced into local vehicle fleets

2.7.2 Municipal Activities and Incentives to Promote PEVs

The project assessed potential policies to encourage and incentivize broader community-wide adoption of PEVs. The economic, convenience, and status based incentives include: preferential or reduced-cost parking in pay parking areas, extended on-street parking time limits, free work-place charging, and special PEV utility rates available using second-meters. Appendix G of this report includes the project's PEV incentives memo outlining potential incentive policies and the Plug-in Electric Vehicle Collaborative list of current National and California-based programs for PEV users.

2.8 PEV Education and Outreach Activities

2.8.1 Media-Based Outreach

The Upstate team worked to keep partners, stakeholders, and interested community members engaged and involved in the progress of the PEV readiness project by utilizing outreach methods including social media, printed collateral, document sharing, and website.

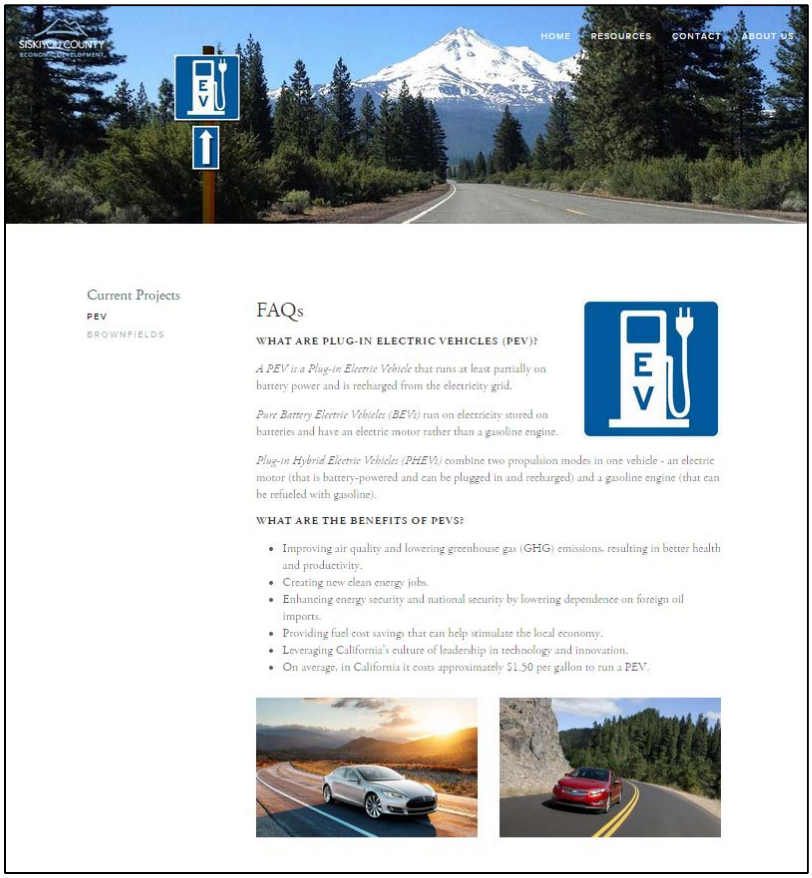
Printed Collateral: The Upstate team utilized printed materials, such as the printed flyer included in Appendix H, to provide information at events and available to the general public at the SCEDC office.

Website: The SCEDC created a page on their website that provides information on PEV's in California and information on the Upstate PEV readiness, information about the PEVCC (including meeting minutes), a list of information resources related to PEVs, and links to charging station locators. Also included on the page are links to project reports and outcomes, as well as updates about current project related events (presentations, PEV ride and drive event, etc.). An image of the web page is shown in Figure 18. The webpage can be accessed at: http://www.siskiyoucounty.org/pev

Document and Presentation Share: The Upstate team regularly made video presentations available to view for interested parties who were not able to view a presentation in person. These links were provided through email communications and on our website. http://vimeo.com/86343047

Social Media: Facebook and Twitter – the SCEDC regularly updates these two social media outlets with brief points of interest on projects, including PEV's. Throughout the life of the project, these outlets were updated with PEV information as needed. https://www.facebook.com/SiskiyouEDC and https://twitter.com/siskiyouedc

Figure 18: Cover Image of Siskiyou County Economic Development Upstate Electric Vehicles Webpage



Source: SCEDC, 2014

2.8.2 Outreach Events

Outreach events were a key component to the Upstate Outreach and Education Plan. Throughout the life of the project, the Upstate team conducted numerous outreach events including presentations to local community groups, tabling at community events, participation in PEV conferences, and the coordination of one informational event, including the showcasing of seven different PEVs and Hybrid PEVs from a local car dealership, Redding Crown Motors.

- Yreka Rest-stop on the Mexico to Canada, BC2BC by EV rally on July 2, 2013 – Yreka, CA (Figure 19)
- EV 101: The Future is Now! Planning the Electric Vehicle Charging Network in Northern California – Redding, CA (Figures 20 and 21)
- Zero Emission Vehicle conference – Sacramento, CA
- Electric Vehicle Road Map 7 conference – Portland, OR

Figure 19: EV 101: The Future is Now! Planning the Electric Vehicle Charging Network in Northern California – Redding, CA

Source: SCEDC, 2014

Figure 20: EV 101: The Future is Now! Planning the Electric Vehicle Charging Network in Northern California – Redding, CA

Source: SERC, 2014

Figure 21: EV 101: The Future is Now! Planning the Electric Vehicle Charging Network in Northern California – Redding, CA

Source: SERC, 2014

2.8.3.1 Education and Outreach Plan

The goal of this plan is to provide information on Plug in Electric Vehicles to various sectors of Siskiyou, Shasta and Tehama Counties through a diverse approach to education and outreach. The complete plan can be found in Appendix H. A summary of the education and outreach plan is outlined below. The audience for a multi-media outreach approach includes:

- Emergency and First Responders
- Community Leadership and Local Government
  - o County Boards of Supervisors, City Councils and other elected and appointed bodies.
- Community Services
  - o Formalized groups which include Rotary, Elks, Kiwanis, etc…
- Public Fleet Operators
- Private Fleet Operators
- Consumers
  - o Buyers/Potential Buyers
  - o All others

Many of the communities within the Upstate planning region are actively involved with their local governments. This plan will utilize that activism to try reaching several of the identified groups initially through this forum.

The Outreach Methods

- Direct Presentations
  - o PowerPoint when available and in speech format when unavailable.
- Radio Ads
  - o Short ads describing the planning process and notifying of ways to engage
- Print Material
  - o Flyers for distribution at meetings and other community events
- Web-Based

    - Web-site with routinely updated project information and method to receive additional information.

The Plan

- Create Materials
    - Create Web-Site
    - Create Print Material
    - Write and Record Radio Ads
    - Create Presentation
- Develop List of All Community Leadership Groups
- Develop List of All Community Service Groups
- Develop List of All Public Fleets
- Develop List of All Private Fleets
- Develop a List of All Emergency Responders
- Develop List of All Local Media Outlets
- Scheduling
    - Schedule Meetings for all Leadership and Service groups
    - Schedule meetings with public and private entities

2.9 Sharing Project Results

The following is a list of locations and organizations with which the project results and progress were shared:

- EV101 Workshop – Redding, CA
- Zero Emission Vehicle Conference– Sacramento, CA
- North State Super Region Partnership, meeting presentation – April 30th, 2014 - Weaverville, CA
- Electric Vehicle Road Map 7 Conference – Portland, OR
- Local Transportation Commission – Yreka, Siskiyou County, CA
- Board of Supervisors – Red Bluff, Tehama County, CA
- Transportation Department and Air Pollution Control – Red Bluff, Tehama County, CA
- Shasta Regional Transportation Agency – Shasta Lake, Shasta County, CA
- Distributed Video Presentation of Upstate PEV Plan
- Weed Rotary Meeting – Weed, CA
- Yreka Rotary, meeting presentation – Yreka, CA
- Mt. Shasta Rotary, meeting presentation – Mt. Shasta, CA

2.10 Upstate PEV Readiness Plan

One of the primary goals of the Upstate PEV project was public education and outreach. The Upstate PEV Readiness Plan is another tool to accomplish this education goal by summarizing the results of this final report in a non-technical format that is more easily understood by a broad stakeholder audience. This broad stakeholder audience includes elected community leaders and staff, transportation advocates, PEV owners, building and permitting officials, and the general public. This Upstate PEV Readiness Plan will also serve as an example to communities neighboring the Upstate region who wish to adopt a similar plan for their region. Further, this plan should also help prepare property owners that have committed to hosting a charging station for the infrastructure development phase of the Upstate PEV plan. The report cover page for the Upstate PEV Readiness plan is shown below in Figure 19. The report will be available in our future outreach efforts and on our project website: http://www.siskiyoucounty.org/pev

Figure 19: Cover Page of Upstate PEV Readiness Plan

Source: SCEDC, 2014

CHAPTER 3: Conclusions and Recommendations

3.1 Assessment of Project Success

The Upstate Plug-in Vehicle Readiness Project team, including the PEVCC, is very excited by the positive outcome of our project goals. Efforts to promote PEV adoption and develop an infrastructure plan have been successful. This project demonstrated that three counties and a coalition of private and public organizations in the Upstate region can work collaboratively to meet large goals, adopt a plan, and coordinate across disciplines. Further, with the completion of the PEV Readiness Plan, the Upstate region is now prepared to engage future funding support for implementation and infrastructure deployment.

To evaluate the success of the Upstate PEV Readiness Project we have used the project's metrics (section 1.3) as a prompt for discussion of the results in the bullets below:

- The Upstate PEVCC was successful in gaining adequate representation and participation of stakeholders in the three different counties, Tehama, Shasta, and Siskiyou, that formed the Upstate region. Further, the Upstate PEVCC also had adequate representation from impacted sectors including electricity producers, local elected officials, non-profits, air quality management boards, and transportation boards. Progress of the PEVCC contributions were successfully recorded through meeting minutes, feedback from workgroups, and communication updates.
- The Infrastructure Deployment Plan accomplished much more than was intended. The objective methodology of the plan helped unify the PEVCC and promoted engagement in our goals of outreach and education. The Infrastructure Deployment Plan was comprised of two elements, namely macro-siting and micro-siting. The macro-siting approach employed an agent-based model to assess the need for EV charging stations throughout the region. The model utilized existing travel demand and travel survey data to simulate PEV driver behavior. The micro-siting process utilized a decision matrix to evaluate candidate EV parking spaces with a scoring rubric. More specifically, candidate EV charging locations were scored by weighting objectives of the California Energy Commission, the PEVCC, the outreach experience from the North Coast PEV readiness project, and the engineering contracting firm GHD. Scoring objectives primarily included aspects like public access, infrastructure cost, and ownership options that met requirements for future California Energy Commission Infrastructure funding opportunities.
- Permitting requirements for installing electric vehicle supply equipment (EVSE) were assessed with the help of local building and planning officials in Upstate region communities. In addition, a workshop was put on in Redding, CA during March 2014 to help educate local building and planning officials on example application, inspection, and permitting methods that have been successful in other areas. A plan was developed to streamline those requirements and follow the feedback from the assessment and outreach events that should improve future EVSE installation processes in the Upstate region.
- The municipal vehicle fleets in the cities of Redding and Mt. Shasta were successfully evaluated for plug-in electric vehicle adoption feasibility. Based on these evaluations, a plan to accelerate plug-in electric vehicle adoption was created for regional vehicle fleets. Several public and private vehicle

fleets were contacted and given plug-in electric vehicle adoption information and the feedback from fleet managers was positive.
- An educational outreach plan to improve plug-in electric vehicle adoption in Upstate communities was achieved and a campaign was developed. A wide variety of stakeholders received information on the Governor's ZEV commitments and the benefits of PEVs in Upstate California through a spectrum of media outlets including digital, print, and in-person speaking engagements. Examples of these stakeholders ranged from high level Local Transportation Commissions and County Supervisors to interested Rotary members and the general public at events.

3.2 Conclusions and Lessons Learned

The Upstate Plug-in Vehicle Readiness Project was a tremendous learning experience for stakeholders in our region and generally resulted in a positive project outcome. The original goals and aims of the project were achieved, and the planning documents that were produced will be a tremendous asset to future PEV infrastructure deployment and utilization. The communities representing the Upstate region have been open to PEV planning and the majority of stakeholders that participated in this PEV readiness effort have been very supportive.

The following is a list of the primary lessons that were learned from this exercise in PEV readiness planning:

- Outreach and engagement of key stakeholders is critical to overall program success for the region.
- Overall, relatively few chargers are needed to support a large number of PEV drivers in the region. Approximately 120 chargers were sufficient to support ~5000 drivers in the 2% penetration scenario. The total estimated cost to install these chargers is $4.2M, which is an investment of $850 per driver, a value commensurate with incentives already in place at the state and federal levels for subsidizing vehicle purchases.
- Both Level 2 and Level 3 chargers play an important role in supporting PEV drivers. Generally, Level 2 chargers are distributed throughout the region in rough proportion to traffic intensity and Level 3 chargers are concentrated along the I5 corridor and, to a lesser extent, along other principal arterials.
- Concerns have been raised regarding the impact of EVSE charging on site host's peak demand charges. PEV charging stations, especially DC fast-charge stations, can significantly impact peak demand charges if PEV charging is coincident with existing facility peak demand.
- The peak demand impacts of EVSE charging on electrical distribution circuits is expected to be modest at this point and well within the range of natural load growth that utilities already account for in the course of normal system planning and upgrading activities.
- The benefits of PEV adoption were very apparent to stakeholders and the public. PEVs can reduce air emissions (both criteria pollutants and greenhouse gases), can lower operating costs for drivers, and can be used to promote tourism and economic development.
- Municipal fleets offer good opportunities to deploy PEVs and demonstrate their benefits. PEVs can save local governments money and help them green their fleets. In addition, it allows them to

lead by example and can help influence the purchase decisions of businesses and residents in the community. However, there is a need for larger, heavier duty PEV models because some areas of the Upstate Region depend more on trucks and SUVs than light-duty passenger vehicles. For example, the City of Mt. Shasta receives large amounts of snow in the winter, requiring the use of larger vehicles with four-wheel drive and high ground clearance.

- Transportation planning boards and jurisdictional leaders (including planning and building officials) were receptive to PEV introduction, adoption, and charging infrastructure. Transportation planning boards and air pollution control districts, in particular, were very receptive to the idea of using PEVs to address their commitments to improve air quality and lower transportation related pollution.
- There is a need to develop a viable EVSE ownership model(s) for the region. Prospective EVSE site hosts were generally receptive to the idea of developing a cooperative cost-sharing network. This cooperative network, inspired by the North Coast PEV Readiness Plan ownership model, would allow a consistent consumer experience, better data gathering, reduced cost of installation, and easier EVSE maintenance. It could also allow lightly used EV charging stations that are located in more remote locations and are critical to interconnectivity and safety to be partially subsidized by heavily used stations located in more urban areas.
- Building departments in the region are generally receptive to the installation of EVSE and don’t see a problem with permitting these facilities. Nonetheless, some standardization and streamlining could help create a more convenient process. In addition, zoning regulations for EVSE should be better defined so that building departments know how best to classify and handle EVSE permits.
- Continued education, outreach and incentives are critical to establishing a strong PEV market. There is a need to educate drivers regarding their expectations for PEV range, access to and need for public charging infrastructure, and total cost of ownership for PEVs compared to comparable petroleum fueled vehicles.

3.3 Recommendations

In reflection of what the Upstate Plug-in Electric Vehicle Readiness Project has accomplished, the following recommendations are listed below:

- Stakeholders and the public are receptive to the benefits of PEVs in Upstate California and promotion of PEV benefits should continue.
- Efforts should be made to maintain the Upstate PEVCC.
- The response has been positive to the current charging infrastructure in Shasta County and the Tesla charging stations in Siskiyou and Tehama County. Implementation and EVSE infrastructure deployment efforts should continue in the Upstate region as it is a critical link on Interstate-5 connecting the West Coast Electric Highway. These deployment efforts should be based on the Upstate Plug-in Electric Vehicle Readiness Plan and data should be collected to assess the results of such efforts. Data collection is critical to refining current models and planning future infrastructure deployment.

- Continue collaborative efforts in the region across various organizations, including transportation planning boards, air pollution control districts, economic development groups, municipal government and others. Work to deploy publicly accessible EVSE and to establish a publicly owned EVSE network with an aim to transition it to a private ownership model where appropriate and desirable.
- Identify a lead organization and other key partners and prepare to pursue grant funding for EVSE infrastructure deployment that follows the deployment guidelines developed in this project.
- It is recommended that EVSE infrastructure be installed in phases. While an initial level of infrastructure will be important from the outset in order to provide geographic coverage, reduce range anxiety, and promote PEV adoption, full EVSE deployment can be accomplished over time as the penetration of PEVs increases. In fact, it is recommended that following each phase of EVSE deployment data be collected and evaluated to assess EVSE usage rates. In addition, PEV drivers in the region can be surveyed to assess where additional charging is needed. These types of information can then be used to refine plans for future EVSE deployment.
- A statewide policy to reduce peak demand charges associated with utility metering of publically accessible EVSE, once all reasonable peak-demand mitigation measures have been met, would greatly benefit and incentivize future infrastructure deployment.
- Continue efforts to support other low or zero emission alternative fuel vehicles (e.g. hydrogen). Siskiyou County, part of the Upstate region, has joined the Northwest California Alternative Fuels Readiness project funded by PON-13-603 under the California Energy Commission.

APPENDIX A
PEVCC Documents and Information

Upstate Region Plug-In Electric Vehicle

Coordinating Council Charter

Adopted June 26, 2013

PURPOSE

The Upstate Region Plug-in Electric Vehicle Coordinating Council (PEVCC) is a collaborative coalition comprised of City and County governments, local government Joint Powers Authorities, regional and state government agencies, utilities, educational institutions, non-profits, and business partners. The PEVCC is coordinated by the Siskiyou County Economic Development Council, which will help create agendas, organize meetings, and assist with coordinating working teams comprised of PEVCC-members' representatives and other relevant stakeholders.

The PEVCC has the goals of:

☐ Developing regionally-specific guidelines for PEV infrastructure deployment.

☐ Identifying optimal locations for regional charging infrastructure at sites including public parking areas, commercial properties, highway corridors, and workplaces.

☐ Determining investment requirements and implementation timelines to meet the local community's needs as PEV adoption increases.

☐ Utilize regionally-specific planning data and studies, as well as locally-customized projections of PEV adoption, to support the optimal, phased deployment of charging infrastructure.

☐ Developing PEV education and promotion plans on the benefits of PEV adoption.

☐ Develop strategies to facilitate accelerated PEV adoption in private and public fleets.

☐ Project energy-cost savings and greenhouse gas emissions reductions from regional PEV use.

☐ Share lessons-learned and best-practices with other regions, particularly rural regions, for PEV infrastructure permitting, installation, deployment, maintenance, and inspection.

MISSION STATEMENT

The members of the Upstate Region PEVCC will work together to promote and accelerate the local adoption of PEV technology as a key strategy for linking various parts of the West Coast and the State of California with PEV infrastructure and further develop the renewable energy resources in our region to meet our community's transportation needs.

MEMBERSHIP

An official representative from each member organization will participate as a voting PEVCC member. Other representatives from each member group can serve as non-voting PEVCC participants and/or work group participants as appropriate. The PEVCC shall appoint members to serve as a Chair and a Vice-Chair:

☐ The Chair shall be the chairperson of the PEVCC and shall conduct all PEVCC meetings.

☐ The Vice-Chair shall serve in the Chair's absence.

☐ The term of office for the Chair and Vice-Chair shall be one year, commencing on January l of each year (excepting the initial year). The initial Chair and Vice- Chair shall be entitled to serve one full term of office in addition to any partial initial term.

☐ If a vacancy occurs in the position of Chair or Vice-Chair, the PEVCC shall appoint another member to fill the vacancy for the duration of the unexpired term.

RESPONSIBILITIES

The principal responsibilities of member-organizations' representatives serving on the PEVCC are to:

☐ Serve as a representative and advocate for their organization.

☐ Participate in PEVCC meetings; all PEVCC designated representatives are required to participate in the two annual PEVCC core meetings.

☐ Participate in working groups; PEVCC member organizations are required to participate in at least one working group. Working group participants can be an organizations official PEVCC representative and/or other staff members/representatives when appropriate.

☐ Seek input from within their organization and from their stakeholders on key issues for the PEVCC's consideration.

☐ Seek input from within their organization and from their stakeholders regarding priorities and direction for PEVCC activities.

☐ Report PEVCC activities, information, and decisions back to the appropriate staff, decision makers, constituents, and stakeholders of their organization.

☐ Serve as a liaison between the PEVCC and their organization.

CONDUCT OF THE PEVCC'S BUSINESS

The PEVCC will remain active and engaged between full Council meetings via bi-monthly status updates and PEVCC workgroups, which will be established to address specific project areas. Each workgroup will be made up of appropriate representatives from relevant member entities and will coordinate with topic experts from outside entities (such as original equipment manufacturers) as needed. PEVCC workgroups will include:

☐ Fleet management

☐ EVSE permitting, installation, and inspection

☐ Publicly-accessible charging infrastructure

☐ Technology evaluation and off-peak charging

☐ Community education and outreach

Additional workgroups may be established as-needed to address other topic areas.

For all meetings, agendas will be forwarded to all PEVCC members prior to the meeting. Following meetings, draft meeting minutes will be approved by the Chair and Vice-Chair, that draft will forward to PEVCC members. The minutes pre-approved by the Chair and Vice-Chair will be formally approved by the PEVCC at the following meeting. approved meeting minutes will be posted on the PEVCC website.

DECISION MAKING PROCESS

☐ A quorum is comprised of representatives of at least 2/3 of the PEVCC's member entities.

☐ A quorum is required before PEVCC decisions are finalized.

☐ Meetings are conducted consistent with the California Open Meeting Act of 2004.

☐ The PEVCC will strive for consensus. If consensus cannot be made, a super-majority (66%) based decision approach will be instituted.

☐ The PEVCC will approve updates to this charter.

This charter was approved by the PEVCC on June 26, 2013.

Upstate Region Plug-in Electric Vehicle Coordinating Council Member Entities

Anticipated, July 1, 2013

Work group abbreviations:

FM = Fleet management	PI = EVSE permitting, installation, and inspection
EO = Community education and outreach	TE = Technology evaluation and off-peak charging
PC = Publicly-accessible charging infrastructure	

PEVCC Member Organization	Work group participation
Local/Regional Government/Non-Profit:	
City of Mt. Shasta (Confirmed, Project Applicant)	FM, PI, PC, EO
Siskiyou County Economic Development Council (Confirmed, Lead)	FM, PI, PC, TE, EO
City of Yreka (Confirmed)	FM, PI, PC, EO
City of Redding	FM, PI, PC, EO
County of Siskiyou (Confirmed)	FM, PI, PC, EO
Upstate Economic Development (Confirmed)	PI, PC, EO

The Siskiyou County Economic Development and Upstate Economic Development will represent and serve as liaisons to smaller cities, such as Lakehead, Shasta Lake, Anderson, Dunsmuir and the counties of Glenn, Butte, Shasta and Tehama. The Cities and Counties may become members of the PEVCC.

Utility	
Pacific Gas & Electric (Confirmed)	PI, PC, TE, EO
Pacific Power (Confirmed)	PI, PC, TE, EO
Redding Electric Utility (Confirmed)	PI, PC, TE, EO
Technical	
Schatz Energy Research Center (Confirmed)	FM, PI, PC, TE, EO
GHD (Confirmed)	FM, PI, PC, TE, EO
Cal Trans District 2	FM, PC
Education	
College of the Siskiyous	FM, PC, EO
Business	
Shasta Builders Exchange	PI
Jim Wilson Motors	FM, TE, EO
Crowne Motors	FM, TE, EO
Lithia Motors	FM, TE, EO

Upstate Plug-in Electric Vehicle Coordinating Council (PEVCC) Membership		
Name	**Organization**	**Status**
Bob Nash	**SCEDD**	**active**
Hope Seth	Shasta County EDC	inactive
Kelli Anthis	Shasta College - SBDC	inactive
Grace Bennett	Siskiyou County Board of Supervisors/Local Transportation Commission	inactive
Tim Stearns	**Mt. Shasta**	**active**
David Simmen	City of Yreka	inactive
Erik Andersson	**Pacific Power**	**active**
Maryann Murphy Shaw	College of the Siskiyou	inactive
Pat Keener	**REU / City of Redding**	**active**
Monica Tolen	**REU / City of Redding**	**active**
Lowell Watros	**REU**	**active**
Sean Tiedgen	**Shasta Regional Transportation Agency**	**active**
Bruce De Terra	CalTrans District 2	inactive
Frances Dea Sanchez	**CalTrans District 2**	**active**
Trina Blanchette	**CalTrans District 2**	**active**
Allison O'Sullivan	Upstate	inactive
Ulric Kwan	PG&E	inactive
Alan Abbs	**Tehama County Air Pollution Control District**	**active**
Barbara Okeeffe	**Tehama County Department of Transporation**	**active**
Sean Moore	**Tehama County Department of Planning**	**active**

APPENDIX B
Task 3.1 & 3.2 Supplemental Figure and Tables – Macro-Siting Report

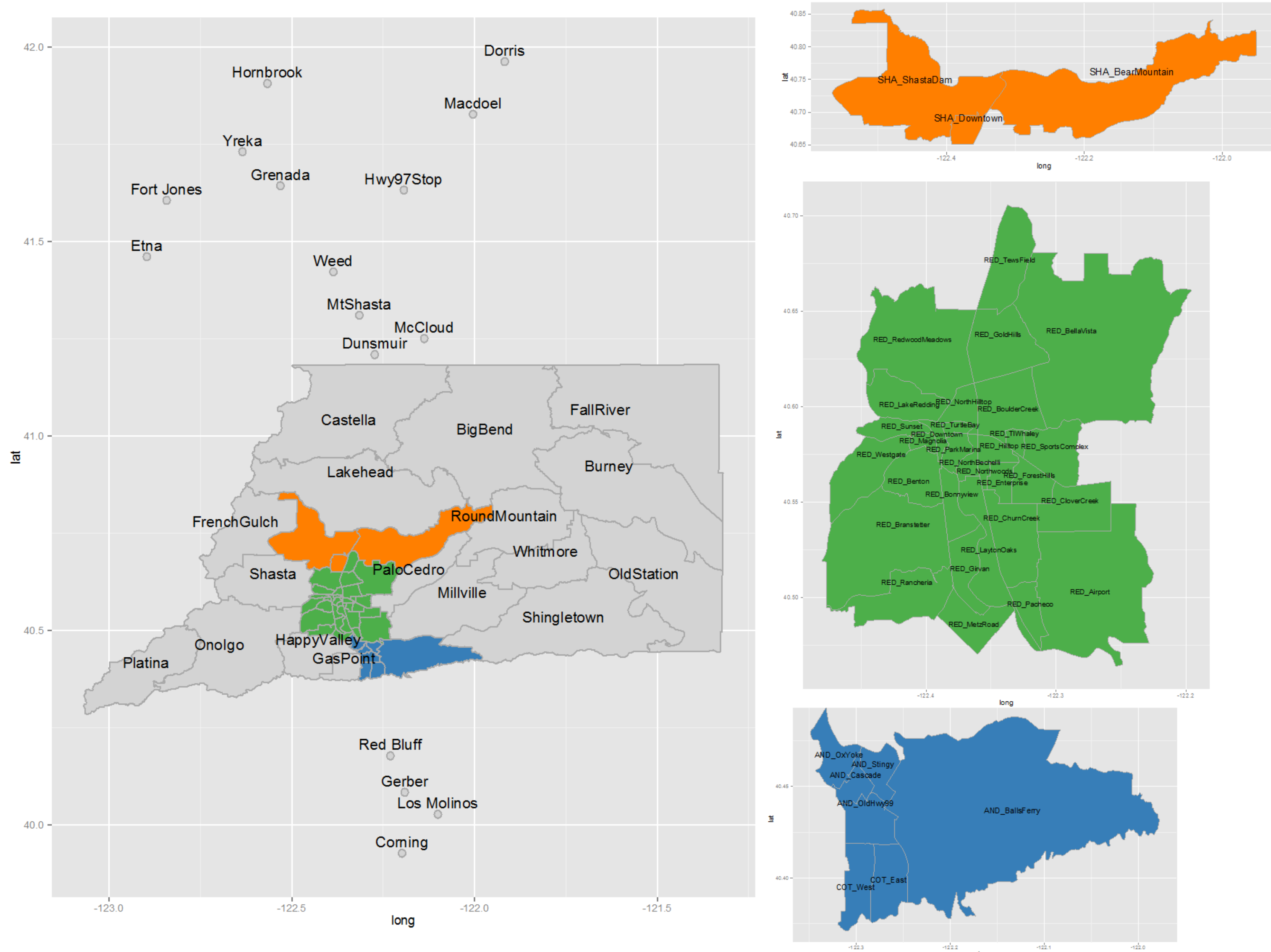


Figure 1: Upstate Region with TAZs labeled by name.

EVSE deployment guidelines for 0.5% fleet penetration

Name	Level	# Chargers	Priority	Name	Level	# Chargers	Priority
AND_Cascade	2	1.0	1	BigBend	2	0.6	3
AND_OldHwy99	2	1.2	1	Castella	2	0.8	3
Burney	2	1.4	1	Dunsmuir	2	0.8	3
Corning	2	1.8	1	Etna	2	0.8	3
FallRiver	2	1.0	1	GasPoint	2	1.4	3
MtShasta	2	1.2	1	McCloud	2	2.4	3
PaloCedro	2	1.0	1	Millville	2	1.0	3
Red Bluff	2	2.0	1	OnoIgo	2	0.6	3
RED_Airport	2	1.0	1	Platina	2	0.6	3
RED_Benton	2	1.0	1	Red Bluff	3	1.0	3
RED_Bonnyview	2	1.2	1	RED_CloverCreek	2	1.2	3
RED_Branstetter	2	1.0	1	RED_LaytonOaks	3	0.2	3
RED_ChurnCreek	2	1.2	1	RED_MetzRoad	2	1.0	3
RED_Downtown	2	1.0	1	RED_NorthBechelli	3	0.2	3
RED_Enterprise	2	1.0	1	RED_NorthHilltop	2	1.0	3
RED_GoldHills	2	1.2	1	RED_Pacheco	2	1.0	3
RED_Hilltop	2	1.0	1	RED_ParkMarina	3	0.2	3
RED_Magnolia	2	1.0	1	RED_TIWhaley	3	0.2	3
RED_ParkMarina	2	1.0	1	RoundMountain	2	1.2	3
RED_Rancheria	2	1.0	1	SHA_BearMountain	2	1.0	3
RED_RedwoodMeadows	2	1.0	1	SHA_ShastaDam	2	1.2	3
RED_SportsComplex	2	1.2	1	Whitmore	2	1.0	3
AND_OxYoke	2	1.0	2	AND_Cascade	3	0.2	4
AND_Stingy	2	1.0	2	AND_OldHwy99	3	0.4	4
COT_East	2	1.0	2	Castella	3	0.4	4
COT_West	2	1.2	2	Corning	3	0.4	4
COT_West	3	0.2	2	COT_East	3	0.4	4
Gerber	2	1.0	2	Dunsmuir	3	0.4	4
HappyValley	2	1.0	2	Fort Jones	2	0.8	4
Lakehead	2	1.0	2	FrenchGulch	2	0.4	4
Los Molinos	2	1.0	2	Grenada	2	0.8	4
RED_BellaVista	2	1.0	2	Grenada	3	0.2	4
RED_ForestHills	2	1.0	2	Hornbrook	2	0.2	4
RED_Girvan	2	1.0	2	Hwy97Stop	2	0.2	4
RED_LakeRedding	2	1.0	2	Lakehead	3	0.2	4
RED_LaytonOaks	2	1.2	2	OldStation	2	1.0	4
RED_Northwoods	2	1.0	2	Platina	3	0.2	4
RED_Sunset	2	1.0	2	RED_BoulderCreek	3	0.2	4
RED_TewsField	2	1.0	2	RED_Girvan	3	0.2	4
RED_TurtleBay	2	1.0	2	RED_Rancheria	3	0.2	4
RED_Westgate	2	1.0	2	RED_TIWhaley	2	0.8	4
Shasta	2	1.2	2	RoundMountain	3	0.2	4
Shingletown	2	1.6	2	SHA_Downtown	2	1.2	4
Weed	2	1.0	2	Whitmore	3	0.2	4

EVSE deployment guidelines for 1% fleet penetration

Name	Level	# Chargers	Priority	Name	Level	# Chargers	Priority
AND_Cascade	2	1.4	1	AND_OxYoke	3	0.4	3
AND_OldHwy99	2	1.6	1	BigBend	2	2.2	3
Burney	2	2.0	1	Castella	2	1.4	3
Corning	2	1.8	1	Corning	3	1.0	3
FallRiver	2	1.2	1	COT_West	3	0.8	3
PaloCedro	2	1.2	1	Fort Jones	2	0.8	3
Red Bluff	2	2.0	1	Grenada	3	0.2	3
RED_Airport	2	1.0	1	Hornbrook	2	0.2	3
RED_Benton	2	1.0	1	McCloud	2	1.0	3
RED_Bonnyview	2	1.0	1	Millville	2	0.8	3
RED_ChurnCreek	2	1.0	1	OldStation	2	0.4	3
RED_Downtown	2	1.0	1	OnoIgo	2	0.2	3
RED_Enterprise	2	1.2	1	RED_Airport	3	0.2	3
RED_GoldHills	2	1.0	1	RED_BoulderCreek	3	0.2	3
RED_Hilltop	2	1.2	1	RED_Downtown	3	0.6	3
RED_LaytonOaks	2	1.0	1	RED_Hilltop	3	0.6	3
RED_Magnolia	2	1.2	1	RED_LaytonOaks	3	0.2	3
RED_Northwoods	2	1.0	1	RED_RedwoodMeadows	3	0.6	3
RED_ParkMarina	2	1.2	1	RED_TewsField	2	1.0	3
RED_Rancheria	2	1.0	1	RoundMountain	2	1.0	3
RED_RedwoodMeadows	2	1.2	1	Shasta	2	1.0	3
RED_SportsComplex	2	1.0	1	Yreka	2	1.2	3
AND_OxYoke	2	1.2	2	AND_Cascade	3	0.4	4
AND_Stingy	2	1.2	2	AND_OldHwy99	3	0.4	3
COT_East	2	1.0	1	Burney	3	0.4	4
COT_West	2	0.8	2	Castella	3	0.2	4
GasPoint	2	1.0	2	Dunsmuir	2	1.0	4
Gerber	2	1.0	2	Dunsmuir	3	0.4	4
HappyValley	2	1.0	2	Etna	2	0.6	4
Lakehead	2	1.2	2	Etna	3	0.2	4
Los Molinos	2	1.4	2	FrenchGulch	2	1.4	3
MtShasta	2	1.2	1	Gerber	3	0.2	4
Red Bluff	3	1.4	2	Grenada	2	0.6	4
RED_BellaVista	2	1.0	2	Hwy97Stop	2	1.0	4
RED_Branstetter	2	1.0	1	Hwy97Stop	3	0.2	3
RED_CloverCreek	2	1.0	2	Lakehead	3	0.2	4
RED_ForestHills	2	1.0	2	Macdoel	2	0.2	4
RED_Girvan	2	1.0	2	Millville	3	0.2	4
RED_LakeRedding	2	1.0	2	MtShasta	3	0.2	4
RED_MetzRoad	2	1.0	2	OldStation	3	0.2	4
RED_NorthHilltop	2	1.0	2	Platina	2	0.6	3
RED_Pacheco	2	1.2	2	Platina	3	0.2	4
RED_Sunset	2	1.2	2	RED_ChurnCreek	3	0.2	4
RED_TlWhaley	2	1.0	2	RED_GoldHills	3	0.4	4
RED_TurtleBay	2	1.2	2	RED_Magnolia	3	0.2	4

Name	Level	# Chargers	Priority	Name	Level	# Chargers	Priority
RED_Westgate	2	1.0	2	RED_NorthHilltop	3	0.2	4
SHA_BearMountain	2	1.0	2	RED_Northwoods	3	0.2	4
SHA_ShastaDam	2	1.0	2	RED_Westgate	3	0.2	4
Shingletown	2	1.0	2	SHA_BearMountain	3	0.4	4
Weed	2	1.2	2	SHA_Downtown	3	0.2	4
Whitmore	2	1.0	2	Shasta	3	0.2	4
				Weed	3	0.4	4

EVSE deployment guidelines for 2% fleet penetration

Name	Level	# Chargers	Priority	Name	Level	# Chargers	Priority
AND_Cascade	2	2.0	1	AND_Stingy	3	0.4	3
AND_OldHwy99	2	1.4	1	BigBend	2	3.8	3
AND_OxYoke	2	1.0	1	BigBend	3	1.4	3
AND_Stingy	2	1.0	1	Dunsmuir	2	0.4	3
Burney	2	2.0	1	Dunsmuir	3	0.8	3
Corning	2	1.2	1	Etna	2	0.6	3
COT_East	2	1.0	1	Gerber	2	0.8	3
FallRiver	2	2.2	1	Gerber	3	0.4	3
PaloCedro	2	1.6	1	Grenada	3	0.6	3
Red Bluff	2	1.4	1	Los Molinos	3	0.8	3
RED_Airport	2	2.0	1	McCloud	2	0.6	3
RED_BellaVista	2	1.0	1	McCloud	3	0.4	3
RED_Benton	2	2.4	1	Millville	2	1.0	3
RED_Bonnyview	2	1.2	1	MtShasta	3	0.8	3
RED_Branstetter	2	1.0	1	OnoIgo	2	1.8	3
RED_ChurnCreek	2	2.0	1	PaloCedro	3	0.6	3
RED_Downtown	2	1.0	1	Platina	2	1.4	3
RED_Enterprise	2	1.8	1	RED_Bonnyview	3	0.6	3
RED_ForestHills	2	1.2	1	RED_BoulderCreek	2	3.2	3
RED_Girvan	2	1.2	1	RED_CloverCreek	3	0.4	3
RED_GoldHills	2	1.0	1	RED_Girvan	3	0.2	3
RED_Hilltop	2	1.2	1	RED_GoldHills	3	0.8	3
RED_LakeRedding	2	1.0	1	RED_Hilltop	3	1.0	3
RED_LakeRedding	3	0.2	1	RED_MetzRoad	3	0.4	3
RED_LaytonOaks	2	1.2	1	RED_Northwoods	3	0.6	3
RED_Magnolia	2	1.2	1	RED_Rancheria	3	0.2	3
RED_NorthBechelli	2	1.6	1	RED_RedwoodMeadows	3	0.6	3
RED_Northwoods	2	0.8	1	RED_TewsField	3	0.6	3
RED_ParkMarina	2	1.0	1	SHA_BearMountain	3	0.2	3
RED_Rancheria	2	1.4	1	SHA_ShastaDam	3	0.2	3
RED_RedwoodMeadows	2	2.2	1	Shasta	3	0.2	3
RED_SportsComplex	2	1.2	1	Weed	3	0.4	3
RED_Sunset	2	1.2	1	Whitmore	2	1.2	3
Shingletown	2	1.4	1	Whitmore	3	0.2	3
AND_Cascade	3	1.4	2	AND_BallsFerry	2	1.2	4
AND_OxYoke	3	0.6	2	AND_OldHwy99	3	0.6	4

Name	Level	# Chargers	Priority	Name	Level	# Chargers	Priority
Castella	2	0.4	2	Burney	3	0.6	4
Corning	3	1.4	2	Castella	3	2.0	4
COT_East	3	0.8	2	Etna	3	0.4	4
COT_West	2	0.8	2	FallRiver	3	0.2	4
COT_West	3	0.8	2	Fort Jones	2	0.2	4
FrenchGulch	2	0.2	2	Fort Jones	3	0.4	4
GasPoint	2	1.4	2	FrenchGulch	3	1.2	4
HappyValley	2	1.2	2	Grenada	2	0.6	4
Lakehead	2	1.2	2	HappyValley	3	0.2	4
Los Molinos	2	1.2	2	Hornbrook	2	0.6	4
MtShasta	2	1.4	2	Hornbrook	3	0.2	4
Red Bluff	3	2.4	2	Hwy97Stop	2	0.2	4
RED_BoulderCreek	3	1.0	2	Hwy97Stop	3	0.6	4
RED_Branstetter	3	0.2	2	Lakehead	3	0.2	4
RED_CloverCreek	2	1.0	2	Macdoel	3	0.6	4
RED_Downtown	3	0.6	2	OldStation	2	0.4	4
RED_Magnolia	3	0.6	2	OldStation	3	0.4	4
RED_MetzRoad	2	1.4	2	RED_BellaVista	3	0.4	4
RED_NorthHilltop	2	2.2	2	RED_Benton	3	0.6	4
RED_Pacheco	2	1.4	2	RED_ChurnCreek	3	1.0	4
RED_ParkMarina	3	0.6	2	RED_ForestHills	3	1.2	4
RED_TewsField	2	0.8	2	RED_LaytonOaks	3	0.4	4
RED_TIWhaley	2	1.0	2	RED_NorthBechelli	3	0.2	4
RED_TurtleBay	2	0.8	2	RED_NorthHilltop	3	0.6	4
RED_TurtleBay	3	0.4	2	RED_Pacheco	3	0.2	4
RED_Westgate	2	1.0	2	RED_SportsComplex	3	0.2	4
RoundMountain	2	1.0	2	RED_Sunset	3	0.2	4
SHA_BearMountain	2	1.0	2	RED_Westgate	3	0.2	4
SHA_Downtown	2	1.4	2	RoundMountain	3	0.2	4
SHA_ShastaDam	2	1.0	2	SHA_Downtown	3	0.6	4
Shasta	2	0.8	2	Shingletown	3	0.6	4
Weed	2	1.4	2	Yreka	2	1.4	4
				Yreka	3	0.6	4

APPENDIX C
Task 3.3 Interim Report – Micro Siting

Upstate Plug-In Vehicle Readiness Plan

Task 3.3 Interim Report- Micro-Siting Analysis

Prepared for

Siskiyou County Economic Development Council

Prepared by

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GHD Inc.

October 2014

Revision: Draft

Table of Contents

Introduction 1
Summary of Results 1
Methodology 2
Micro-Siting Rubric 3
Objectives and Weights used in the Mico-Siting Rubric 3
Preliminary Site Plans 10
Engineer’s Opinion of Probable Construction Costs 10
Results and Discussion 11
Recommendations 13

Appendix C1 – Micro-siting Rubric C1
Appendix C2 – Preliminary Site Plans C2
Appendix C3 – Preliminary Engineer’s Opinion of Probable Costs C3

List of Tables

Table 1: List of Recommended Stations for Phase 1 of Upstate Plug-In Electric Vehicle Charging Network 2
Table 2: List of Basic Services from LEED 2009 9
Table 3: Scoring Rules for Rubric 10
Table 4: Summary of Preliminary Engineer's Opinion of Probable Construction Costs 12

Introduction

The Upstate Plug-In Electric Vehicle Readiness Plan (Plan) provides a guide for the implementation of infrastructure to support plug-in electric vehicle (PEV) charging throughout Siskiyou, Shasta, and Tehama counties (Upstate Region). Within the Plan, sites for Electric Vehicle Charging Stations (EVCS) were identified in a systematic two-step process.

The first step of EVCS site identification involved use of a data driven computer simulation model herein defined as the Plug-in Electric Vehicle Infrastructure Model, or PEVI, to identify the potential distribution of chargers with the goal of minimizing PEV driver inconvenience. The PEVI model considered geographic placement of chargers, number of chargers deployed, and charger type. The size of the geographic areas used in the simulation ranged from a neighborhood comprising several city blocks to vast rural sections of the Upstate Region comprising hundreds of square miles. This first step is referred to as the macro-siting analysis and the results were presented in the Task 3.1 and 3.2 Interim Reports.

The second step of EVCS site identification involved translating the results of the macro-siting analysis into candidate on-the-ground locations within those larger geographic areas. The second step is herein referred to as the micro-siting analysis. This report summarizes the work completed in the micro-scale analysis completed under Task 3.3 of the Plan.

Note that there are three “Levels” of PEV chargers that are referred to in this report. A Level 1 EVCS (L1) requires 120 Volts (V) single phase electricity and charges at 20 Amps (A). A Level 2 EVCS (L2) requires 240V, single phase electricity and charges at up to 80A. Level 3 EVCS (L3), also referred to as “DC Fast Charge” requires either 208V or 480V three phase power and charging currents can be in the hundreds of amps. For more information regarding L1, L2, and L3 chargers refer to the Upstate Plug-In Electric Vehicle Readiness Task 4 Interim Report.

Summary of Results

Task 3.3 results include a micro-siting rubric tool that was used to rank candidate EVCS sites. The rubric was developed collaboratively by the project team with input from the Plug-In Electric Vehicle Coordinating Council (PEVCC) for the purpose of ranking candidate sites based on criteria important to the community. The candidate sites were identified through a public outreach process, local knowledge, and on-the ground site surveys.

A total of 99 candidate sites for EVCS were identified in the planning area and assessed on the ground using the rubric. The sites were assessed for L1, and/or L2, and/or L3 EVCS as appropriate based on site specific characteristics and engineering judgment. After ranking the sites, owner consultations were initiated on 29 of the sites to determine which sites had interested owners who would likely provide a letter of support for a subsequent grant application for installing EVCS. As a result of these conversations a list of nine highly ranked sites with owners who committed to hosting an EVSE were selected for further evaluation, including development of preliminary site plans and cost estimates. These sites, which are shown in Table 1 below, will be shovel-ready upon completion of site-specific project permitting and final engineering work. A combination of L2 and L3 EVCS are proposed for the sites listed in Table 1 as part of the first phase of implementing the Upstate Plug-In Electric Vehicle Charging Network (Network).

To put these results into context, the macro-siting analysis indicated that for the 2% PEV penetration rate, approximately 120 EVCS would be sufficient to support approximately 5,000 PEV drivers in the Upstate Region (see Task 3.2 Interim Report for details).

Table 1: List of Recommended Stations for Phase 1 of Upstate Plug-In Electric Vehicle Charging Network

	County	City	Description
1		Yreka	Junction Shopping Center
2	Siskiyou	Mt. Shasta	Public Parking Lot on W. Lake St.
3		Mt. Shasta	Tri Counties Bank
4		Redding	McConnell Arboretum
5	Shasta	Redding	Sundial Bridge Parking Lot
6		Redding	City Hall
7		Red Bluff	Tehama County Visitor Center
8	Tehama	Red Bluff	River Park
9		Red Bluff	Public Parking on Pine Street Downtown

In addition to the ten sites listed above, Phase 1 of the Upstate Plug-In Electric Vehicle Charging Network should include an L3 station along Interstate 5 between Redding and the City of Mt. Shasta. This is important so that PEVs travelling north can charge in Redding and then have an interim charging option on the route to Mt. Shasta, which involves a change in elevation of approximately 3,000 feet. The apparent best location identified during the mirco-siting analysis was the Shell station at Lakehead CA. The project team was unable to make a connection with the owner of this particular Shell franchise by the time of this writing to gauge their interest in hosting an L3 station. This outreach should be conducted as an important preliminary action during the implementation of Phase 1.

Also note that an alternate location for a combined L2 and L3 in Mt. Shasta was identified in the public parking lot on Chestnut Street. This location has an existing commercial meter pedestal that is only used on July 4th for festivities, which could be used in a low cost L2 EVCS installation. Pacific Power was contacted about a L3 EVCS in this location and indicated that there is the possibility of providing a pole mounted 480V 3 phase transformer for a L3 EVCS at this location.

Methodology

The macro-siting analysis provided the following results that were used to guide the process of selecting on-the-ground locations for EVCS within the planning area:

- Optimal number of Level 2 and Level 3 EVSE in each Transportation Analysis Zone (TAZ) in Siskiyou, Shasta, and Tehama Counties for 0.5%, 1% and 2% PEV market penetration scenarios
- The priority ranking for installing the specified number of EVCS in each TAZ
    - The priority ranking was arrived at by testing which locations had the greatest potential to reduce PEV driver inconvenience on aggregate through repeated agent based computer simulations

The results from the macro-siting analysis were used to set the target number of sites that needed to be identified for each TAZ in the Upstate Region on aggregate. A list of candidate sites was then developed for each jurisdiction in the study area.

A micro-siting rubric was developed with input from the PEVCC to rank each candidate site. Then, field work was conducted to fill in the rubric for most of the candidate sites identified. Due to the geographic size of the planning area and limitations with the scope and budget available for this study, candidate sites could not be identified in all of the TAZs where EVCS were called for in the macro-siting analysis.

Micro-Siting Rubric

The micro-siting rubric was developed collaboratively by the project team and the PEVCC and went through multiple revisions before being used for assessing candidate sites. The rubric consists of a series of weighed objectives and each candidate location was scored based on those objectives.

After consultations with the PEVCC in the Upstate Region, the decision was made to assign different weights to L1, L2, and L3 EVCS to address the need to treat EVCS that support corridor travel differently than EVCS that support local travel. Accordingly, candidate sites for L1, L2, and L3 EVCS were ranked on different scales and a distinction was made between EVCS that primarily support corridor travel and EVSC that primarily support local travel. Note that in some case the same location was evaluated for a variety of charger types. The section below presents the objectives and associated weights used in the micro-siting rubric.

Objectives and Weights used in the Mico-Siting Rubric

Each site was scored on a total of 19 objectives that were agreed upon by the PEVCC. Those objectives are presented below along with the corresponding weights for L1, L2, and L3 EVCS, and the reasoning behind the weights.

OBJECTIVE 1: Willing Owner/ Operator or Host

Weights:

L1: 5

L2: 5

L3: 5

Reasoning:

A willing site host is critical to a given EVCS installation being successful therefore the highest possible weight is assigned to this objective. Each site is scored on the evaluator's perception of how willing the site host may be. If the owner is not contacted during the evaluation the score is usually low to be conservative with some consideration to public entities and "green" private entities being more willing to support an EVCS installation.

OBJECTIVE 2: Accessibility Potential

Weights:

L1: 5

L2: 5

L3: 5

Reasoning:

Making EVCS accessible to differently-abled persons is important for fairness and will likely soon become law therefore the highest possible weight is assigned to this objective. Current guidance on accessibility of EVSE from the Governor's Office of Planning and Research indicates that the first installed of every 25 PEV chargers at a given location should be accessible to a person with disabilities. Each site is scored based on how well the existing parking lot layout can be adapted to meet the intent of the accessibility guidelines. This often results in an EVCS being installed next to an existing ADA compliant parking space or converting two existing parking spaces into a PEV charging stall with an EVCS, and an adjacent access aisle.

<u>OBJECTIVE 3:</u> Close proximity to apparently suitable point of electrical connection

Weights:

L1: 3

L2: 4

L3: 5

Reasoning:

Major electrical service upgrades may be required to power the EV charging station, which could be cost prohibitive. The impacts on a potential installation increase with the power requirements of the EVCS therefore the weights increase to the maximum for L3 EVCS.

<u>OBJECTIVE 4:</u> Minimal trenching required through paved areas

Weights:

L1: 4.5

L2: 4.5

L3: 4.5

Reasoning:

If there is a significant amount of asphalt and/or concrete that has to be cut and replaced to install the conduit and wire to the station then the cost of the installation could be prohibitive. Cost is typically a major factor in whether or not a station is installed, therefore this objective receives a high weight.

<u>OBJECTIVE 5:</u> Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders

Weights:

L1: 5

L2: 5

L3: 5

Reasoning:

Safety is paramount and a critical factor to win public acceptance, therefore this criterion receives the highest possible weight.

<u>OBJECTIVE 6:</u> Within 0.5 mile of at least 10 Basic Services as per LEED 2009 (see Table 2 below)

Weights:

L1: 2

L2: 4

L3: 2

Reasoning:

Since there is a notable dwell time during charging, installing EV charging stations in commercial districts where the driver can walk to a variety of basic services will result in an installation that is highly utilized as compared to a station that is installed where one or two basic services are within walking distance. Therefore the weight should be high for L2 EVCS. L1 is most applicable to workplace charging or multi-family dwelling units and dwell time for L3 stations is relatively low, therefore a lower weight is used for L1 and L3.

<u>OBJECTIVE 7:</u> Site has good pedestrian infrastructure connecting the site to surrounding basic services

Weights:

L1: 3

L2: 4

L3: 2

Reasoning:

Dwell times at L1 EVCS are long and pedestrian infrastructure is less important for workplace and overnight charging than for range extension and public commerce charging. Dwell times for L3 EVCS are short so pedestrian infrastructure is less important than for L2 EVCS. Pedestrian infrastructure is important for L2 EVCS due to moderate dwell times while conducting business. The “hitching post” charging analogy is applicable to L2 where a PEV driver comes to town for business and hitches up, or plugs in while in town.

<u>OBJECTIVE 8:</u> Site is highly visible to the public

Weights:

L1: 2

L2: 4

L3: 4

Reasoning:

If EV charging stations are installed in locations with high visibility, more people will notice them and become aware that electric cars are an option worthy of consideration when electing to purchase a new vehicle. This will lead to higher penetration rates of EVs into the consumer vehicle fleet. Therefore the weight is relatively high. For L1 EVCS this is less important because workplace and overnight charging serve a captive audience that are aware of the benefits of PEV transportation and management will typically make non-PEV drivers aware of the chargers.

<u>OBJECTIVE 9:</u> Suitable for block of multiple chargers

Weights:

L1: 5

L2: 4

L3: 3

Reasoning:

Blocks of multiple EVCS located strategically will result in a more user-friendly charging infrastructure for EV drivers. For L1 EVCS, it is important to provide a bank of EVCS because they have lower power input requirements making them inexpensive to install and because of the captive audiences in the workplace and multi-family dwelling unit environments. For L2 EVCS it is important that drivers know in advance that they have a high probability of being able to park at a given location. This enables them to plan for a timely arrival at their destination. If there are individual stations distributed throughout a given area, a driver may have to drive from station to station to find an unoccupied charging point, which adds stress, wastes energy, and could cause driver delay. The major cost for a bank of chargers is associated with the electrical connection and site work to get power to the charging pedestals. The cost of site work for one station may be only slightly less than the cost for multiple stations, unless an electrical service upgrade is triggered. For L3 EVCS the high input power requirements make banks of multiple EVCS expensive and impractical in many locations given the current economics of Public PEV charging in the non-Tesla PEV fleet.

OBJECTIVE 10: Long term control/ownership of the site is unlikely to change in the next 10 years

Weights:

L1: 3

L2: 3

L3: 3

Reasoning:

Sites that get good usage will persist into the future. They need to be connected to a building/space with long term stability, with predictably high traffic, and nearby services. Public ownership provides a greater chance that the site will endure as an EV charging site.

OBJECTIVE 11: Site is well lit without the addition of dedicated lighting installed with station

Weights:

L1: 3

L2: 3

L3: 3

Reasoning:

If the site is not well lit then lighting may need to be installed as part of the project so that the station is perceived as safe and easy to use after dark. This could add to project cost. The decision to add lighting would be made on a case by case basis taking into account the desires of the property owner, station owner, and the jurisdictional authority. The purpose of this objective is to credit sites with good lighting but not burden poorly lit sites too heavily. Therefore this objective gets a medium weight.

OBJECTIVE 12: Low risk of public backlash from converting conventional parking spaces

Weights:

L1: 4

L2: 3

L3: 2

Reasoning:

The installation of a block of multiple EV charging stations in a high demand parking lot has the potentially to cause animosity if those EV stations were not heavily used. Commuters in conventional vehicles may become resentful if it becomes harder for them to park due to the reduced number of conventional parking spaces. There are ways that the concerns of conventional vehicle drivers can be mitigated, including by using signage or sensors to allow all types of vehicles to use some of the spaces when EV charging demand is low. For this objective the weights are highest for L1 EVCS because there is a higher likelihood that a greater number of parking spaces will be used in an L1 installation. Likewise, the weight for L2 EVCS is higher than for L3 due to likely number of parking spaces affected.

OBJECTIVE 13: Site appears to support workplace charging scenario

Weights:

L1: 5

L2: 3

L3: 1

Reasoning:

Sites were ranked according to how suitable they were for workplace charging. L1 EVCS received the highest possible weight since L1 is most applicable to workplace and multi-family housing. L2 EVCS can also be applicable to workplace charging particularly at sites where clients may also visit the facility. L3 EVCS is not typically installed for workplace charging unless the facility has a PEV fleet with high utilization.

OBJECTIVE 14: Within 0.5 mile of connection points to other modes of transportation

Weights:

L1: 3

L2: 2

L3: 1

Reasoning:

EV drivers may elect to use other modes of transportation like busses or bikes for short trips around town while their vehicle is charging. Locating EV charging stations close to points of connection for other modes of transportation (bus stops or bike lanes) increases the likelihood that the site will be used in this way. In general, the likelihood that drivers will get out of their car and onto a bus or bike as a regular commuting pattern seems to be low, especially in more rural areas, so the weight for this objective is low and scaled with typical dwell times for the type of EVCS.

OBJECTIVE 15: Site appears to be suitable for use by residents of a multi-family housing development

Weights:

L1: 5

L2: 3

L3: 1

Reasoning:

Installing EV charging stations near multi-family housing developments enables residents without garages or dedicated parking spaces to use a PEV and charge it, typically overnight. Therefore this objective is weighted heavily for L1 medium for L2, and low for L3.

<u>OBJECTIVE 16:</u> Site has the potential to support overnight charging for long-distance travelers

Weights:

L1: 4

L2: 5

L3: 1

Reasoning:

The Upstate Region encompasses a large geographic area traversed by multiple highways. Therefore there is a desire to support long distance PEV travel and overnight charging for travelers is an important consideration. L1 and L2 EVCS are both well suited for this purpose with L2 being more effective due to higher input power. L3 is less applicable since dwell time at the EVCS is relatively low.

<u>OBJECTIVE 17:</u> Site fills a gap in PEV charging infrastructure for travelers the I-5 Corridor

Weights:

L1: 1

L2: 4

L3: 5

Reasoning:

There are EVCS along Interstate 5 (I-5) in Oregon and Washington with an average spacing of around 26 miles. Support for PEV transportation along the I-5 corridor stops at the Oregon-California border. The PEVCC is interested in installing EVCS along the I-5 Corridor in the Upstate Region to facilitate PEV travel. This objective is most applicable to L3 EVCS and L2 EVCS can still support PEV travel along the I-5 corridor but on a less convenient basis.

<u>OBJECTIVE 18:</u> Site fills a gap in PEV charging infrastructure along other rural routes

Weights:

L1: 1

L2: 3

L3: 4

Reasoning:

The PEVCC is interested in installing EVCS along other rural routes in the Upstate Region to facilitate PEV travel. Again, this objective is most applicable to L3 EVCS and L2 EVCS can still support PEV travel along rural routes but on a less convenient basis.

<u>OBJECTIVE 19:</u> Site is attended due to the host business type

Weights:

L1: 1

L2: 3

L3: 5

Reasoning:

EVCS can be damaged by vandalism or theft. If a site is attended due to the host business type then it is less likely that it will be damaged, resulting in repair expenses. L3 EVCS are more expensive therefore they receive the highest weight for this objective. The weights decrease for L2 and L1 EVCS due to the lower cost of system components.

In general, the intent of the objectives and weights shown above were clear enough so that the candidate sites could be ranked in the field according to metrics developed with guidance from the PEVCC. There was some redundancy in the objectives that created extra work for evaluators however this was accepted as a result of the consensus based process used by the PEVCC for developing the rubric.

Table 2 below shows the list of basic services that was used to rank sites under Objective 6 above.

Table 2: List of Basic Services from LEED 2009

Basic Services (per LEED 2009):	
Bank	Restaurant
Place of worship	School
Convenience grocery	Supermarket
Day care center	Theater
Cleaners	Community Center
Fire Station	Fitness Center
Hardware	Museum
Laundry	Park
Library	Pharmacy
Medical or dental office	Post office
Senior care facility	Beauty Salon
Note: LEED stands for Leadership in Energy and Environmental Design, which is program of the United States Green Building Council that provides a structure by which various types of building projects can be rated with respect to their environmental impacts.	

The micro-siting rubric included a system for scoring each site based on how well the site met each of the objectives. Table 3 below shows the scoring rules used to rate each site's performance according to the objectives described above.

Table 3: Scoring Rules for Rubric

Scoring Rules	
Site meets objective extremely well	**5**
Site meets objective well	**4**
Site meets objective	**3**
Site could meet objective with effort	**2**
Site will not meet objective	**1**

To calculate the final rank for each candidate site, first the score given for each objective was multiplied by the weight given to that objective and these products were summed to generate a weighted score for each site.

Once the final ranking score was calculated for each site, a post processing step was completed that involved scaling the final score using the priority ranking generated by the PEVI computer model used in the macro-siting analysis. This had the effect of increasing the ranking of candidate sites located in TAZs that the PEVI model had determined were a high priority for minimizing PEV driver inconvenience. The results of this process are shown on the first page of Appendix C1.

The micro-siting analysis also included preparing preliminary site plans and opinions of cost for a shortlist of the top ranked sites. The process for determining which stations to include in the shortlist involved a review of the following: 1) overall rankings from the rubric, 2) accommodation of the desire to site one station in each of the major population centers in the greater Upstate Region as a first step to building out the regional EVCS network, and 3) communications with site owners to the point where the owner was open to the idea of signing a letter stating their support for becoming EVCS site host.

Preliminary Site Plans

The preliminary site plans were prepared by a licensed civil engineer for the stations selected for the first phase of building out the Network. The purpose of this step was to provide a conceptual layout of the potential configuration and to assist in the development of the opinion of cost. The preliminary plans consist of two plan sheets for each site. The first plan sheet shows a vicinity map locating the station within California and a neighborhood scale site plan. The second sheet is an enlargement showing the layout of the EVCS within the parking lot, the preliminary conduit alignment between the apparent best electrical connection and the EVCS, location of signage, proposed parking lot re-striping and lettering, and other details. Note that electrical load studies were not conducted under the micro-siting analysis and the interior of existing electrical service panels were not opened. Final engineering design and permitting is required to make the sites shovel-ready.

Guidance from the California Governor's Office of Planning and Research regarding EVSE accessibility was followed during preparation of the preliminary site plans. Once the preliminary site plans were prepared to the level of detail described above, an Engineer's Opinion of Probable Cost was prepared.

Engineer's Opinion of Probable Construction Costs

The Engineer's Opinion of Probable Construction Costs were prepared by a licensed civil engineer using RS Means Site Work and Landscape Cost Data, cost data from vendors and utilities, and bid results from recent projects. The purpose of this opinion of probable cost is to provide an order of magnitude estimate of potential costs for the preliminary concepts. A cost line item was included for each major item of work identified as part of the preliminary site plans. The quantities of needed construction materials were measured from the preliminary site plans. Additional items included in the cost estimate were: sales tax, General Contractor Requirements, General Contractor Overhead and Profit, a 25% Estimating Contingency, Cost of Bonds and a Location Adjustment Factor to adjust nationwide cost data to the economy in the Upstate Region.

Note that the Engineer's Opinion of Probable Construction Costs should be updated with each future design iteration as the preliminary site plans are refined from their current state to final construction documents stamped by a registered professional engineer with responsible charge over the design. It should be noted that actual construction costs depend not only on the final design, but also how contractors actually bid the projects. Only after bidding and construction are the actual total construction costs known. Refining the opinion of probable costs throughout the process increases the confidence that the bid results will fall within the project budget, but does not guarantee it.

Results and Discussion

The work products generated under Task 3.3 include:

- A completed micro-siting rubric that includes a listing of 99 candidate sites for EVSE in the planning area.
    - All of the candidate sites were assessed on the ground using the rubric and site owner consultations we initiated on 29 sites.
    - A short list of nine highly ranked sites with owners who were open to discussing the concept of hosting a station were selected for further evaluation.
- A set of preliminary engineering plans were prepared for sites on the shortlist
- Engineer's Opinion of Probable Construction Costs prepared with RS Means Site Work and Landscape Cost Data, cost data from vendors and utilities, and bid results from recent projects for the sites on the shortlist including sales tax, General Contractor Requirements, General Contractor Overhead and Profit, a 25% Estimating Contingency, Cost of Bonds, and a Location Adjustment Factor to adjust nationwide cost data to the economy in the Upstate Region

The final micro-siting rubric spreadsheet includes a summary page for L1, L2, and L3 micrositing results listing all of the candidate sites, their TAZ, their final ranking score, and a description of the parking space that was evaluated. Following this are rubric spreadsheets for the following areas: Anderson, Corning, Dunsmuir, Mt. Shasta, Redding, Red Bluff, Weed, Yreka, and Miscellaneous TAZs Compiled. Copies of the completed rubric are included in Appendix C1. An electronic copy of the micro-siting rubric spreadsheet has been provided to the SCEDC.

The preliminary designs for the shortlist of selected sites were compiled into a plan set under a cover page to facilitate review by the California Energy Commission, local building departments and permitting officials, and community leaders. This plan set is included in Appendix C2 to this report.

The intent is for the preliminary plan set to be developed into a biddable set of construction plans under a separate project. Construction specifications for the civil and electrical work will then be appended to the plan set and the project will be released for public bid under a set of general conditions that adhere to the public contract code. In this way the first EVCS in the Network can be implemented as a result of the work completed in this Plan.

Subsequent stations can be implemented following a similar methodology as described above by selecting sites based on the ranking from the rubric, taking into account geographic and political considerations, and the willingness of site hosts.

The Engineer's Opinions of Probable Construction Costs for each site were compiled into a single spreadsheet. The cost spreadsheet includes pages with cost estimates for each of the sites noted in Table 4. Copies of the cost spreadsheet are included in Appendix C3. A summary of the preliminary engineer's opinions of probable construction costs for the shortlist of stations is presented in Upon review of on the micro-siting process, the following observations are noted:

- The collaborative process for developing the rubric went relatively well with quality input received from project team members and from members of the PEVCC.

- There was some redundancy in the objectives that created extra work for evaluators however this was accepted as a result of the consensus based process used by the PEVCC for developing the rubric.

- The amount of time and personnel required to develop the list of candidate sites and rank them with the rubric was significant and candidate sites were not identified outside of major populations centers and travel corridors in the region.
- A significant amount of public outreach and education occurred during the micro-siting process as local government officials and business owners and operators were contacted and engaged in conversations about EVCS and PEVs. These efforts generated interest in the community around the idea of a local Network and PEV transportation in general.
- The micro-siting rubric is a useful tool that could be used by other communities to derive a list of potential EVCS sites in a collaborative manner. If necessary the post processing step using the PEVI model results could be omitted if PEVI model results are not available for the subject area.

Table 4 below.

Upon review of on the micro-siting process, the following observations are noted:

- The collaborative process for developing the rubric went relatively well with quality input received from project team members and from members of the PEVCC.

    - There was some redundancy in the objectives that created extra work for evaluators however this was accepted as a result of the consensus based process used by the PEVCC for developing the rubric.
- The amount of time and personnel required to develop the list of candidate sites and rank them with the rubric was significant and candidate sites were not identified outside of major populations centers and travel corridors in the region.
- A significant amount of public outreach and education occurred during the micro-siting process as local government officials and business owners and operators were contacted and engaged in conversations about EVCS and PEVs. These efforts generated interest in the community around the idea of a local Network and PEV transportation in general.
- The micro-siting rubric is a useful tool that could be used by other communities to derive a list of potential EVCS sites in a collaborative manner. If necessary the post processing step using the PEVI model results could be omitted if PEVI model results are not available for the subject area.

Table 4: Summary of Preliminary Engineer's Opinion of Probable Construction Costs

#	County	City	Description	Installation Type	Preliminary Engineer's Opinion of Probable Costs
1	Siskiyou	Yreka	Junction Shopping Center	One L2 EVCS One L3 EVCS Three stub outs	$ 121,000
2		Mt. Shasta	Public Parking Lot on W. Lake St.	One L2 EVCS Three stub outs	$ 20,000
3		Mt. Shasta	Tri Counties Bank	One L2 EVCS One L3 EVCS	$ 119,000
4	Shasta	Redding	McConnell Arboretum	One L2 EVCS One L3 EVCS Three stub outs	$ 106,000

5		Redding	Sundial Bridge Parking Lot	One L2 EVCS Four stub outs	$ 24,000
6		Redding	City Hall	One L2 EVCS Three stub outs	$ 18,000
7	Tehama	Red Bluff	Tehama County Visitor Center	One L2 EVCS One L3 EVCS One stub out	$ 125,000
8		Red Bluff	River Park	One L2 EVCS One stub out	$ 20,000
9		Red Bluff	Public Parking on Pine Street Downtown	One L2 EVCS Three stub outs	$ 21,000
Total Estimated Construction Costs for Aggregated Project					**$ 574,000**
Note: Stub out refers to a conduit run to another parking space or parking spaces adjacent to proposed EVCS where the conduit system is designed to accommodate multiple EVCS circuits for future expansion. See preliminary design plans and detailed engineer's opinion of probable costs for more detail.					

Note that the costs presented above do not include the following additional project implementation costs:

- Engineering design
- Permitting
- Bid period services
- Construction management
- Project administration
- Finalization of host/owner agreements

Recommendations

As a result of the work completed under Task 3.3, the following recommendations are offered for consideration by the SCDEC and PEVCC:

- Consider using the preliminary site plans and cost estimates included in Appendices B and C to initiate an aggregated project to implement the shortlist of EVCS installations.
- Consider using the data in the micro-siting rubric included in Appendix C1 to plan the rollout of subsequent stations in the Network.
    - The ranking score associated with each site is the result of field assessments guided by the objectives, weights, and criteria developed with the PEVCC
    - The PEVI model prioritization is incorporated into the final ranking score for each site which brings the benefits of the data-driven macro-siting analysis into the decision of where EVCS are sited.
    - The rubric should be viewed as a working tool that is being updated as new information comes in and progress is made towards developing new EVCS sites in the Network.
    - Additional candidate sites can be added to the rubric for areas that were not covered under this analysis due to budget constraints and the size of the geographic region encompassed by the study.

Appendix C1 – Micro-siting Rubric

141007Final

Color Code	Type of Host
(green)	Site Plan and Cost Estimate Developed for L2 only
(yellow)	Site Plan and Cost Estimate Developed for L2 and L3

LEVEL 2 SITE RANKINGS

Rank	Final Adjusted Score	Site Reference Number	Transportation Analysis Zone	Desription
1	260.5	RB11	Red Bluff	Diagonal public street parking on Pine Street at intersection with Rio Street
2	253.8	MTS7	Mt. Shasta	Public parking across from fire station on W. Lake St.
3	245.9	RED28	RED_Hilltop	Petco Parking Stalls - North Side of Shopping Center Main Parking Lot at Transformer at Payless Shoe Source
4	241.4	RED43	RED_ParkMarina	Redding City Hall - existing festival power pedestal near parkview entrance
5	240.9	RED44	RED_ParkMarina	Redding Public Library, Grape Ave. Side across from ballpark
6	240.5	RED39	RED_NorthHilltop	Turtle Bay Exploration Park/Sustainability Gardens - East Parking Lot at ADA Stalls/Landscape Island at Northwest Corner of East Lot
7	239.5	RED31	RED_LakeRedding	Caldwell Park - Teen Center/Skatepark Parking Lot, East side of lot at Teen Center ADA Stalls, Southeast Corner of Lot Under Trees
8	238.6	RB10	Red Bluff	TRAX station parking lot at intersection of Rio Street and Walnut Street.
9	237.7	RED29	RED_Hilltop	Red Lion Hotel - South Parking Lot at West Side of Laundry/Maintence Bldg, First Stall to West of Bldg
10	236.3	MTS5	MtShasta	Chestut Street Public Parking Lot. North Side of Lot near existing temp power meter pedestal
11	232.3	COR2	Corning	Olive Pit Parking Lot - Northwest Corner at Shell Lot Divider at Carwash Entrance (four stalls)
12	230.5	RED_F2	RED_Airport	Future Redding Electric Utility Avtech Parkway - (3611 Avtech Parkway) - Northeast Corner of Bldg at ADA at Noth Entrance
13	229.5	RED40	RED_Northwoods	Ross/Kmart Parking Lot - North End at Center Signage/North Entrance
14	229.2	RED20	RED_Downtown	Redding Downtown Parking Garage (intersection of California & Yuba) - Southern Garage Structure at Basement Level, across from Stairwell at Wall Mounted Meter, North End of Lot
15	227.7	RED45	RED_ParkMarina	Redding City Hall - West side of buiding at ADA at west entrance
16	224.5	AND4	AND_OldHwy99	CA Welcome Center at Shasta Outlets -South End of Parking Lot at base of CA Welcome Ctr Landscaping/Hill at Trasformer
17	224.5	COR1	Corning	Olive Pit Parking Lot - Northwest Corner under Sign (three stalls)
18	224.1	RED1	RED_Airport	Airport Lot - Main Lot at Main Entrance Walkway at ADA Stalls
19	223.2	RED47	RED_Rancheria	Win-River Casino - South Parking Lot at Non-Smoking Entrance at Transformer
20	221.8	RBF9	Red Bluff	Red Bluff River Park - Southwest Corner of Lot at Pump House, East of Chmber of Commerce Bldg
21	221.4	RED19	RED_Downtown	Sacramento River Trail Parking Lot - Southwest Corner of Lot at Retaining Wall at Utility Pole Island and ADA Stalls
22	220.5	RED51	RED_RedwoodMeadows	AM/PM Fueling Station - South End of Lot, South of Pump Canopy at South Stall Bank at Fence. Corner of Oasis Rd and Old Oasis Rd.
23	219.5	RBF3	Red Bluff	Wholsome Goods Parking Lot - North Lot against North Wall
24	219.2	MTS4	MtShasta	Tri-Counties Bank Lot - Northeast Corner of Lot at Retaining Wall
25	218.6	COR3	Corning	Corning Library/City Hall/Park-and-Ride - North End of City Hall/Library Lot Diagnals
26	217.3	RBF2	Red Bluff	Belle Mill Shopping Center - Southeast Corner of Lot, East of Sign, Southeast of FoodMaxx, South of Former Hollywood Video (East Building)
27	215.9	RED5	RED_Benton	Placer Heights Plaza - Holiday Market/CVS - South Side of Main Lot Between Redding Bank of Commerce and CVS at Landscaping Separating Lot from Road at Transformer
28	215.5	RED50	RED_RedwoodMeadows	Railey's Shopping Center - Contiguous to North Side of O'Rieley's Auto at Landscaping/Transformer, East Side of Center Parking Lot
29	214.5	RBF4	Red Bluff	Raileys/Walmart Center - Northwest Corner of Parking Lot, North of Chase Bank at Grass Landscape at Transformer (East of Raileys)
30	214.1	RBF1	Red Bluff	Tehema County Visitor Center - Far North Regional Center - North Valley Services (1040 Washington Street 527-1083) (Transformer T1576)
31	213.5	YKA4	Yreka	Public Lot at North Street and 3rd Street - Southeast Corner at 3rd St Entrance
32	212.7	AND2	AND_Cascade	East Center Street - Diagnal Stalls, East of RR Tracks, South of Fire Hall, SW Across Intersection from Club 49
33	210.5	RED34	RED_Magnolia	Shasta County Public Administration Bldg - Parking garage west of bldg - First level at northwest corner of bldg at NW entrance
34	209.6	MTS1	MtShasta	Shasta Dwntwn Public Lot - at Alma Street Union Pac RR Crossing, West of Burger Express
35	208.2	RED62	RED_NorthHilltop	McConnel Arboretum - Arboretum Lot at West-Northwest Portion of Lot at Landscaping Island at SW Corner of Nursery
36	205.9	RED22	RED_Enterprise	Enterprise Health Foods Parking Lot - North Side of Building at NW Corner
37	205.8	MTS2	MtShasta	Berryvale/shasta Yoga Center Lot - Southeast Corner of lot at ADA, at Yoga Center Entrance
38	204.1	RED41	RED_Northwoods	Black Bear Diner Parking Lot - East Side of Building at Storage Shed/Employee Entrance at ADA Stall
39	203.2	RED15	RED_Branstetter	Westwood Village Shopping Center - Northeast Corner of Parking Lot at Carl's Jr., South Side of Building at Transformer/Drive-thru Entrance
40	202.9	RED9	RED_BoulderCreek	Cinemark Parking Lot - East Parking Lot at Easternmost Stall Bank at East Entrance/Transformer
41	202.1	RED60	RED_TurtleBay	Turtle Bay/Sundial Bridge - Central parking lot west of Sundial Bridge access road, Center-east of lot, adjacent to main ADA stalls
42	201.2	YKA1	Yreka	Yreka Junction Shopping Center - West Side of Parking Lot, South of West Storefronts (inc. AAA) at Transformer E24586
43	200.5	RED26	RED_GoldHills	Ramada Limited Hotel Parking Lot - Northside of Bldg at Southeast of Covered Entrance at Transformer
44	200.4	RED59	RED_TIWhaley	Professional Business Park - East Lot at Public Stalls at Northeast Corner at Cardboard Dumpster, Northeast of Garbage Dumpster Enclosure
45	199.6	YKA5	Yreka	Black Bear Diner Lot - North Side of Building at Entrance
46	199.6	MISC32	SHA_Downtown	Shasta Dwntwn Public Lot - Shasta Dam Blvd at Grand River, West of North Valley Bank, Diagnal Stalls at North Side of Parking Lot
47	197.9	RED11	RED_BoulderCreek	Barnes & Noble/Office Max Parking Lot - East Side of Lot at Easternmost Stall Bank at Southeast Portion of Lot at Transformers
48	197.7	RED8	RED_Bonnyview	Shasta County Public Health Campus - Angled Parking Next to Urgent Care Parking at Utility Pole/Transformer (middle of campus)
49	196.8	AND5	AND_OldHwy99	Walmart Super Center - Northeast Corner of Lot North of Vacant Bank Bldg., North Side of Drive Thru Exit
50	196.3	RED12	RED_BoulderCreek	Mt. Shasta Mall Parking Lot - Northwestern Corner of Lot at Retaining Wall at Northwest Macy's Entrance, Stall Bank at North Perimeter at Transformer
51	193.2	RED54	RED_SportsComplex	City of Redding Public Works 20055 Viking Way - Main lot, ADA at Pub Wrks (Bldg 3) Entrance
52	192.7	AND6	AND_OxYoke	Gaia Hotel & Spa/Woodside Restaurant - Northeast Corner of Parking Lot at Northeast Corner of Woodside Grill at Double Space, North of Transformer
53	192.3	DUN6	Dunsmuir	Public Lot - South of City Hall, West Side of Main Street, Across from Fire Department - Stalls at Transformer at South Side of Lot
54	190.9	RED56	RED_Sunset	Shasta YMCA Main Lot - Northwest Corner of Lot at NE Corner of Bldg/Mechanical Room at Fence at Dumpster Enclosure
55	190.4	RED61	RED_Westgate	Topps Supermarket Shopping Center -
56	189.5	RBF6	Red Bluff	Burrito Bandito/Starbucks Center - Southwest Corner of Lot at ADA Stalls
57	186.4	RB12	Red Bluff	PG&E remediation site at intersection of Rio Street and Antelope BLVD
58	185.5	RED55	RED_SportsComplex	Redding Baseball Field Sports Complex - Main lot, Northeast of Main Entrance at Loading/Drop-off Zone, South of Roundabout
59	185.0	MISC30	SHASTA	Shasta Post Office - Parking Stalls on West Side of Building at ADA Stall
60	184.1	RED49	RED_RedwoodMeadows	Starbucks/Subway/Cash Advance Parking Lot - East Stall Bank, South of Drive-Thru Entrance at Dumpster/Transformer
61	183.2	RED32	RED_LakeRedding	Caldwell Park - Fish Viewing Facility Parking Lot at ADA Stalls
62	182.1	MISC21	Los Molinos	Umpqua Bank Lot - East Side of Lot at Landscaping
63	181.5	WED1	Weed	Bel Air Park - ADA at College Avenue at Intersection of Terrace St and College at Playground
64	180.9	MISC5	COT_East	Cottonwood West - Tri-Counties Bank Parking Lot - East Side at Rock Landscaping/Vacant Lot
65	179.6	DUN3	Dunsmuir	Angled Public Parking on Sacramento Ave.by railyard- two spaces on either south end of row
66	175.0	RED27	RED_GoldHills	Tractor Supply Company (TSC) Parking lot - Southeast Corner of Parking Lot at South Entrance at Exterior Fencing Sales Yard
67	174.2	MISC4	Castella	Castella Chevron/Post Office - Minimart ADA at Northeast Corner of Bldg
68	174.1	RED23	RED_Enterprise	Tower Fueling Station (Robert Ct. & Hartnell) Parking Lot - Southwest Portion of Lot at West Entrance at Landscaping
69	172.1	MISC6	COT_West	Cottonwood East - Holiday/Chevron Lot - North and/or East of Chevron Station
70	168.2	AND8	AND_Stingy	Anderson River Park - Tennis Court Northeast Parking Lot at Bocce Ball/BBQ Area - East of Tennis Courts at Southeast Corner of Lot
71	167.3	DUN2	Dunsmuir	City Parking Lot near visitor center and City Hall- Parking space next to ADA space on north side
72	165.8	WED2	Weed	Weed Chamber of Commerce Parking Lot at Southeast of Spirit Gas Station
73	157.1	MISC34	SHA_ShastaDam	Sportsmans Express/Shell Station - West Side of Building, South of Pump Canopy at Bldg Wall Panel
74	156.5	DUN5	Dunsmuir	Dunsmuir City Park Parking Lot- Two parking spaces on north side nearest sidewalk
75	156.2	YKA2	Yreka	Bottling Works Mall Parking Lot - Stalls at Footbridge West Entrance Steps
76	155.0	MISC31	SHA_BearMountain	Chevron Station?KC's Corner Mart/Nellie's Grill - East Side of Building at Dumpster/Transformer
77	150.8	RED42	RED_Pacheco	TA Truck Stop - East Side of Country Pride Restaurant Northeast Corner of Structure

LEVEL 3 SITE RANKINGS

Rank	Final Adjusted Score	Site Reference Number	Transportation Analysis Zone	Desription
1	191.4	RED6	RED_Benton	Placer Heights Plaza - Holiday Market/CVS - South Side of Main Lot Between Redding Bank of Commerce and CVS at Landscaping Separating Lot from Road at Transformer
2	180.9	MISC20	Lakehead	Shell Station - Lakeshore _ - Exit 702 - East Side of Lot Near ADA
3	180.8	RBF7	Red Bluff	Red Bluff River Park - Southwest Corner of Lot at Pump House, East of Chmber of Commerce Bldg
4	179.6	RED30	RED_Hilltop	Petco Parking Stalls - North Side of Shopping Center Main Parking Lot at Transformer at Payless Shoe Source
5	175.8	RBF8	Red Bluff	Raileys/Walmart Center - Northwest Corner of Parking Lot, North of Chase Bank at Grass Landscape at Transformer (East of Raileys)
6	172.1	AND3	AND_Cascade	Gateway Center/Anderson Square - Northwest Corner of Gateway Center Lot, South of Shell Gas Canopy at West Entry/Exit North of Transformer
7	169.6	RED52	RED_RedwoodMeadows	AM/PM Fueling Station - South End of Lot, South of Pump Canopy at South Stall Bank at Fenc. Corner of Oasis Rd and Old Oasis Rd.
8	168.8	RBF5	Red Bluff	Tehema County Visitor Center - Far North Regional Center - North Valley Services (1040 Washington Street 527-1083) (Transformer T1576)
9	166.8	MTS6	MtShasta	Chestut Street Public Parking Lot. North Side of Lot
10	165.7	MTS3	MtShasta	Tri-Counties Bank Lot - Northeast Corner of Lot at Retaining Wall
11	163.9	YKA3	Yreka	Yreka Junction Shopping Center - West Side of Parking Lot, South of West Storefronts (inc. AAA) at Transformer E24586
12	162.7	RED13	RED_BoulderCreek	Cinemark Parking Lot - East Parking Lot at Easternmost Stall Bank at East Entrance/Transformer
13	161.2	WED4	Yreka	Black Bear Diner Lot - West Side of Lot
14	159.6	RED10	RED_BoulderCreek	Barnes & Noble/Office Max Parking Lot - East Side of Lot at Easternmost Stall Bank at Southeast Portion of Lot at Transformers
15	157.7	RED38	RED_NorthHilltop	McConnel Arboretum - Arboretum Lot at West-Northwest Portion of Lot at Landscaping Island at SW Corner of Nursery
16	157.5	RED21	RED_Downtown	Redding Downtown Parking Garage (intersection of California & Yuba) - Southern Garage Structure at Basement Level, across from Stairwell at Wall Mounted Meter, North End of Lot
17	155.8	WED3	Weed	Weed Pilot Truckstop Northwest Lot at Auto Parking Lot at Northwest of Market
18	153.1	MISC33	SHA_Downtown	Shasta Dwntwn Public Lot - Shasta Dam Blvd at Grand River, West of North Valley Bank, Diagnal Stalls at North Side of Parking Lot
19	149.6	RED46	RED_Rancheria	Win-River Casino - South Parking Lot at Non-Smoking Entrance at Transformer
20	149.2	AND7	AND_OxYoke	Gaia Hotel & Spa/Woodside Restaurant - Northeast Corner of Parking Lot at Northeast Corner of Woodside Grill at Double Space, North of Transformer
21	145.4	COR4	Corning	Woodson Park - Southwest Corner Street Diagnals Corner Walnut & Peach (Option at SE, NW Corner)
22	138.1	RED48	RED_RedwoodMeadows	Starbucks/Subway/Cash Advance Parking Lot - East Stall Bank, South of Drive-Thru Entrance at Dumpster/Transformer

Summary of Level 2 EV Charging Station Micrositing Results

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Geographic Zone	Top Ranked Sites in Geographic Zone	Final Score Adjusted for PEVI Priorities	Site Reference Number	Transportation Analysis Zone	Desription	Status	Candidate Site Count	Rubric Completed Count	Owership Conversation Count
Dunsmuir	1	148.2	DUN4	Dunsmuir	Angled Public Parking on Sacramento Ave.by railyard- two spaces on either south end of row	No contact with owner yet	1	1	0
Redding	1	173.9	RED_F1	RED_Airport	Future Redding Electric Utility Avtech Parkway - (3611 Avtech Parkway) - Northeast Corner of Bldg at ADA at Noth Entrance	No contact with owner yet	1	1	0
	2	164.6	RED58	RED_TIWhaley	Professional Business Park - East Lot at Public Stalls at Northeast Corner at Cardboard Dumpster, Northeast of Garbage Dumpster Enclosure	No contact with owner yet	1	1	0
	3	147.5	RED53	RED_SportsComplex	City of Redding Public Works 20055 Viking Way - Main lot, ADA at Pub Wrks (Bldg 3) Entrance	No contact with owner yet	1	1	0
	4	143.9	RED7	RED_Bonnyview	Shasta County Public Health Campus - Angled Parking Next to Urgent Care Parking at Utility Pole/Transformer (middle of campus)	No contact with owner yet	1	1	0
						Sum -->	5	5	0

L1 count	5
Check	5

Summary of Level 2 EV Charging Station Micrositing Results

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Geographic Zone	Top Ranked Sites in Geographic Zone	Final Score Adjusted for PEVI Priorities	Site Reference Number	Transportation Analysis Zone	Desription	Status	Candidate Site Count	Rubric Completed Count	Owership Conversation Count
Anderson	1	224.5	AND4	AND_OldHwy99	CA Welcome Center at Shasta Outlets -South End of Parking Lot at base of CA Welcome Ctr Landscaping/Hill at Trasformer	No contact with owner yet	1	1	0
	2	212.7	AND2	AND_Cascade	East Center Street - Diagnal Stalls, East of RR Tracks, South of Fire Hall, SW Across Intersection from Club 49	No contact with owner yet	1	1	0
	3	196.8	AND5	AND_OldHwy99	Walmart Super Center - Northeast Corner of Lot North of Vacant Bank Bldg., North Side of Drive Thru Exit	No contact with owner yet	1	1	0
	4	192.7	AND6	AND_OxYoke	Gaia Hotel & Spa/Woodside Restaurant - Northeast Corner of Parking Lot at Northeast Corner of Woodside Grill at Double Space, North of Transformer	No contact with owner yet	1	1	0
	5	168.2	AND8	AND_Stingy	Anderson River Park - Tennis Court Northeast Parking Lot at Bocce Ball/BBQ Area - East of Tennis Courts at Southeast Corner of Lot	No contact with owner yet	1	1	0
Corning	1	232.3	COR2	Corning	Olive Pit Parking Lot - Northwest Corner at Shell Lot Divider at Carwash Entrance (four stalls)	No contact with owner yet	1	1	0
	2	224.5	COR1	Corning	Olive Pit Parking Lot - Northwest Corner under Sign (three stalls)	No contact with owner yet	1	1	0
	3	218.6	COR3	Corning	Corning Library/City Hall/Park-and-Ride - North End of City Hall/Library Lot Diagnals	No contact with owner yet	1	1	0
Dunsmuir	1	192.3	DUN6	Dunsmuir	Public Lot - South of City Hall, West Side of Main Street, Across from Fire Department - Stalls at Transformer at South Side of Lot	No contact with owner yet	1	1	0
	2	179.6	DUN3	Dunsmuir	Angled Public Parking on Sacramento Ave.by railyard- two spaces on either south end of row	No contact with owner yet	1	1	0
	3	167.3	DUN2	Dunsmuir	City Parking Lot near visitor center and City Hall- Parking space next to ADA space on north side	No contact with owner yet	1	1	0
	4	156.5	DUN5	Dunsmuir	Dunsmuir City Park Parking Lot- Two parking spaces on north side nearest sidewalk	No contact with owner yet	1	1	0
Mt. Shasta	1	253.8	MTS7	Mt. Shasta	Public parking across from fire station on W. Lake St.	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	2	236.3	MTS5	MtShasta	Chestut Street Public Parking Lot. North Side of Lot near existing temp power meter pedestal	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	3	219.2	MTS4	MtShasta	Tri-Counties Bank Lot - Northeast Corner of Lot at Retaining Wall	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	4	209.6	MTS1	MtShasta	Shasta Dwntwn Public Lot - at Alma Street Union Pac RR Crossing, West of Burger Express	Owner interested	1	1	1
	5	205.8	MTS2	MtShasta	Berryvale/shasta Yoga Center Lot - Southeast Corner of lot at ADA, at Yoga Center Entrance	No contact with owner yet	1	1	0
Redding	1	245.9	RED28	RED_Hilltop	Petco Parking Stalls - North Side of Shopping Center Main Parking Lot at Transformer at Payless Shoe Source	No contact with owner yet	1	1	0
	2	241.4	RED43	RED_ParkMarina	Redding City Hall - existing festival power pedestal near parkview entrance	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	3	240.9	RED44	RED_ParkMarina	Redding Public Library, Grape Ave. Side across from ballpark	Owner interested, utility contacted and POC discussed	1	1	1
	4	240.5	RED39	RED_NorthHilltop	Turtle Bay Exploration Park/Sustainability Gardens - East Parking Lot at ADA Stalls/Landscape Island at Northwest Corner of East Lot	Owner interested, utility contacted and POC discussed	1	1	1
	5	239.5	RED31	RED_LakeRedding	Caldwell Park - Teen Center/Skatepark Parking Lot, East side of lot at Teen Center ADA Stalls, Southeast Corner of Lot Under Trees	Owner interested, utility contacted and POC discussed	1	1	1
	6	237.7	RED29	RED_Hilltop	Red Lion Hotel - South Parking Lot at West Side of Laundry/Maintence Bldg, First Stall to West of Bldg	Owner already has NEMA 14-50 plug for Evs and is interested in J station.	1	1	1
	7	230.5	RED_F2	RED_Airport	Future Redding Electric Utility Avtech Parkway - (3611 Avtech Parkway) - Northeast Corner of Bldg at ADA at Noth Entrance	Owner interested, utility contacted and POC discussed	1	1	1
	8	229.5	RED40	RED_Northwoods	Ross/Kmart Parking Lot - North End at Center Signage/North Entrance	No contact with owner yet	1	1	0
	9	229.2	RED20	RED_Downtown	Redding Downtown Parking Garage (intersection of California & Yuba) - Southern Garage Structure at Basement Level, across from Stairwell at Wall Mounted Meter, North End of Lot	Owner and utility contacted. Electrical POC would be difficult	1	1	1
	10	227.7	RED45	RED_ParkMarina	Redding City Hall - West side of buiding at ADA at west entrance	Owner contacted, better site at City Hall identified (RED43)	1	1	1
	11	224.1	RED1	RED_Airport	Airport Lot - Main Lot at Main Entrance Walkway at ADA Stalls	No contact with owner yet	1	1	0
	12	223.2	RED47	RED_Rancheria	Win-River Casino - South Parking Lot at Non-Smoking Entrance at Transformer	No contact with owner yet	1	1	0
	13	221.4	RED19	RED_Downtown	Sacramento River Trail Parking Lot - Southwest Corner of Lot at Retaining Wall at Utility Pole Island and ADA Stalls	Owner interested, utility contacted and POC discussed	1	1	1
	14	220.5	RED51	RED_RedwoodMeadows	AM/PM Fueling Station - South End of Lot, South of Pump Canopy at South Stall Bank at Fence. Corner of Oasis Rd and Old Oasis Rd.	No contact with owner yet	1	1	0
	15	215.9	RED5	RED_Benton	Placer Heights Plaza - Holiday Market/CVS - South Side of Main Lot Between Redding Bank of Commerce and CVS at Landscaping Separating Lot from Road at Transformer	No contact with owner yet	1	1	0
	16	215.5	RED50	RED_RedwoodMeadows	Railey's Shopping Center - Contiguous to North Side of O'Rieley's Auto at Landscaping/Transformer, East Side of Center Parking Lot	No contact with owner yet	1	1	0
	17	210.5	RED34	RED_Magnolia	Shasta County Public Administration Bldg - Parking garage west of bldg - First level at northwest corner of bldg at NW entrance	No contact with owner yet	1	1	0
	18	208.2	RED62	RED_NorthHilltop	McConnel Arboretum - Arboretum Lot at West-Northwest Portion of Lot at Landscaping Island at SW Corner of Nursery	No contact with owner yet	1	1	0
	19	205.9	RED22	RED_Enterprise	Enterprise Health Foods Parking Lot - North Side of Building at NW Corner	No contact with owner yet	1	1	0
	20	204.1	RED41	RED_Northwoods	Black Bear Diner Parking Lot - East Side of Building at Storage Shed/Employee Entrance at ADA Stall	No contact with owner yet	1	1	0
	21	203.2	RED15	RED_Branstetter	Westwood Village Shopping Center - Northeast Corner of Parking Lot at Carl's Jr., South Side of Building at Transformer/Drive-thru Entrance	No contact with owner yet	1	1	0
	22	202.9	RED9	RED_BoulderCreek	Cinemark Parking Lot - East Parking Lot at Easternmost Stall Bank at East Entrance/Transformer	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	23	202.1	RED60	RED_TurtleBay	Turtle Bay/Sundial Bridge - Central parking lot west of Sundial Bridge access road, Center-east of lot, adjacent to main ADA stalls	No contact with owner yet	1	1	0
	24	200.5	RED26	RED_GoldHills	Ramada Limited Hotel Parking Lot - Northside of Bldg at Southeast of Covered Entrance at Transformer	No contact with owner yet	1	1	0
	25	200.4	RED59	RED_TIWhaley	Professional Business Park - East Lot at Public Stalls at Northeast Corner at Cardboard Dumpster, Northeast of Garbage Dumpster Enclosure	No contact with owner yet	1	1	0
	26	197.9	RED11	RED_BoulderCreek	Barnes & Noble/Office Max Parking Lot - East Side of Lot at Easternmost Stall Bank at Southeast Portion of Lot at Transformers	No contact with owner yet	1	1	0
	27	197.7	RED8	RED_Bonnyview	Shasta County Public Health Campus - Angled Parking Next to Urgent Care Parking at Utility Pole/Transformer (middle of campus)	No contact with owner yet	1	1	0
	28	196.3	RED12	RED_BoulderCreek	Mt. Shasta Mall Parking Lot - Northwestern Corner of Lot at Retaining Wall at Northwest Macy's Entrance, Stall Bank at North Perimeter at Transformer	Owner contacted, not interested	1	1	1
	29	193.2	RED54	RED_SportsComplex	City of Redding Public Works 20055 Viking Way - Main lot, ADA at Pub Wrks (Bldg 3) Entrance	No contact with owner yet	1	1	0
	30	190.9	RED56	RED_Sunset	Shasta YMCA Main Lot - Northwest Corner of Lot at NE Corner of Bldg/Mechanical Room at Fence at Dumpster Enclosure	No contact with owner yet	1	1	0
	31	190.4	RED61	RED_Westgate	Topps Supermarket Shopping Center -	Owner and utility contacted. Electrical POC would be difficult	1	1	1
	32	185.5	RED55	RED_SportsComplex	Redding Baseball Field Sports Complex - Main lot, Northeast of Main Entrance at Loading/Drop-off Zone, South of Roundabout	No contact with owner yet	1	1	0
	33	184.1	RED49	RED_RedwoodMeadows	Starbucks/Subway/Cash Advance Parking Lot - East Stall Bank, South of Drive-Thru Entrance at Dumpster/Transformer	Owner and utility contacted. Electrical POC would be difficult	1	1	1
	34	183.2	RED32	RED_LakeRedding	Caldwell Park - Fish Viewing Facility Parking Lot at ADA Stalls	No contact with owner yet	1	1	0
	35	175.0	RED27	RED_GoldHills	Tractor Supply Company (TSC) Parking lot - Southeast Corner of Parking Lot at South Entrance at Exterior Fencing Sales Yard	No contact with owner yet	1	1	0
	36	174.1	RED23	RED_Enterprise	Tower Fueling Station (Robert Ct. & Hartnell) Parking Lot - Southwest Portion of Lot at West Entrance at Landscaping	No contact with owner yet	1	1	0
	37	150.8	RED42	RED_Pacheco	TA Truck Stop - East Side of Country Pride Restaurant Northeast Corner of Structure	No contact with owner yet	1	1	0
	38	0.0	--	--	--	No contact with owner yet	0	0	0
	39	0.0	--	--	--	No contact with owner yet	0	0	0
	40	0.0	--	--	--	No contact with owner yet	0	0	0
	41	0.0	--	--	--	No contact with owner yet	0	0	0
	42	0.0	--	--	--	No contact with owner yet	0	0	0
	43	0.0	--	--	--	No contact with owner yet	0	0	0
	44	0.0	--	--	--	No contact with owner yet	0	0	0
	45	0.0	--	--	--	No contact with owner yet	0	0	0
	46	0.0	--	--	--	No contact with owner yet	0	0	0
	47	0.0	--	--	--	No contact with owner yet	0	0	0
	48	0.0	--	--	--	No contact with owner yet	0	0	0
	49	0.0	--	--	--	No contact with owner yet	0	0	0
Red Bluff	1	260.5	RB11	Red Bluff	Diagonal public street parking on Pine Street at intersection with Rio Street	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	2	238.6	RB10	Red Bluff	TRAX station parking lot at intersection of Rio Street and Walnut Street.	Owner interested but parking policy change likely required	1	1	1
	3	221.8	RBF9	Red Bluff	Red Bluff River Park - Southwest Corner of Lot at Pump House, East of Chmber of Commerce Bldg	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	4	219.5	RBF3	Red Bluff	Wholsome Goods Parking Lot - North Lot against North Wall	No contact with owner yet	1	1	0
	5	217.3	RBF2	Red Bluff	Belle Mill Shopping Center - Southeast Corner of Lot, East of Sign, Southeast of FoodMaxx, South of Former Hollywood Video (East Building)	No contact with owner yet	1	1	0
	6	214.5	RBF4	Red Bluff	Raileys/Walmart Center - Northwest Corner of Parking Lot, North of Chase Bank at Grass Landscape at Transformer (East of Raileys)	No contact with owner yet	1	1	0

Geographic Zone	Top Ranked Sites in Geographic Zone	Final Score Adjusted for PEVI Priorities	Site Reference Number	Transportation Analysis Zone	Desription	Status	Candidate Site Count	Rubric Completed Count	Owership Conversation Count
	7	214.1	RBF1	Red Bluff	Tehema County Visitor Center - Far North Regional Center - North Valley Services (1040 Washington Street 527-1083) (Transformer T1576)	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	8	189.5	RBF6	Red Bluff	Burrito Bandito/Starbucks Center - Southwest Corner of Lot at ADA Stalls	No contact with owner yet	1	1	0
	9	186.4	RB12	Red Bluff	PG&E remediation site at intersection of Rio Street and Antelope BLVD	No contact with owner yet	1	1	0
Weed	1	181.5	WED1	Weed	Bel Air Park - ADA at College Avenue at Intersection of Terrace St and College at Playground	No contact with owner yet	1	1	0
	2	165.8	WED2	Weed	Weed Chamber of Commerce Parking Lot at Southeast of Spirit Gas Station	No contact with owner yet	1	1	0
Yreka	1	213.5	YKA4	Yreka	Public Lot at North Street and 3rd Street - Southeast Corner at 3rd St Entrance	Owner contacted, on the fence.	1	1	1
	2	201.2	YKA1	Yreka	Yreka Junction Shopping Center - West Side of Parking Lot, South of West Storefronts (inc. AAA) at Transformer E24586	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	3	199.6	YKA5	Yreka	Black Bear Diner Lot - North Side of Building at Entrance	No contact with owner yet	1	1	0
	4	156.2	YKA2	Yreka	Bottling Works Mall Parking Lot - Stalls at Footbridge West Entrance Steps	No contact with owner yet	1	1	0
Miscellaneous	1	199.6	MISC32	SHA_Downtown	Shasta Dwntwn Public Lot - Shasta Dam Blvd at Grand River, West of North Valley Bank, Diagnal Stalls at North Side of Parking Lot	No contact with owner yet	1	1	0
	2	185.0	MISC30	SHASTA	Shasta Post Office - Parking Stalls on West Side of Building at ADA Stall	No contact with owner yet	1	1	0
	3	182.1	MISC21	Los Molinos	Umpqua Bank Lot - East Side of Lot at Landscaping	No contact with owner yet	1	1	0
	4	180.9	MISC5	COT_East	Cottonwood West - Tri-Counties Bank Parking Lot - East Side at Rock Landscaping/Vacant Lot	No contact with owner yet	1	1	0
	5	174.2	MISC4	Castella	Castella Chevron/Post Office - Minimart ADA at Northeast Corner of Bldg	No contact with owner yet	1	1	0
	6	172.1	MISC6	COT_West	Cottonwood East - Holiday/Chevron Lot - North and/or East of Chevron Station	No contact with owner yet	1	1	0
	7	157.1	MISC34	SHA_ShastaDam	Sportsmans Express/Shell Station - West Side of Building, South of Pump Canopy at Bldg Wall Panel	No contact with owner yet	1	1	0
	8	155.0	MISC31	SHA_BearMountain	Chevron Station?KC's Corner Mart/Nellie's Grill - East Side of Building at Dumpster/Transformer	Conversation with staff indicate interest. Owner contact info on file.	1	1	1
	9	0.0	--	--	--	Conversation with staff indicate interest. Owner contact info on file.	0	0	1
	10	0.0	--	--	--	No contact with owner yet	0	0	0
	11	0.0	--	--	--	No contact with owner yet	0	0	0
	12	0.0	--	--	--	No contact with owner yet	0	0	0
	13	0.0	--	--	--	No contact with owner yet	0	0	0
	14	0.0	--	--	--	No contact with owner yet	0	0	0
	15	0.0	--	--	--	No contact with owner yet	0	0	0
	16	0.0	--	--	--	No contact with owner yet	0	0	0
	17	0.0	--	--	--	No contact with owner yet	0	0	0
	18	0.0	--	--	--	No contact with owner yet	0	0	0
	19	0.0	--	--	--	No contact with owner yet	0	0	0
	20	0.0	--	--	--	No contact with owner yet	0	0	0
	21	0.0	--	--	--	No contact with owner yet	0	0	0
	22	0.0	--	--	--	No contact with owner yet	0	0	0
	23	0.0	--	--	--	No contact with owner yet	0	0	0
	24	0.0	--	--	--	No contact with owner yet	0	0	0
	25	0.0	--	--	--	No contact with owner yet	0	0	0
	26	0.0	--	--	--	No contact with owner yet	0	0	0
	27	0.0	--	--	--	No contact with owner yet	0	0	0
	28	0.0	--	--	--	No contact with owner yet	0	0	0
						Sum -->	77	77	25

L2 Count 109
Check 109

Summary of Level 2 EV Charging Station Micrositing Results

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Geographic Zone	Top Ranked Sites in Geographic Zone	Final Score Adjusted for PEVI Priorities	Site Reference Number	Transportation Analysis Zone	Desription	Status	Candidate Site Count	Rubric Completed Count	Owership Conversation Count
Anderson	1	172.1	AND3	AND_Cascade	Gateway Center/Anderson Square - Northwest Corner of Gateway Center Lot, South of Shell Gas Canopy at West Entry/Exit North of Transformer	No contact with owner yet	1	1	0
	2	149.2	AND7	AND_OxYoke	Gaia Hotel & Spa/Woodside Restaurant - Northeast Corner of Parking Lot at Northeast Corner of Woodside Grill at Double Space, North of Transformer	No contact with owner yet	1	1	0
Corning	1	145.4	COR4	Corning	Woodson Park - Southwest Corner Street Diagnals Corner Walnut & Peach (Option at SE, NW Corner)	No contact with owner yet	1	1	0
Mt. Shasta	1	166.8	MTS6	MtShasta	Chestut Street Public Parking Lot. North Side of Lot	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
	2	165.7	MTS3	MtShasta	Tri-Counties Bank Lot - Northeast Corner of Lot at Retaining Wall	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
Redding	1	191.4	RED6	RED_Benton	Placer Heights Plaza - Holiday Market/CVS - South Side of Main Lot Between Redding Bank of Commerce and CVS at Landscaping Separating Lot from Road at Transforme	No contact with owner yet	1	1	0
	2	179.6	RED30	RED_Hilltop	Petco Parking Stalls - North Side of Shopping Center Main Parking Lot at Transformer at Payless Shoe Source	No contact with owner yet	1	1	0
	3	169.6	RED52	RED_RedwoodMeado	AM/PM Fueling Station - South End of Lot, South of Pump Canopy at South Stall Bank at Fenc. Corner of Oasis Rd and Old Oasis Rd.	No contact with owner yet	1	1	0
	4	162.7	RED13	RED_BoulderCreek	Cinemark Parking Lot - East Parking Lot at Easternmost Stall Bank at East Entrance/Transformer	No contact with owner yet	1	1	0
	5	159.6	RED10	RED_BoulderCreek	Barnes & Noble/Office Max Parking Lot - East Side of Lot at Easternmost Stall Bank at Southeast Portion of Lot at Transformers	No contact with owner yet	1	1	0
	6	157.7	RED38	RED_NorthHilltop	McConnel Arboretum - Arboretum Lot at West-Northwest Portion of Lot at Landscaping Island at SW Corner of Nursery	No contact with owner yet	1	1	0
	7	157.5	RED21	RED_Downtown	Redding Downtown Parking Garage (intersection of California & Yuba) - Southern Garage Structure at Basement Level, across from Stairwell at Wall Mounted Meter, Nort	No contact with owner yet	1	1	0
	8	149.6	RED46	RED_Rancheria	Win-River Casino - South Parking Lot at Non-Smoking Entrance at Transformer	No contact with owner yet	1	1	0
	9	138.1	RED48	RED_RedwoodMeado	Starbucks/Subway/Cash Advance Parking Lot - East Stall Bank, South of Drive-Thru Entrance at Dumpster/Transformer	No contact with owner yet	1	1	0
	10	0.0	--	--	--	No contact with owner yet	0	0	0
	11	0.0	--	--	--	No contact with owner yet	0	0	0
Red Bluff	1	180.8	RBF7	Red Bluff	Red Bluff River Park - Southwest Corner of Lot at Pump House, East of Chmber of Commerce Bldg	No contact with owner yet	1	1	0
	2	175.8	RBF8	Red Bluff	Raileys/Walmart Center - Northwest Corner of Parking Lot, North of Chase Bank at Grass Landscape at Transformer (East of Raileys)	No contact with owner yet	1	1	0
	3	168.8	RBF5	Red Bluff	Tehema County Visitor Center - Far North Regional Center - North Valley Services (1040 Washington Street 527-1083) (Transformer T1576)	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
Weed	1	161.2	WED4	Yreka	Black Bear Diner Lot - West Side of Lot	No contact with owner yet	1	1	0
	2	155.8	WED3	Weed	Weed Pilot Truckstop Northwest Lot at Auto Parking Lot at Northwest of Market	No contact with owner yet	1	1	0
Yreka	1	163.9	YKA3	Yreka	Yreka Junction Shopping Center - West Side of Parking Lot, South of West Storefronts (inc. AAA) at Transformer E24586	Owner interested, POC discussed with utility , site plan and cost estimate done	1	1	1
Miscellaneous	1	180.9	MISC20	Lakehead	Shell Station - Lakeshore _ - Exit 702 - East Side of Lot Near ADA	No contact with owner yet	1	1	0
	2	153.1	MISC33	SHA_Downtown	Shasta Dwntwn Public Lot - Shasta Dam Blvd at Grand River, West of North Valley Bank, Diagnal Stalls at North Side of Parking Lot	No contact with owner yet	1	1	0
	3	0.0	--	--	--	No contact with owner yet	0	0	0
						Sum -->	22	22	4

L3 Count	25
Check	25

Scoring Rules	
Site meets objective extremely well	5

Scoring Rules	
Site meets objective extremely well	5
Site meets objective well	4
Site meets objective	3
Site could meet objective with effort	2
Site will not meet objective	1

Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host Willng	2) ADA Accessibility Potential ADA	3) Close proximity to apparently suitable electrical point of connection Elect.	4) Minimal trenching required through paved areas Trench	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders Safe Dsgn	6) Within 1/2 mile of at Basic Services as per LEED 2009 Basic Svcs	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services PED	8) Site is highly visible to the public Visible	9) Suitable for block of multiple chargers Multi	10) Long term control/ownership of the site is unlikely to change in the next 10 years Longterm Owner	11) Site is well lit without the addition of dedicated lighting installed with station Light	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces Bklash	13) Site appears to support workplace charging scenario WORK	14) Within 1/2 mile of connection points to other modes of transportation Other Trans	15) Site appears to be suitable for use by residents of a multi-family housing development Mulit-fam	16) Site has the potential to support overnight charging for long-distance travelers NITE	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor 1-5 Gap	18) Site fills a gap in EV Charging Network along other rural routes Rural Gap	19) Site is attended due to the site host business type Attend	Final weighted score (sum of the products of the weights times the scores, Max possible score = 202.5)	TAZ	PEVI Model Prioritization	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 1 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 2 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 3 Chargers**
		L1 Weights (1-5)->			5	5	3	4.5	5	2	3	2	5	3	3	4	5	3	5	4	1	1	1						
		L2 Weights (1-5)->			5	5	4	4.5	5	4	4	4	4	3	3	3	3	2	3	5	4	3	3						
		L3 Weights (1-5)->			5	5	5	4.5	5	2	2	4	3	3	3	2	1	1	1	1	5	4	5						
Anderson	AND1	**No Appropriate Site Observed**																						1	AND_BallsFerry	3			
	AND2	**East Center Street - Diagnal Stalls, East of RR Tracks, South of Fire Hall, SW Across Intersection from Club 49**	L2	Public	2	4	4	4	4	4	4	4	4	4	3	3	2	4	1	2	5	1	2	234.0	AND_Cascade	1		212.7	
	AND3	**Gateway Center/Anderson Square - Northwest Corner of Gateway Center Lot, South of Shell Gas Canopy at West Entry/Exit North of Transformer**	L3	Private	2	3	3	3	3	4	3	5	2	3	4	4	3	4	3	5	5	1	5	206.5	AND_Cascade	2			172.1
	AND4	**CA Welcome Center at Shasta Outlets -South End of Parking Lot at base of CA Welcome Ctr Landscaping/Hill at Trasformer**	L2	Private	2	4	4	4	4	4	4	4	4	4	4	4	4	3	1	2	5	1	3	247.0	AND_OldHwy99	1		224.5	
	AND5	**Walmart Super Center - Northeast Corner of Lot North of Vacant Bank Bldg., North Side of Drive Thru Exit**	L2	Private	2	3	3	3	4	4	4	3	2	4	4	4	4	2	1	2	5	1	2	216.5	AND_OldHwy99	1		196.8	
	AND6	**Gaia Hotel & Spa/Woodside Restaurant - Northeast Corner of Parking Lot at Northeast Corner of Woodside Grill at Double Space, North of Transformer**	L2	Private	2	3	4	4	4	1	2	2	2	3	3	4	2	3	1	5	5	1	4	212.0	AND_OxYoke	1		192.7	
	AND7	**Gaia Hotel & Spa/Woodside Restaurant - Northeast Corner of Parking Lot at Northeast Corner of Woodside Grill at Double Space, North of Transformer**	L3	Private	3	3	4	4	4	1	2	2	2	3	3	4	2	3	1	5	5	1	4	194.0	AND_OxYoke	3			149.2
	AND8	**Anderson River Park - Tennis Court Northeast Parking Lot at Bocce Ball/BBQ Area - East of Tennis Courts at Southeast Corner of Lot**	L2	Public	2		4	4	4	1	4	3	3	4	3	4	1	2	1	1	5	1	2	185.0	AND_Stingy	1		168.2	
	AND9																												

L1 Count	0
L2 Count	5
L3 Count	2

Notes:

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5 Max Possible Adjusted Score for Level 1 Station= 293.2
6 Max Possible Adjusted Score for Level 2 Station= 325.0
7 Max Possible Adjusted Score for Level 3 Station= 279.5

Scoring Rules	
Site meets objective extremely well	5
Site meets objective well	4
Site meets objective	3
Site could meet objective with effort	2
Site will not meet objective	1

Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host **Willng**	2) ADA Accessibility Potential **ADA**	3) Close proximity to apparently suitable electrical point of connection **Elect.**	4) Minimal trenching required through paved areas **Trench**	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders **Safe Dsgn**	6) Within 1/2 mile of at Basic Services as per LEED 2009 **Basic Svcs**	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services **PED**	8) Site is highly visible to the public **Visible**	9) Suitable for block of multiple chargers **Multi**	10) Long term control/ownership of the site is unlikely to change in the next 10 years **Longterm Owner**	11) Site is well lit without the addition of dedicated lighting installed with station **Light**	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces **Bklash**	13) Site appears to support workplace charging scenario **WORK**	14) Within 1/2 mile of connection points to other modes of transportation **Other Trans**	15) Site appears to be suitable for use by residents of a multi-family housing development **Mulit-fam**	16) Site has the potential to support overnight charging for long-distance travelers **NITE**	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor **1-5 Gap**	18) Site fills a gap in EV Charging Network along other rural routes **Rural Gap**	19) Site is attended due to the site host business type **Attend**	Final weighted score (sum of the products of the weights times the scores, Max possible score = 202.5)	TAZ	PEVI Model Prioritization	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 1 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 2 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 3 Chargers**
				L1 Weights (1-5)->	**5**	**5**	**3**	**4.5**	**5**	**2**	**3**	**2**	**5**	**3**	**3**	**4**	**5**	**3**	**5**	**4**	**1**	**1**	**1**						
				L2 Weights (1-5)->	**5**	**5**	**4**	**4.5**	**5**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**2**	**3**	**5**	**4**	**3**	**3**						
				L3 Weights (1-5)->	**5**	**5**	**5**	**4.5**	**5**	**2**	**2**	**4**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**5**	**4**	**5**						
Corning	COR1	**Olive Pit Parking Lot - Northwest Corner under Sign (three stalls)**	L2	Private	3	3	4	5	3	4	5	3	3	4	3	4	4	4	1	3	5	1	3	246.9	Corning	1		224.5	
	COR2	**Olive Pit Parking Lot - Northwest Corner at Shell Lot Divider at Carwash Entrance (four stalls)**	L2	Private	3	4	3	3	5	4	5	3	4	4	4	4	4	4	1	3	5	1	3	255.5	Corning	1		232.3	
	COR3	**Corning Library/City Hall/Park-and-Ride - North End of City Hall/Library Lot Diagnals**	L2	Public	3	4	3	3	4	2	3	4	3	5	5	4	3	5	1	2	5	1	5	240.5	Corning	1		218.6	
	COR4	**Woodson Park - Southwest Corner Street Diagnals Corner Walnut & Peach (Option at SE, NW Corner)**	L3	Public	2	3	4	4	3	3	3	4	3	5	3	5	1	3	1	1	5	1	1	189.0	Corning	3			145.4

L1 Count	0
L2 Count	3
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Scoring Rules	
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Site could meet objective with effort	2
Site will not meet objective	1

Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host **Willng**	2) ADA Accessibility Potential **ADA**	3) Close proximity to apparently suitable electrical point of connection **Elect.**	4) Minimal trenching required through paved areas **Trench**	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders **Safe Dsgn**	6) Within 1/2 mile of at Basic Services as per LEED 2009 **Basic Svcs**	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services **PED**	8) Site is highly visible to the public **Visible**	9) Suitable for block of multiple chargers **Multi**	10) Long term control/ownership of the site is unlikely to change in the next 10 years **Longterm Owner**	11) Site is well lit without the addition of dedicated lighting installed with station **Light**	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces **Bklash**	13) Site appears to support workplace charging scenario **WORK**	14) Within 1/2 mile of connection points to other modes of transportation **Other Trans**	15) Site appears to be suitable for use by residents of a multi-family housing development **Mulit-fam**	16) Site has the potential to support overnight charging for long-distance travelers **NITE**	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor **1-5 Gap**	18) Site fills a gap in EV Charging Network along other rural routes **Rural Gap**	19) Site is attended due to the site host business type **Attend**	Final weighted score (sum of the products of the weights times the scores, Max possible score = 202.5)	TAZ	PEVI Model Prioritization	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 1 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 2 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 3 Chargers**
		L1 Weights (1-5)->			5	5	3	4.5	5	2	3	2	5	3	3	4	5	3	5	4	1	1	1						
		L2 Weights (1-5)->			5	5	4	4.5	5	4	4	4	4	3	3	3	3	2	3	5	4	3	3						
		L3 Weights (1-5)->			5	5	5	4.5	5	2	2	4	3	3	3	2	1	1	1	1	5	4	5						
Dunsmuir	DUN2	**City Parking Lot near visitor center and City Hall-** Parking space next to ADA space on north side	L2	Public	2	4	4	3	3	5	5	5	1	5	3	2	3	3	1	1	5	1	1	217.5	Dunsmuir	3		167.3	
	DUN3	**Angled Public Parking on Sacramento Ave.by railyard-** two spaces on either south end of row	L2	Public	2	2	4	3	3	5	5	4	3	5	3	3	4	3	3	3	5	1	1	233.5	Dunsmuir	3		179.6	
	DUN4	**Angled Public Parking on Sacramento Ave.by railyard-** two spaces on either south end of row	L1	Public	2	2	4	3	3	5	5	4	3	5	3	3	4	3	3	3	5	1	1	207.5	Dunsmuir	4	148.2		
	DUN5	**Dunsmuir City Park Parking Lot-** Two parking spaces on north side nearest sidewalk	L2	Public	2	2	3	3	3	3	3	3	3	5	3	4	3	3	1	3	5	1	1	203.5	Dunsmuir	3		156.5	
	DUN6	**Public Lot - South of City Hall, West Side of Main Street, Across from Fire Department - Stalls at Transformer at South Side of Lot**	L2	Public	2	2	3	4	4	5	5	4	4	5	2	3	4	4	2	4	5	1	3	250.0	Dunsmuir	3		192.3	

L1 Count	1
L2 Count	4
L3 Count	0

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		L1 Weights (1-5)->			5	5	3	4.5	5	2	3	2	5	3	3	4	5	3	5	4	1	1	1						
		L2 Weights (1-5)->			5	5	4	4.5	5	4	4	4	4	3	3	3	3	2	3	5	4	3	3						
		L3 Weights (1-5)->			5	5	5	4.5	5	2	2	4	3	3	3	2	1	1	1	1	5	4	5						
Mt. Shasta	MTS1	**Shasta Dwntwn Public Lot - at Alma Street Union Pac RR Crossing, West of Burger Express**	L2	Public	2	5	5	3	3	5	4	3	4	5	4	4	4	3	1	3	5	1	2	251.5	MtShasta	2		209.6	
	MTS2	**Berryvale/shasta Yoga Center Lot - Southeast Corner of lot at ADA, at Yoga Center Entrance**	L2	Private	2	4	3	2	4	5	5	5	3	3	4	4	4	3	1	3	5	1	4	247.0	MtShasta	2		205.8	
	MTS6	**Chestut Street Public Parking Lot. North Side of Lot**	L3	Public	5	3	3	3	3	5	5	5	3	5	5	5	5	5	3	4	5	1	3	233.5	MtShasta	4			166.8
	MTS4	**Tri-Counties Bank Lot - Northeast Corner of Lot at Retaining Wall**	L2	Private	4	4	4	4	4	4	4	3	4	4	2	5	4	4	1	3	5	1	5	263.0	MtShasta	2		219.2	
	MTS7	**Public parking across from fire station on W. Lake St.**	L2	Public	5	5	5	5	5	5	5	3	5	5	3	5	5	3	1	4	5	1	3	304.5	Mt. Shasta	2		253.8	
	MTS5	**Chestut Street Public Parking Lot. North Side of Lot near existing temp power meter pedestal**	L2	Public	5	3	3	3	3	5	5	5	3	5	5	5	5	5	3	4	5	1	3	283.5	MtShasta	2		236.3	
	MTS3	**Tri-Counties Bank Lot - Northeast Corner of Lot at Retaining Wall**	L3	Private	4	4	4	4	4	4	4	3	4	4	2	5	4	4	1	3	5	1	5	232.0	MtShasta	4			165.7

L1 Count	0
L2 Count	5
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				L1 Weights (1-5)->	5	5	3	4.5	5	2	3	2	5	3	3	4	5	3	5	4	1	1	1						
				L2 Weights (1-5)->	5	5	4	4.5	5	4	4	4	4	3	3	3	3	2	3	5	4	3	3						
				L3 Weights (1-5)->	5	5	5	4.5	5	2	2	4	3	3	3	2	1	1	1	1	5	4	5						
	RED_F1	**Future Redding Electric Utility Avtech Parkway - (3611 Avtech Parkway) - Northeast Corner of Bldg at ADA at Noth Entrance**	L1	Public	5	4	5	5	5	1	5	2	5	4	4	4	5	3	1	1	3	1	3	243.5	RED_Airport	4	173.9		
	RED_F2	**Future Redding Electric Utility Avtech Parkway - (3611 Avtech Parkway) - Northeast Corner of Bldg at ADA at Noth Entrance**	L2	Public	5	4	5	5	5	1	5	2	5	4	4	4	5	3	1	1	3	1	3	253.5	RED_Airport	1		230.5	
	RED1	**Airport Lot - Main Lot at Main Entrance Walkway at ADA Stalls**	L2	Public	5	5	3	3	5	1	5	4	4	5	4	3	2	5	1	1	3	1	5	246.5	RED_Airport	1		224.1	
	RED2	**TBD**	L2																					0.0	RED_BellaVista	1		0.0	
	RED3	**TBD**	L2																					0.0	RED_BellaVista	1		0.0	
	RED4	**TBD**	L2																					0.0	RED_BellaVista	1		0.0	
	RED5	**Placer Heights Plaza - Holiday Market/CVS - South Side of Main Lot Between Redding Bank of Commerce and CVS at Landscaping Separating Lot from Road at Transformer**	L2	Private	2	3	3	5	5	5	3	3	5	4	4	5	4	2	1	1	2	2	4	237.5	RED_Benton	1		215.9	
	RED6	**Placer Heights Plaza - Holiday Market/CVS - South Side of Main Lot Between Redding Bank of Commerce and CVS at Landscaping Separating Lot from Road at Transformer**	L3	Private	2	3	3	5	5	5	3	3	5	4	4	5	4	2	1	1	2	2	4	210.5	RED_Benton	1			191.4
	RED7	**Shasta County Public Health Campus - Angled Parking Next to Urgent Care Parking at Utility Pole/Transformer (middle of campus)**	L1	Public	2	2	4	5	4	1	3	2	4	5	2	5	5	3	1	1	1	3	4	201.5	RED_Bonnyview	4	143.9		
	RED8	**Shasta County Public Health Campus - Angled Parking Next to Urgent Care Parking at Utility Pole/Transformer (middle of campus)**	L2	Public	2	3	5	5	4	1	3	2	4	5	2	5	5	3	1	1	1	3	4	217.5	RED_Bonnyview	1		197.7	
	RED9	**Cinemark Parking Lot - East Parking Lot at Easternmost Stall Bank at East Entrance/Transformer**	L2	Private	2	3	4	5	4	4	3	3	5	4	4	4	4	4	4	1	3	1	4	243.5	RED_BoulderCreek	2		202.9	
	RED10	**Barnes & Noble/Office Max Parking Lot - East Side of Lot at Easternmost Stall Bank at Southeast Portion of Lot at Transformers**	L3	Private	2	3	4	5	4	4	3	3	5	3	3	5	4	4	3	1	3	1	4	207.5	RED_BoulderCreek	3			159.6
	RED11	**Barnes & Noble/Office Max Parking Lot - East Side of Lot at Easternmost Stall Bank at Southeast Portion of Lot at Transformers**	L2	Private	2	3	4	5	4	4	3	3	5	3	3	5	4	4	3	1	3	1	4	237.5	RED_BoulderCreek	2		197.9	
	RED12	**Mt. Shasta Mall Parking Lot - Northwestern Corner of Lot at Retaining Wall at Northwest Macy's Entrance, Stall Bank at North Perimeter at Transformer**	L2	Private	2	3	4	5	3	4	3	3	5	4	2	5	4	4	4	1	3	1	4	235.5	RED_BoulderCreek	2		196.3	
	RED13	**Cinemark Parking Lot - East Parking Lot at Easternmost Stall Bank at East Entrance/Transformer**	L3	Private	2	3	4	5	4	4	3	3	5	4	4	4	4	4	3	1	3	1	4	211.5	RED_BoulderCreek	3			162.7
	RED14	**TBD**	L3																					0.0	RED_BoulderCreek	3			0.0
	RED15	**Westwood Village Shopping Center - Northeast Corner of Parking Lot at Carl's Jr., South Side of Building at Transformer/Drive-thru Entrance**	L2	Private	2	3	3	3	3	5	5	3	4	3	3	4	3	4	3	1	2	3	4	223.5	RED_Branstetter	1		203.2	
	RED16	**TBD**	L2																					0.0	RED_ChurnCreek	1		0.0	
	RED17	**TBD**	L2																					0.0	RED_ChurnCreek	1		0.0	
	RED18	**TBD**	L2																					0.0	RED_CloverCreek	2		0.0	
	RED19	**Sacramento River Trail Parking Lot - Southwest Corner of Lot at Retaining Wall at Utility Pole Island and ADA Stalls**	L2	Public	3	5	5	5	5	2	5	3	4	5	3	4	1	3	1	1	3	1	4	243.5	RED_Downtown	1		221.4	
	RED20	**Redding Downtown Parking Garage (intersection of California & Yuba) - Southern Garage Structure at Basement Level, across from Stairwell at Wall Mounted Meter, North End of Lot**	L2	Public	3	2	3	5	4	5	5	2	5	5	5	5	5	5	1	1	3	1	4	252.1	RED_Downtown	1		229.2	

Scoring Rules	
Site meets objective extremely well	5
Site meets objective well	4
Site meets objective	3
Site could meet objective with effort	2
Site will not meet objective	1

Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host Willng	2) ADA Accessibility Potential ADA	3) Close proximity to apparently suitable electrical point of connection Elect.	4) Minimal trenching required through paved areas Trench	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders Safe Dsgn	6) Within 1/2 mile of at Basic Services as per LEED 2009 Basic Svcs	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services PED	8) Site is highly visible to the public Visible	9) Suitable for block of multiple chargers Multi	10) Long term control/ownership of the site is unlikely to change in the next 10 years Longterm Owner	11) Site is well lit without the addition of dedicated lighting installed with station Light	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces Bklash	13) Site appears to support workplace charging scenario WORK	14) Within 1/2 mile of connection points to other modes of transportation Other Trans	15) Site appears to be suitable for use by residents of a multi-family housing development Mulit-fam	16) Site has the potential to support overnight charging for long-distance travelers NITE	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor 1-5 Gap	18) Site fills a gap in EV Charging Network along other rural routes Rural Gap	19) Site is attended due to the site host business type Attend	Final weighted score (sum of the products of the weights times the scores, Max possible score = 202.5)	TAZ	PEVI Model Prioritization	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 1 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 2 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 3 Chargers**
				L1 Weights (1-5)->	**5**	**5**	**3**	**4.5**	**5**	**2**	**3**	**2**	**5**	**3**	**3**	**4**	**5**	**3**	**5**	**4**	**1**	**1**	**1**						
				L2 Weights (1-5)->	**5**	**5**	**4**	**4.5**	**5**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**2**	**3**	**5**	**4**	**3**	**3**						
				L3 Weights (1-5)->	**5**	**5**	**5**	**4.5**	**5**	**2**	**2**	**4**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**5**	**4**	**5**						
Redding	RED21	**Redding Downtown Parking Garage (intersection of California & Yuba) - Southern Garage Structure at Basement Level, across from Stairwell at Wall Mounted Meter, North End of Lot**	L3	Public	3	4	2	3	4	5	5	4	5	5	5	5	5	5	1	1	3	1	4	220.5	RED_Downtown	4			157.5
	RED22	**Enterprise Health Foods Parking Lot - North Side of Building at NW Corner**	L2	Private	3	4	4	5	4	3	3	2	4	2	4	5	3	4	3	1	3	1	2	226.5	RED_Enterprise	1		205.9	
	RED23	**Tower Fueling Station (Robert Ct. & Hartnell) Parking Lot - Southwest Portion of Lot at West Entrance at Landscaping**	L2	Private	2	2	3	3	2	3	4	4	3	4	4	2	1	3	3	1	3	1	4	191.5	RED_Enterprise	1		174.1	
	RED24	**TBD**	L2																					0.0	RED_ForestHills	1		0.0	
	RED25	**TBD**	L3																					0.0	RED_Girvan	1			0.0
	RED26	**Ramada Limited Hotel Parking Lot - Northside of Bldg at Southeast of Covered Entrance at Transformer**	L2	Private	2	3	3	5	4	2	3	3	4	4	4	3	1	1	1	5	3	1	4	220.5	RED_GoldHills	1		200.5	
	RED27	**Tractor Supply Company (TSC) Parking lot - Southeast Corner of Parking Lot at South Entrance at Exterior Fencing Sales Yard**	L2	Private	2	3	2	3	3	2	3	3	4	4	2	4	3	1	1	3	3	1	3	192.5	RED_GoldHills	1		175.0	
	RED28	**Petco Parking Stalls - North Side of Shopping Center Main Parking Lot at Transformer at Payless Shoe Source**	L2	Private	2	5	5	5	4	5	5	4	4	4	4	4	4	4	1	3	3	1	4	270.5	RED_Hilltop	1		245.9	
	RED29	**Red Lion Hotel - South Parking Lot at West Side of Laundry/Maintence Bldg, First Stall to West of Bldg**	L2	Private	4	3	4	5	4	5	5	2	3	4	5	4	2	4	1	5	3	1	4	261.5	RED_Hilltop	1		237.7	
	RED30	**Petco Parking Stalls - North Side of Shopping Center Main Parking Lot at Transformer at Payless Shoe Source**	L3	Private	2	5	5	5	4	5	5	4	4	4	4	4	4	4	1	3	3	1	4	233.5	RED_Hilltop	3			179.6
	RED31	**Caldwell Park - Teen Center/Skatepark Parking Lot, East side of lot at Teen Center ADA Stalls, Southeast Corner of Lot Under Trees**	L2	Public	5	5	4	5	4	3	5	4	4	5	5	4	1	4	4	1	3	1	2	263.5	RED_LakeRedding	1		239.5	
	RED32	**Caldwell Park - Fish Viewing Facility Parking Lot at ADA Stalls**	L2	Public	2	5	2	3	5	2	5	3		5	4	4	1	3	2	1	3	1	2	201.5	RED_LakeRedding	1		183.2	
	RED33	**TBD**	L2																					0.0	RED_LaytonOaks	1		0.0	
	RED34	**Shasta County Public Administration Bldg - Parking garage west of bldg - First level at northwest corner of bldg at NW entrance**	L2	Public	3	2	5	5	3	4	4	2	4	4	4	3	4	4	2	2	3	1	3	231.5	RED_Magnolia	1		210.5	
	RED35	**TBD**	L2																					0.0	RED_MetzRoad	2		0.0	
	RED36	**BD**	L2																					0.0	RED_NorthBechelli	2		0.0	
	RED37	**TBD**	L2																					0.0	RED_NorthBechelli	2		0.0	
	RED62	**McConnel Arboretum - Arboretum Lot at West-Northwest Portion of Lot at Landscaping Island at SW Corner of Nursery**	L2	Private	5	4	3	2	5	2	5	3	4	5	2	5	2	4	1	1	3	1	3	229.0	RED_NorthHilltop	1		208.2	
	RED38	**McConnel Arboretum - Arboretum Lot at West-Northwest Portion of Lot at Landscaping Island at SW Corner of Nursery**	L3	Private	5	4	3	2	5	2	5	3	4	5	2	5	2	4	1	1	3	1	3	205.0	RED_NorthHilltop	3			157.7
	RED39	**Turtle Bay Exploration Park/Sustainability Gardens - East Parking Lot at ADA Stalls/Landscape Island at Northwest Corner of East Lot**	L2	Public	5	5	5	5	5	3	5	3	3	5	4	5	3	4	1	1	3	1	3	264.5	RED_NorthHilltop	1		240.5	
	RED40	**Ross/Kmart Parking Lot - North End at Center Signage/North Entrance**	L2	Private	2	3	3	5	4	5	2	5	5	4	5	5	5	4	1	2	3	1	4	252.5	RED_Northwoods	1		229.5	
	RED41	**Black Bear Diner Parking Lot - East Side of Building at Storage Shed/Employee Entrance at ADA Stall**	L2	PRivate	2	5	5	5	3	5	4	2	3	3	5	3	1	4	1	1	3	1	3	224.5	RED_Northwoods	1		204.1	
	RED42	**TA Truck Stop - East Side of Country Pride Restaurant Northeast Corner of Structure**	L2	Private	2	2	3	2	4	2	2	3	4	4	3	4	2	1	1	1	3	1	4	181.0	RED_Pacheco	2		150.8	

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			1) Willing owner/operator or host	2) ADA Accessibility Potential	3) Close proximity to apparently suitable electrical point of connection	4) Minimal trenching required through paved areas	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders	6) Within 1/2 mile of at Basic Services as per LEED 2009	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services	8) Site is highly visible to the public	9) Suitable for block of multiple chargers	10) Long term control/ownership of the site is unlikely to change in the next 10 years	11) Site is well lit without the addition of dedicated lighting installed with station	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces	13) Site appears to support workplace charging scenario	14) Within 1/2 mile of connection points to other modes of transportation	15) Site appears to be suitable for use by residents of a multi-family housing development	16) Site has the potential to support overnight charging for long-distance travelers	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor	18) Site fills a gap in EV Charging Network along other rural routes	19) Site is attended due to the site host business type
			Willng	ADA	Elect.	Trench	Safe Dsgn	Basic Svcs	PED	Visible	Multi	Longterm Owner	Light	Bklash	WORK	Other Trans	Mulit-fam	NITE	1-5 Gap	Rural Gap	Attend
		L1 Weights (1-5)->	5	5	3	4.5	5	2	3	2	5	3	3	4	5	3	5	4	1	1	1
		L2 Weights (1-5)->	5	5	4	4.5	5	4	4	4	4	3	3	3	3	2	3	5	4	3	3
		L3 Weights (1-5)->	5	5	5	4.5	5	2	2	4	3	3	3	2	1	1	1	1	5	4	5

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	RED43	**Redding City Hall - existing festival power pedestal near parkview entrance**	L2	Public	5	5	5	5	4	3	5	2	4	5	4	5	4	4	1	1	3	1	4	265.5	RED_ParkMarina	1		241.4	
	RED44	**Redding Public Library, Grape Ave. Side across from ballpark**	L2	Public	5	4	4	4	4	4	5	5	4	5	5	4	3	4	1	1	3	1	4	265.0	RED_ParkMarina	1		240.9	
	RED45	**Redding City Hall - West side of buiding at ADA at west entrance**	L2	Public	3	5	4	3	4	3	5	4	4	5	4	5	4	4	1	1	3	1	4	250.5	RED_ParkMarina	1		227.7	
	RED46	**Win-River Casino - South Parking Lot at Non-Smoking Entrance at Transformer**	L3	Private	2	5	2	3	4	2	4	3	5	5	5	3	1	3	1	3	3	2	5	209.5	RED_Rancheria	4			149.6
	RED47	**Win-River Casino - South Parking Lot at Non-Smoking Entrance at Transformer**	L2	Private	2	5	3	3	4	2	4	3	5	5	5	3	1	3	1	5	3	2	5	245.5	RED_Rancheria	1		223.2	
	RED48	**Starbucks/Subway/Cash Advance Parking Lot - East Stall Bank, South of Drive-Thru Entrance at Dumpster/Transformer**	L3	Private	2	2	3	5	3	3	3	3	4	3	5	3	2	3	1	1	3	1	3	179.5	RED_RedwoodMeadows	3			138.1
	RED49	**Starbucks/Subway/Cash Advance Parking Lot - East Stall Bank, South of Drive-Thru Entrance at Dumpster/Transformer**	L2	Private	2	2	4	5	3	3	3	3	4	3	5	3	2	3	1	1	3	1	3	202.5	RED_RedwoodMeadows	1		184.1	
	RED50	**Railey's Shopping Center - Contiguous to North Side of O'Rieley's Auto at Landscaping/Transformer, East Side of Center Parking Lot**	L2	Private	2	4	4	4	3	5	4	3	4	3	5	3	4	4	3	1	3	1	4	237.0	RED_RedwoodMeadows	1		215.5	
	RED51	**AM/PM Fueling Station - South End of Lot, South of Pump Canopy at South Stall Bank at Fence. Corner of Oasis Rd and Old Oasis Rd.**	L2	Private	2	3	4	5	4	4	4	3	4	4	4	4	3	3	3	1	4	1	5	242.5	RED_RedwoodMeadows	1		220.5	
	RED52	**AM/PM Fueling Station - South End of Lot, South of Pump Canopy at South Stall Bank at Fenc. Corner of Oasis Rd and Old Oasis Rd.**	L3	Private	2	3	4	5	4	4	4	3	4	4	4	4	3	4	4	1	4	1	5	220.5	RED_RedwoodMeadows	3			169.6
	RED53	**City of Redding Public Works 20055 Viking Way - Main lot, ADA at Pub Wrks (Bldg 3) Entrance**	L1	Public	2	4	4	5	4	1	3	1	5	5	3	5	4	1	1	1	3	1	4	206.5	RED_SportsComplex	4	147.5		
	RED54	**City of Redding Public Works 20055 Viking Way - Main lot, ADA at Pub Wrks (Bldg 3) Entrance**	L2	Public	2	4	4	5	4	1	3	1	4	5	3	5	4	1	1	1	3	1	4	212.5	RED_SportsComplex	1		193.2	
	RED55	**Redding Baseball Field Sports Complex - Main lot, Northeast of Main Entrance at Loading/Drop-off Zone, South of Roundabout**	L2	Public	2	2	4	4	5	1	4	3	3	5	5	3	2	2	1	1	3	1	3	204.0	RED_SportsComplex	1		185.5	
	RED56	**Shasta YMCA Main Lot - Northwest Corner of Lot at NE Corner of Bldg/Mechanical Room at Fence at Dumpster Enclosure**	L2	Private	2	2	3	2	4	4	4	2	4	5	4	4	3	4	1	2	3	1	3	210.0	RED_Sunset	1		190.9	
	RED57	**TBD**	L2																					0.0	RED_TewsField	2		0.0	
	RED58	**Professional Business Park - East Lot at Public Stalls at Northeast Corner at Cardboard Dumpster, Northeast of Garbage Dumpster Enclosure**	L1	Private	4	4	5	5	4	2	3	2	4	3	4	4	5	4	2	1	3	2	3	230.5	RED_TIWhaley	4	164.6		
	RED59	**Professional Business Park - East Lot at Public Stalls at Northeast Corner at Cardboard Dumpster, Northeast of Garbage Dumpster Enclosure**	L2	Private	4	4	5	5	4	2	3	2	4	3	4	4	5	4	2	1	3	2	3	240.5	RED_TIWhaley	2		200.4	
	RED60	**Turtle Bay/Sundial Bridge - Central parking lot west of Sundial Bridge access road, Center-east of lot, adjacent to main ADA stalls**	L2	Public	5	5	4	3	4	2	5	4	5	5	3	4	1	4	1	1	3	1	3	242.5	RED_TurtleBay	2		202.1	
	RED61	**Topps Supermarket Shopping Center -**	L2	Private	2	2	3	5	4	4	4	4	4	4	5	4	3	4	1	1	2	3	3	228.5	RED_Westgate	2		190.4	
		L1 Count	4																								4.0	49.0	11.0
		L2 Count	49																										
		L3 Count	11																										

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Notes:

1 TAZ stands for Transportation Analysis Zone.

Scoring Rules	
Site meets objective extremely well	5
Site meets objective well	4
Site meets objective	3
Site could meet objective with effort	2
Site will not meet objective	1

Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host Willng	2) ADA Accessibility Potential ADA	3) Close proximity to apparently suitable electrical point of connection Elect.	4) Minimal trenching required through paved areas Trench	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders Safe Dsgn	6) Within 1/2 mile of at Basic Services as per LEED 2009 Basic Svcs	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services PED	8) Site is highly visible to the public Visible	9) Suitable for block of multiple chargers Multi	10) Long term control/ownership of the site is unlikely to change in the next 10 years Longterm Owner	11) Site is well lit without the addition of dedicated lighting installed with station Light	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces Bklash	13) Site appears to support workplace charging scenario WORK	14) Within 1/2 mile of connection points to other modes of transportation Other Trans	15) Site appears to be suitable for use by residents of a multi-family housing development Mulit-fam	16) Site has the potential to support overnight charging for long-distance travelers NITE	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor 1-5 Gap	18) Site fills a gap in EV Charging Network along other rural routes Rural Gap	19) Site is attended due to the site host business type Attend	Final weighted score (sum of the products of the weights times the scores, Max possible score = 202.5)	TAZ	PEVI Model Prioritization	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 1 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 2 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 3 Chargers**
				L1 Weights (1-5)->	5	5	3	4.5	5	2	3	2	5	3	3	4	5	3	5	4	1	1	1						
				L2 Weights (1-5)->	5	5	4	4.5	5	4	4	4	4	3	3	3	3	2	3	5	4	3	3						
				L3 Weights (1-5)->	5	5	5	4.5	5	2	2	4	3	3	3	2	1	1	1	1	5	4	5						

2 L1 stands for Level 1 Charging Station (20A, 120V_AC)
3 L2 stands for Level 2 Charging Station (up to 80A, 208 or 240V_AC)
4 L3 stands for Level 3 Charging Station (DC Fast Charge)
5 Max Possible Adjusted Score for Level 1 Station= 293.2
6 Max Possible Adjusted Score for Level 2 Station= 325.0
7 Max Possible Adjusted Score for Level 3 Station= 279.5

Scoring Rules	
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		L1 Weights (1-5)->			5	5	3	4.5	5	2	3	2	5	3	3	4	5	3	5	4	1	1	1						
		L2 Weights (1-5)->			5	5	4	4.5	5	4	4	4	4	3	3	3	3	2	3	5	4	3	3						
		L3 Weights (1-5)->			5	5	5	4.5	5	2	2	4	3	3	3	2	1	1	1	1	5	4	5						
Red Bluff	RBF1	**Tehema County Visitor Center - Far North Regional Center - North Valley Services (1040 Washington Street 527-1083) (Transformer T1576)**	L2	Private	2	4	3	3	4	3	3	3	4	4	4	4	3	4	1	4	5	1	3	235.5	Red Bluff	1		214.1	
	RBF2	**Belle Mill Shopping Center - Southeast Corner of Lot, East of Sign, Southeast of FoodMaxx, South of Former Hollywood Video (East Building)**	L2	Private	2	5	5	4	4	5	5	2	4	3	3	4	4	3	1	1	5	1	1	239.0	Red Bluff	1		217.3	
	RBF3	**Wholsome Goods Parking Lot - North Lot against North Wall**	L2	Private	3	3	3	3	3	5	5	3	4	3	4	4	4	4	3	3	5	1	1	241.5	Red Bluff	1		219.5	
	RBF4	**Raileys/Walmart Center - Northwest Corner of Parking Lot, North of Chase Bank at Grass Landscape at Transformer (East of Raileys)**	L2	Private	2	4	4	4	4	3	4	3	4	3	4	5	4	4	1	1	5	1	3	236.0	Red Bluff	1		214.5	
	RBF5	**Tehema County Visitor Center - Far North Regional Center - North Valley Services (1040 Washington Street 527-1083) (Transformer T1576)**	L3	Private	2	4	3	3	4	3	3	3	4	4	4	4	3	4	1	4	5	1	3	202.5	Red Bluff	2			168.8
	RBF6	**Burrito Bandito/Starbucks Center - Southwest Corner of Lot at ADA Stalls**	L2	Private	2	3	3	3	4	3	3	3	3	4	3	3	2	2	1	3	5	1	3	208.5	Red Bluff	1		189.5	
	RBF9	**Red Bluff River Park - Southwest Corner of Lot at Pump House, East of Chmber of Commerce Bldg**	L2	Public	4	4	4	4	4	3	3	3	4	5	4	4	2	3	1	3	5	1	2	244.0	Red Bluff	1		221.8	
	RB10	**TRAX station parking lot at intersection of Rio Street and Walnut Street.**	L2	Public	2	2	3	5	5	5	5	5	3	5	5	2	4	5	1	3	5	1	4	262.5	Red Bluff	1		238.6	
	RB11	**Diagonal public street parking on Pine Street at intersection with Rio Street**	L2	Public	4	4	4	3	4	5	5	5	5	5	4	5	5	5	1	3	5	1	3	286.5	Red Bluff	1		260.5	
	RB12	**PG&E remediation site at intersection of Rio Street and Antelope BLVD**	L2	Private	2	2	2	2	2	5	5	5	2	2	2	2	5	5	1	3	5	1	2	205.0	Red Bluff	1		186.4	
	RBF7	**Red Bluff River Park - Southwest Corner of Lot at Pump House, East of Chmber of Commerce Bldg**	L3	Public	4	4	4	4	4	3	3	3	4	5	4	4	2	3	1	3	5	1	2	217.0	Red Bluff	2			180.8
	RBF8	**Raileys/Walmart Center - Northwest Corner of Parking Lot, North of Chase Bank at Grass Landscape at Transformer (East of Raileys)**	L3	Private	2	4	4	4	4	3	4	3	4	3	4	5	4	4	1	1	5	1	3	211.0	Red Bluff	2			175.8

L1 Count	0
L2 Count	9
L3 Count	3

Notes:

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3 L2 stands for Level 2 Charging Station (up to 80A, 208 or 240V_AC)
4 L3 stands for Level 3 Charging Station (DC Fast Charge)
5 Max Possible Adjusted Score for Level 1 Station= 293.2
6 Max Possible Adjusted Score for Level 2 Station= 325.0
7 Max Possible Adjusted Score for Level 3 Station= 279.5

Scoring Rules	
Site meets objective extremely well	5
Site meets objective well	4
Site meets objective	3
Site could meet objective with effort	2
Site will not meet objective	1

Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host **Willng**	2) ADA Accessibility Potential **ADA**	3) Close proximity to apparently suitable electrical point of connection **Elect.**	4) Minimal trenching required through paved areas **Trench**	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders **Safe Dsgn**	6) Within 1/2 mile of at Basic Services as per LEED 2009 **Basic Svcs**	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services **PED**	8) Site is highly visible to the public **Visible**	9) Suitable for block of multiple chargers **Multi**	10) Long term control/ownership of the site is unlikely to change in the next 10 years **Longterm Owner**	11) Site is well lit without the addition of dedicated lighting installed with station **Light**	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces **Bklash**	13) Site appears to support workplace charging scenario **WORK**	14) Within 1/2 mile of connection points to other modes of transportation **Other Trans**	15) Site appears to be suitable for use by residents of a multi-family housing development **Mulit-fam**	16) Site has the potential to support overnight charging for long-distance travelers **NITE**	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor **1-5 Gap**	18) Site fills a gap in EV Charging Network along other rural routes **Rural Gap**	19) Site is attended due to the site host business type **Attend**	Final weighted score (sum of the products of the weights times the scores, Max possible score = 202.5)	TAZ	PEVI Model Prioritization	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 1 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 2 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 3 Chargers**
		L1 Weights (1-5)->			**5**	**5**	**3**	**4.5**	**5**	**2**	**3**	**2**	**5**	**3**	**3**	**4**	**5**	**3**	**5**	**4**	**1**	**1**	**1**					
		L2 Weights (1-5)->			**5**	**5**	**4**	**4.5**	**5**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**2**	**3**	**5**	**4**	**3**	**3**					
		L3 Weights (1-5)->			**5**	**5**	**5**	**4.5**	**5**	**2**	**2**	**4**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**5**	**4**	**5**					
Weed	WED1	**Bel Air Park - ADA at College Avenue at Intersection of Terrace St and College at Playground**	L2	Public	2	5	4	4	5	3	4	4	4	5	3	5	1	3	1	1	5	1	1	236.0	Weed	3		181.5	
	WED2	**Weed Chamber of Commerce Parking Lot at Southeast of Spirit Gas Station**	L2	Public	2	3	3	3	4	5	4	5	1	4	4	2	3	3	1	1	5	1	3	215.5	Weed	3		165.8	
	WED3	**Weed Pilot Truckstop Northwest Lot at Auto Parking Lot at Northwest of Market**	L3	Private	2	3	3	3	4	3	3	3	4	4	4	5	2	1	1	1	5	1	5	202.5	Weed	3			155.8
	WED4	**Black Bear Diner Lot - West Side of Lot**	L3	Private	2	4	3	3	4	3	4	3	4	4	4	4	2	4	1	5	5	1	4	209.5	Yreka	3			161.2

L1 Count	0
L2 Count	2
L3 Count	2

Notes:

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7 Max Possible Adjusted Score for Level 3 Station= 279.5

Scoring Rules	
Site meets objective extremely well	5
Site meets objective well	4
Site meets objective	3
Site could meet objective with effort	2
Site will not meet objective	1

Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host Willng	2) ADA Accessibility Potential ADA	3) Close proximity to apparently suitable electrical point of connection Elect.	4) Minimal trenching required through paved areas Trench	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders Safe Dsgn	6) Within 1/2 mile of at Basic Services as per LEED 2009 Basic Svcs	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services PED	8) Site is highly visible to the public Visible	9) Suitable for block of multiple chargers Multi	10) Long term control/ownership of the site is unlikely to change in the next 10 years Longterm Owner	11) Site is well lit without the addition of dedicated lighting installed with station Light	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces Bklash	13) Site appears to support workplace charging scenario WORK	14) Within 1/2 mile of connection points to other modes of transportation Other Trans	15) Site appears to be suitable for use by residents of a multi-family housing development Mulit-fam	16) Site has the potential to support overnight charging for long-distance travelers NITE	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor 1-5 Gap	18) Site fills a gap in EV Charging Network along other rural routes Rural Gap	19) Site is attended due to the site host business type Attend	Final weighted score (sum of the products of the weights times the scores, Max possible score = 202.5)	TAZ	PEVI Model Prioritization	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 1 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 2 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 3 Chargers**
		L1 Weights (1-5)->			**5**	**5**	**3**	**4.5**	**5**	**2**	**3**	**2**	**5**	**3**	**3**	**4**	**5**	**3**	**5**	**4**	**1**	**1**	**1**						
		L2 Weights (1-5)->			**5**	**5**	**4**	**4.5**	**5**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**2**	**3**	**5**	**4**	**3**	**3**						
		L3 Weights (1-5)->			**5**	**5**	**5**	**4.5**	**5**	**2**	**2**	**4**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**5**	**4**	**5**						
Yreka	YKA1	**Yreka Junction Shopping Center - West Side of Parking Lot, South of West Storefronts (inc. AAA) at Transformer E24586**	L2	Private	2	4	5	5	4	5	2	3	5	4	5	4	4	4	1	3	5	1	3	261.5	Yreka	3		201.2	
	YKA2	**Bottling Works Mall Parking Lot - Stalls at Footbridge West Entrance Steps**	L2	Private	2	3	3	4	4	5	3	2	3	3	2	4	3	3	1	1	5	1	1	203.0	Yreka	3		156.2	
	YKA3	**Yreka Junction Shopping Center - West Side of Parking Lot, South of West Storefronts (inc. AAA) at Transformer E24586**	L3	Private	2	4	5	5	4	5	2	3	5	4	5	4	4	4	1	3	5	1	3	229.5	Yreka	4			163.9
	YKA4	**Public Lot at North Street and 3rd Street - Southeast Corner at 3rd St Entrance**	L2	Public	2	3	5	5	4	5	5	4	5	5	4	5	5	4	5	1	5	1	2	277.5	Yreka	3		213.5	
	YKA5	**Black Bear Diner Lot - North Side of Building at Entrance**	L2	Private	2	5	5	5	3	3	4	4	4	4	4	2	2	4	1	5	5	1	4	259.5	Yreka	3		199.6	

L1 Count	0
L2 Count	4
L3 Count	1

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Scoring Rules	
Site meets objective extremely well	5
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Site meets objective	3
Site could meet objective with effort	2
Site will not meet objective	1

Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host Willng	2) ADA Accessibility Potential ADA	3) Close proximity to apparently suitable electrical point of connection Elect.	4) Minimal trenching required through paved areas Trench	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders Safe Dsgn	6) Within 1/2 mile of at Basic Services as per LEED 2009 Basic Svcs	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services PED	8) Site is highly visible to the public Visible	9) Suitable for block of multiple chargers Multi	10) Long term control/ownership of the site is unlikely to change in the next 10 years Longterm Owner	11) Site is well lit without the addition of dedicated lighting installed with station Light	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces Bklash	13) Site appears to support workplace charging scenario WORK	14) Within 1/2 mile of connection points to other modes of transportation Other Trans	15) Site appears to be suitable for use by residents of a multi-family housing development Mulit-fam	16) Site has the potential to support overnight charging for long-distance travelers NITE	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor 1-5 Gap	18) Site fills a gap in EV Charging Network along other rural routes Rural Gap	19) Site is attended due to the site host business type Attend	Final weighted score (sum of the products of the weights times the scores, Max possible score = 202.5)	TAZ	PEVI Model Prioritization	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 1 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 2 Chargers**	Final Adjusted Score Accounting for Final Weighted Rubric Score and PEVI ranking-**Level 3 Chargers**
		L1 Weights (1-5)->			**5**	**5**	**3**	**4.5**	**5**	**2**	**3**	**2**	**5**	**3**	**3**	**4**	**5**	**3**	**5**	**4**	**1**	**1**	**1**						
		L2 Weights (1-5)->			**5**	**5**	**4**	**4.5**	**5**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**2**	**3**	**5**	**4**	**3**	**3**						
		L3 Weights (1-5)->			**5**	**5**	**5**	**4.5**	**5**	**2**	**2**	**4**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**5**	**4**	**5**						
Burney	MISC2	**TBD**	L2																					0.0	Burney	2		0.0	
	MISC3	**TBD**	L2																					0.0	Burney	2		0.0	
Castella	MISC4	**Castella Chevron/Post Office - Minimart ADA at Northeast Corner of Bldg**	L2	Private	2	5	2	4	4	3	3	3	2	3	4	4	2	1	1	1	5	1	4	209.0	Castella	2		174.2	
Cottonwood	MISC5	**Cottonwood West - Tri-Counties Bank Parking Lot - East Side at Rock Landscaping/Vacant Lot**	L2	Private	2	4	3	4	4	2	3	2	3	3	2	3	2	2	1	2	5	1	3	199.0	COT_East	1		180.9	
	MISC6	**Cottonwood East - Holiday/Chevron Lot - North and/or East of Chevron Station**	L2	Private	2	2	3	3	3	4	3	3	3	4	4	4	3	3	1	1	5	1	4	206.5	COT_West	2		172.1	
Etna	MISC7	**TBD**	L2																					0.0	Etna	3		0.0	
Fall River	MISC8	**TBD**	L2																					0.0	FallRiver	2		0.0	
	MISC9	**TBD**	L2																					0.0	FallRiver	2		0.0	
	MISC10	TBD	L2																					0.0	FallRiver	2		0.0	
Fort Jones	MISC11	**TBD**	L2																					0.0	Fort Jones	4		0.0	
Gas Point	MISC13	**TBD**	L2																					0.0	GasPoint	2		0.0	
Grenada	MISC16	**TBD**	L2	NA																				0.0	Grenada	3		0.0	
Happy Valley	MISC17	**TBD**	L2																					0.0	HappyValley	1		0.0	
	MISC18	**TBD**	L2																					0.0	HappyValley	1		0.0	
Hwy 97 Stop	MISC19	**TBD**	L2																					0.0	Hwy97Stop	4		0.0	
Lakehead	MISC20	**Shell Station - Lakeshore _ - Exit 702 - East Side of Lot Near ADA**	L3	Private	3	3	2	4	4	3	2	4	2	3	4	4	2	1	1	2	5	1	5	199.0	Lakehead	1			180.9
Los Molinos	MISC21	**Umpqua Bank Lot - East Side of Lot at Landscaping**	L2	Private	2	3	4	3	3	4	5	4	4	3	5	4	3	3	1	1	1	5	1	218.5	Los Molinos	2		182.1	
McCloud	MISC22	**TBD**	L2																					0.0	McCloud	3		0.0	
Millville	MISC23	**TBD**	L2																					0.0	Millville	2		0.0	
Old Station	MISC24	**TBD**	L2																					0.0	OldStation	3		0.0	
	MISC25	**TBD**	L2																					0.0	OldStation	3		0.0	
Palo Cedro	MISC27	**TBD**	L2																					0.0	PaloCedro	1		0.0	
	MISC28	**TBD**	L2																					0.0	PaloCedro	1		0.0	
Round Mountain	MISC29	**TBD**	L2																					0.0	RoundMountain	2		0.0	
Shasta	MISC30	**Shasta Post Office - Parking Stalls on West Side of Building at ADA Stall**	L2	Public	2	5	5	4	5	2	3	4	4	5	2	3	1	3	1	1	1	5	2	222.0	SHASTA	2		185.0	
Bear Mountain	MISC31	**Chevron Station?KC's Corner Mart/Nellie's Grill - East Side of Building at Dumpster/Transformer**	L2	Private	2	2	4	4	4	3	1	2	1	2	4	5	2	1	1	1	5	1	4	186.0	SHA_BearMountain	2		155.0	

Scoring Rules	
Site meets objective extremely well	5
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Site meets objective	3
Site could meet objective with effort	2
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Geographic Zone	Site Reference Number	Candidate Site Descriptions (be as specific as possible. Provide a map, Google Earth placemark, photograph(s) or site plan sketch if possible. Code maps, photos, sketches, etc to site reference code)	Level 1, Level 2, or Level 3 EVSE?	Property Owner- Public or Private	1) Willing owner/operator or host	2) ADA Accessibility Potential	3) Close proximity to apparently suitable electrical point of connection	4) Minimal trenching required through paved areas	5) Site has the potential to accommodate a safe design that is user friendly and that does not present an obstacle or hazard to users or bystanders	6) Within 1/2 mile of at Basic Services as per LEED 2009	7) Site has good pedestrian infrastructure connecting the site and surrounding basic services	8) Site is highly visible to the public	9) Suitable for block of multiple chargers	10) Long term control/ownership of the site is unlikely to change in the next 10 years	11) Site is well lit without the addition of dedicated lighting installed with station	12) Low risk of public backlash from converting significant numbers of high demand conventional parking spaces	13) Site appears to support workplace charging scenario	14) Within 1/2 mile of connection points to other modes of transportation	15) Site appears to be suitable for use by residents of a multi-family housing development	16) Site has the potential to support overnight charging for long-distance travelers	17) Site fills a gap in EV charging infrastructure for travelers along the I-5 corridor	18) Site fills a gap in EV Charging Network along other rural routes	19) Site is attended due to the site host business type	weighted score (sum of the products of the weights times the s, Max possible score = 202.5)		Model Prioritization	Adjusted Score Accounting for Final Weighted Rubric Score EVI ranking-**Level 1 Chargers**	Adjusted Score Accounting for Final Weighted Rubric Score EVI ranking-**Level 2 Chargers**	Adjusted Score Accounting for Final Weighted Rubric Score EVI ranking-**Level 3 Chargers**
				L1 Weights (1-5)->	**5**	**5**	**3**	**4.5**	**5**	**2**	**3**	**2**	**5**	**3**	**3**	**4**	**5**	**3**	**5**	**4**	**1**	**1**	**1**						
				L2 Weights (1-5)->	**5**	**5**	**4**	**4.5**	**5**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**2**	**3**	**5**	**4**	**3**	**3**						
				L3 Weights (1-5)->	**5**	**5**	**5**	**4.5**	**5**	**2**	**2**	**4**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**5**	**4**	**5**						
SHA_Dwntwn	MISC32	**Shasta Dwntwn Public Lot - Shasta Dam Blvd at Grand River, West of North Valley Bank, Diagnal Stalls at North Side of Parking Lot**	L2	Public	2	2	4	5	4	4	5	4	4	5	3	4	3	4	1	1	5	1	3	239.5	SHA_Downtown	2		199.6	
	MISC33	**Shasta Dwntwn Public Lot - Shasta Dam Blvd at Grand River, West of North Valley Bank, Diagnal Stalls at North Side of Parking Lot**	L3	Public	2	2	2	4	4	4	5	4	4	5	3	4	3	4	1	1	5	1	3	199.0	SHA_Downtown	3			153.1
Shasta Dam	MISC34	**Sportsmans Express/Shell Station - West Side of Building, South of Pump Canopy at Bldg Wall Panel**	L2	Private	2	2	5	3	3	2	1	2	4	2	4	4	1	1	1	1	5	2	5	188.5	SHA_ShastaDam	2		157.1	
Shingletown	MISC35	**TBD**	L2																					0.0	Shingletown	2		0.0	
	MISC36	TBD	L3																					0.0	Shingletown	3			0.0

L1 Count	0
L2 Count	28
L3 Count	3

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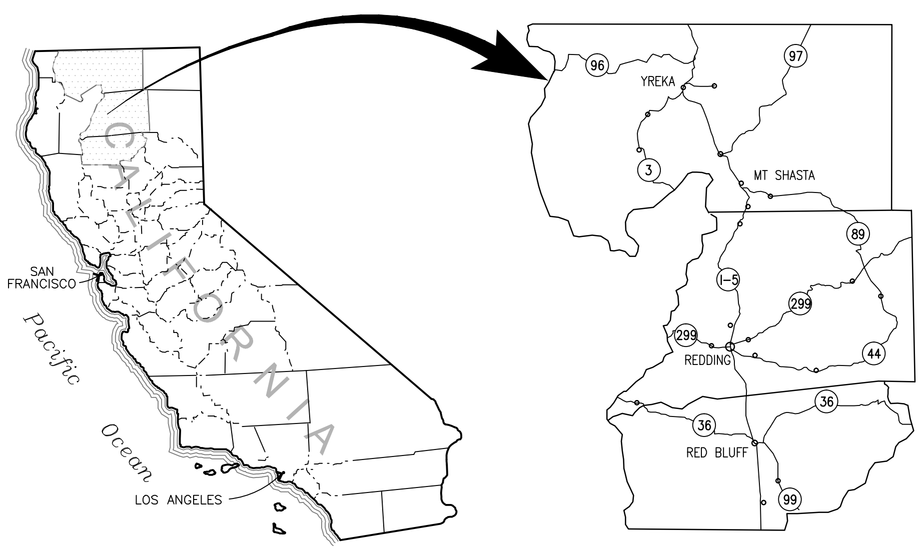
Appendix C2 – Preliminary Site Plans

UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN

PROPOSED EV CHARGING STATIONS FOR PHASE 1: UPSTATE PEV CHARGING NETWORK

AREA MAP



OCTOBER 2014

PREPARED BY

SYMBOLS AND ABBREVIATIONS	
EV	ELECTRIC VEHICLE
EVCS	ELECTRIC VEHICLE CHARGING STATION
V	VOLT
A	AMP
TYP	TYPICAL
CONC	CONCRETE
L2	LEVEL 2 EVCS, 240 OR 208V, SINGLE PHASE INPUT
L3	LEVEL 3 EVCS, 208 OR 480V, THREE PHASE INPUT
Ø	DIAMETER
ϕ	ELECTRICAL PHASE
AWG	AMERICAN WIRE GAUGE
PG&E	PACIFIC GAS & ELECTRIC
REU	REDDING ELECTRIC UTILITY
(N)	NEW
(E)	EXISTING

SHEET INDEX

SHEET #	DRAWING	DRAWING TITLE
1	G-1	TITLE PAGE
2	C-1	YREKA-JUNCTION-SHOPPING-CENTER-VICINITY
3	C-2	YREKA-JUNCTION-SHOPPING-CENTER-ENLARGEMENT
4	C-3	MT SHASTA-PUBLIC LOT-LAKE-ST-VICINITY
5	C-4	MT SHASTA-PUBLICLOT-WLAKEST-ENLARGMENT
6	C-5	MT-SHASTA-TRI-COUNTIES-BANK-VICINITY
7	C-6	MT-SHASTA-TRI-COUNTIES-BANK-ENLARGEMENT
8	C-7	REDDING-ARBORETUM-VICINITY
9	C-8	REDDING-ARBORETUM-ENLARGEMENT
10	C-9	REDDING SUNDIAL BRIDGE- VICINITY
11	C-10	REDDING-SUNDIAL BRIDGE-ENLARGEMENT
12	C-11	REDDING CITY HALL - VICINITY
13	C-12	REDDING CITY HALL- ENLARGEMENT
14	C-13	RED-BLUFF-PINE-STREET-VICINITY
15	C-14	RED-BLUFF-PINE-STREET-ENLARGEMENT
16	C-15	RED-BLUFF-VISITOR-CENTER-VICINITY
17	C-16	RED-BLUFF-VISITOR-CENTER-ENLARGEMENT
18	C-17	RED-BLUFF-RIVER-PARK-VICINITY
19	C-18	RED-BLUFF-RIVER-PARK-ENLARGEMENT

APPROVALS

CITY OF
NAME, TITLE

SIGNED DATE

ENGINEER: GHD Inc.
NAME, PE

SIGNED DATE

PRELIMINARY
NOT FOR CONSTRUCTION

GHD Inc.
2235 Mercury Way Suite 150 Santa Rosa California 95407 USA
T 1 707 523 1010 **F** 1 707 527 8679
W www.ghd.com

BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

MARK	DATE	DESCRIPTION
1	OCT 2014	PRELIMINARY CONCEPT DESIGN

ISSUE

UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

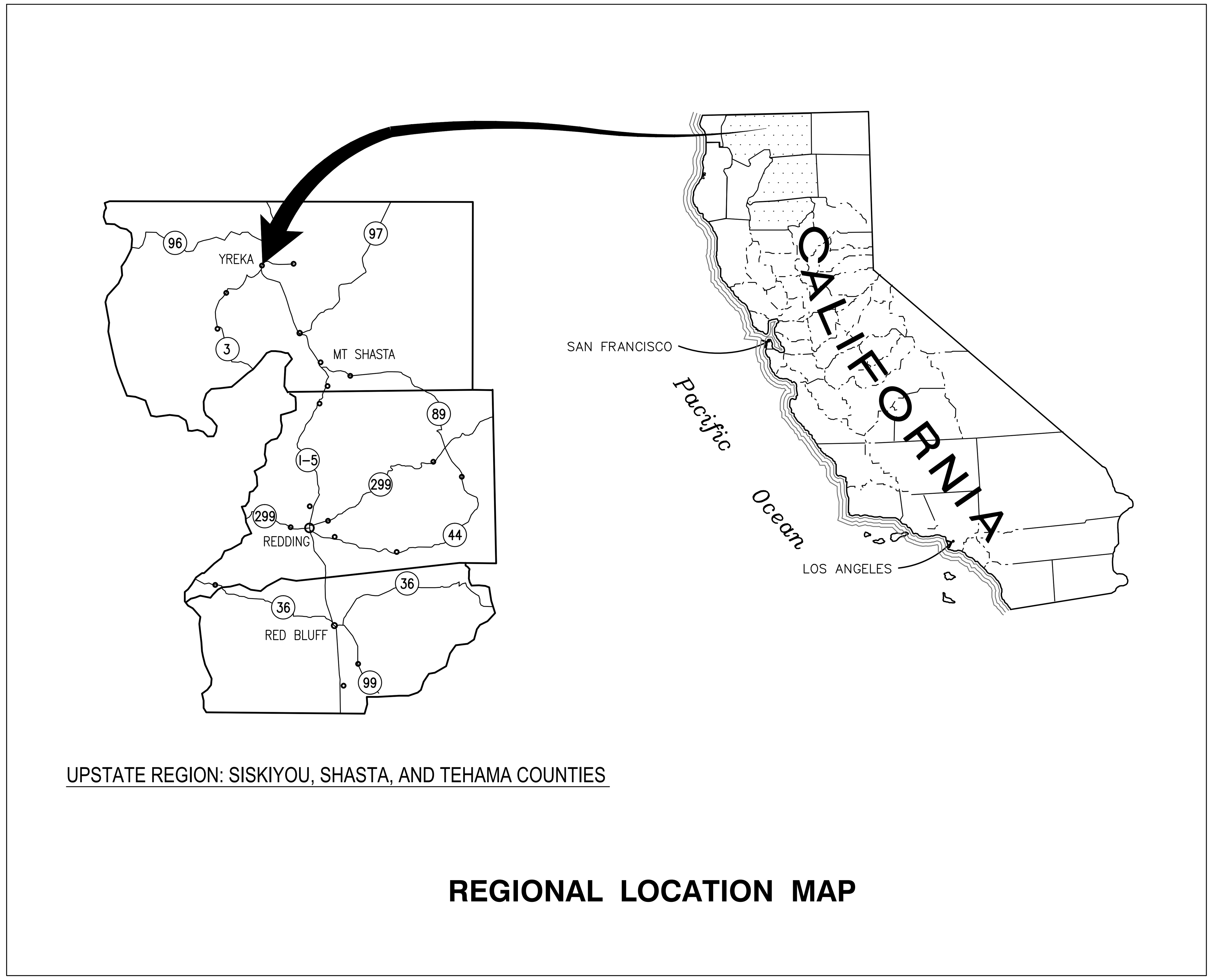
PRELIMINARY PLAN SET

PROJ NO: 8410693
DRWN: DC CHKD: --

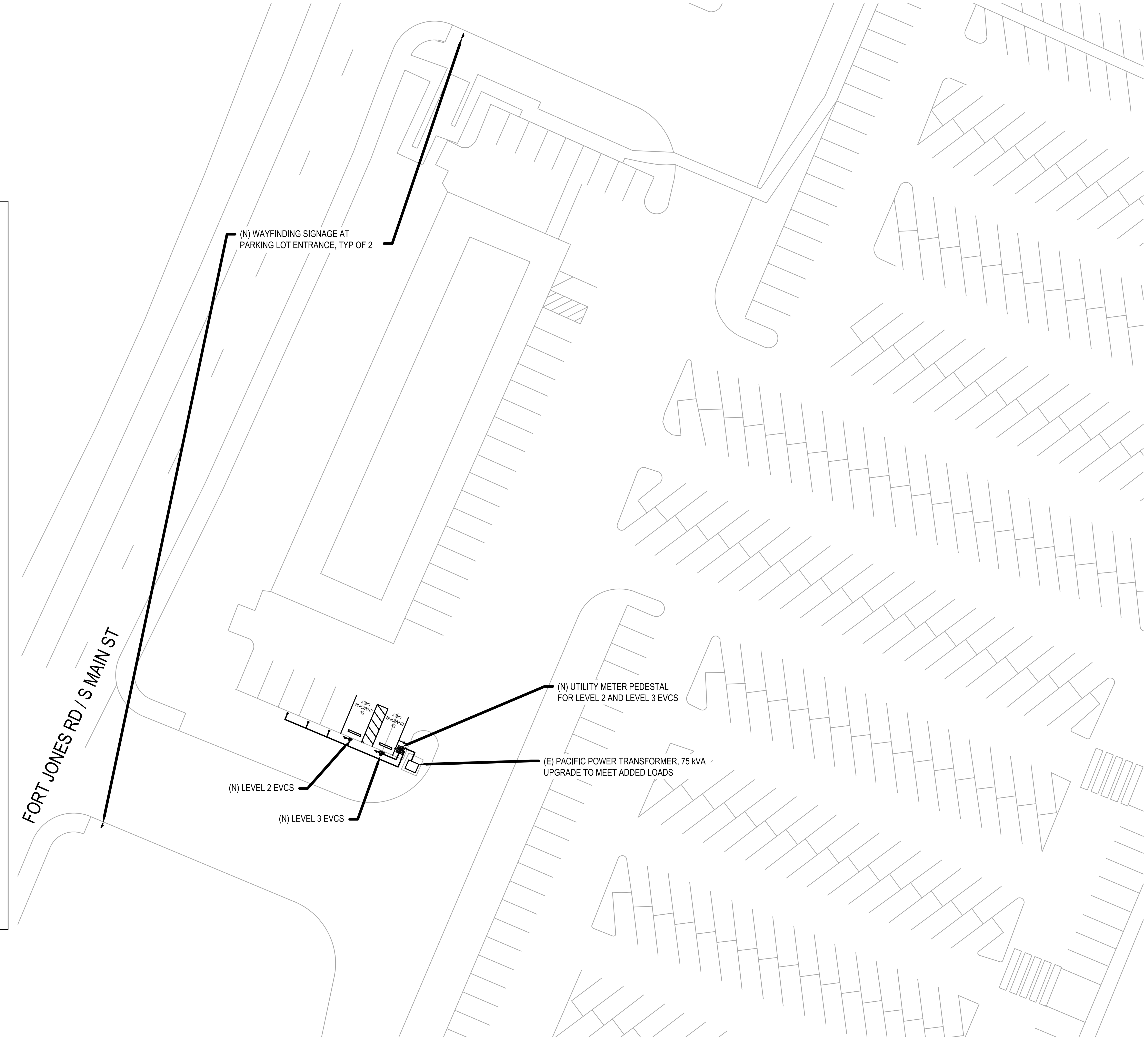
G-1

SHEET 1 OF 2

Plot Date: 9 October 2014 - 10:00 AM Plotted By: David Carter Cad File No: C:\Users\dicarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\UPSTATE-PEV-TITLE.dwg



REGIONAL LOCATION MAP



0 30' 60'
1"=30'

PRELIMINARY

NOT FOR CONSTRUCTION

N

GHD

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T 1 707 523 1010 **F** 1 707 527 8679
W www.ghd.com

BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

REUSE OF DOCUMENTS

MARK	DATE	DESCRIPTION
1	OCT 2014	PRELIMINARY CONCEPT DESIGN

ISSUE

UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

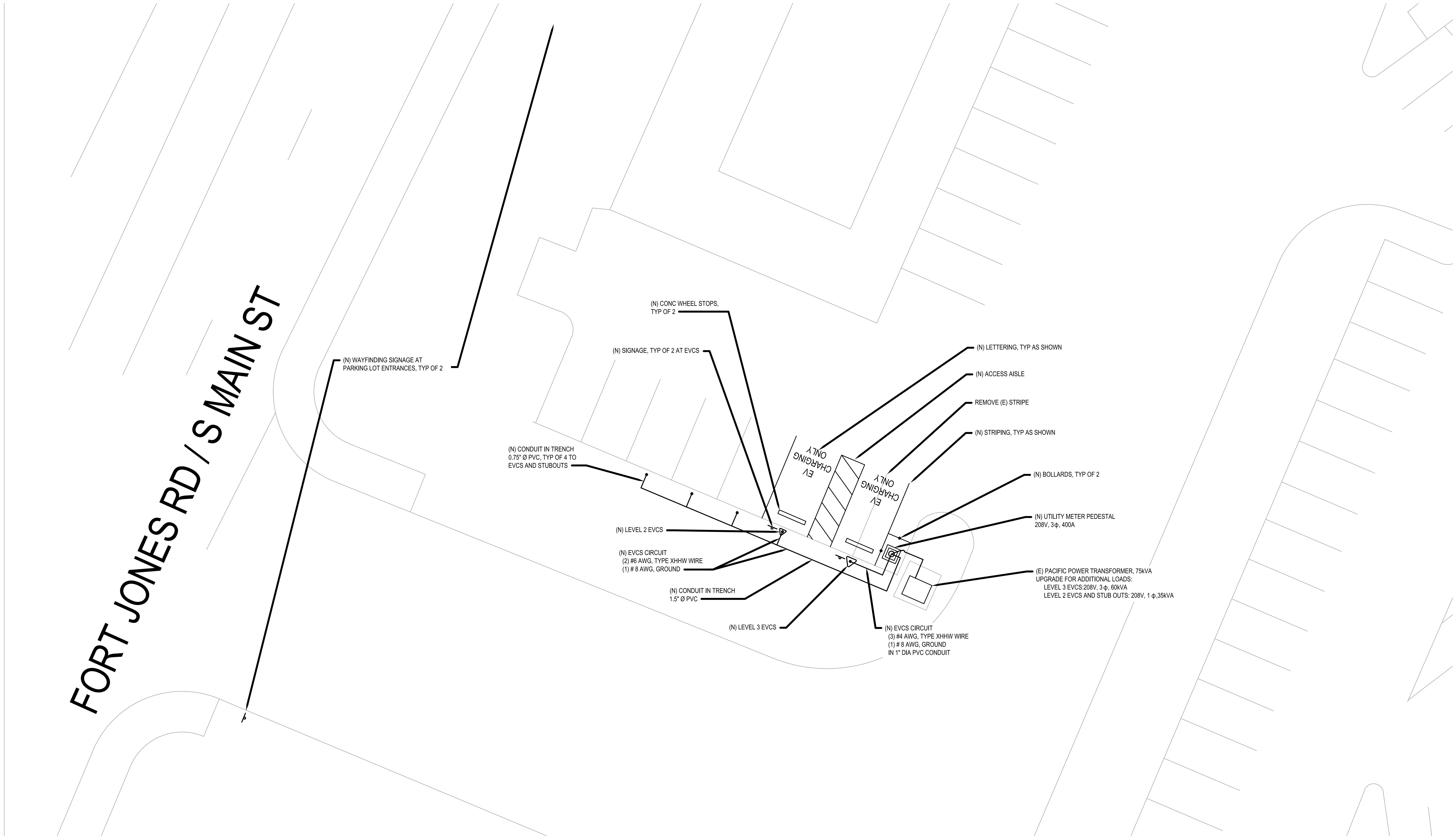
YREKA CA
JUNCTION SHOPPING CENTER
L2 AND L3 EVCS

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-1

SHEET 2 OF 20

Plot Date: 9 October 2014 - 10:00 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\YREKA-JUNCTION-SHOPPING-CENTER-VICINITY.dwg



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0 1"

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

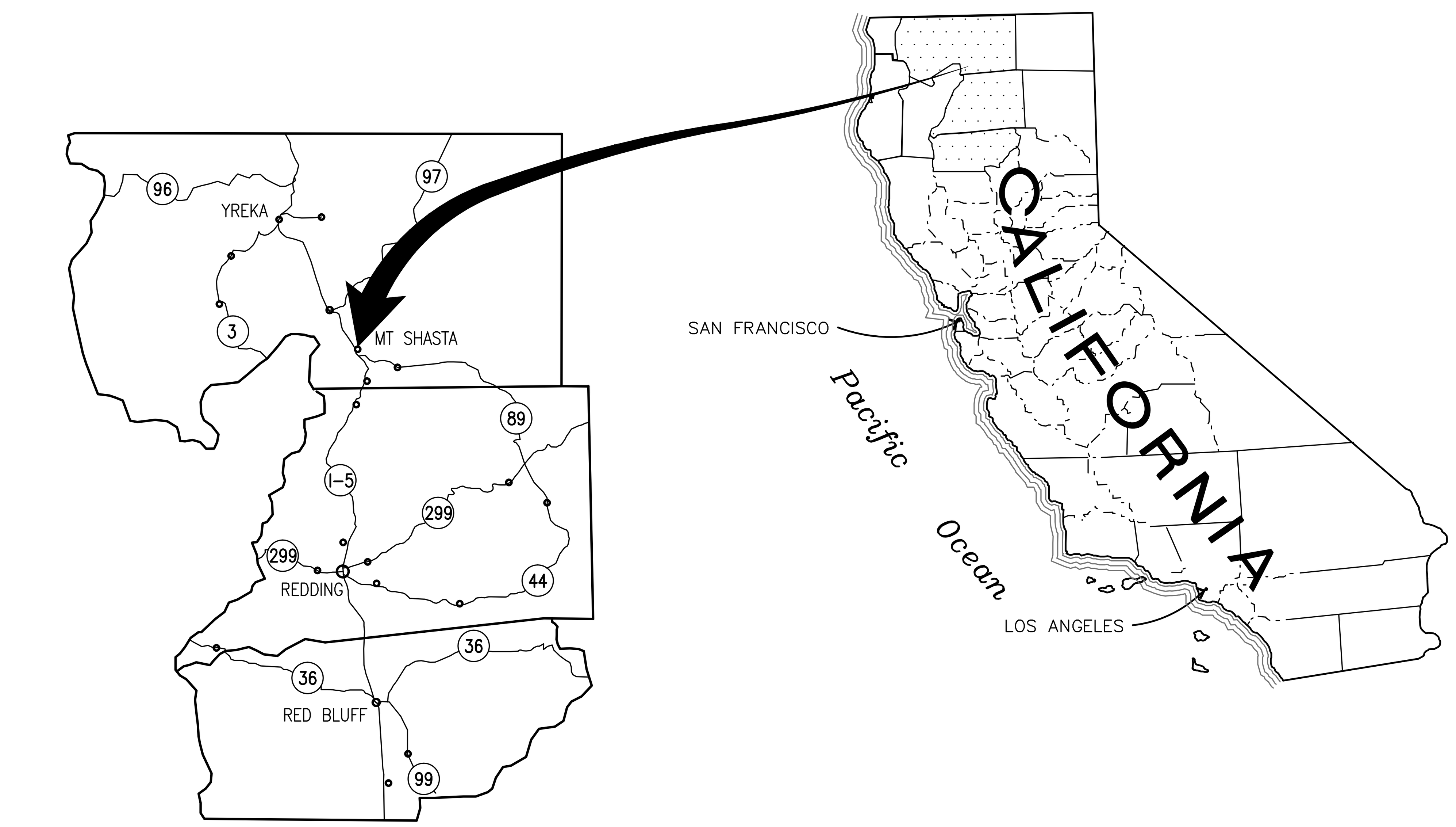
YREKA CA
JUNCTION SHOPPING CENTER
L2 AND L3 EVCS-ENLARGEMENT

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-2

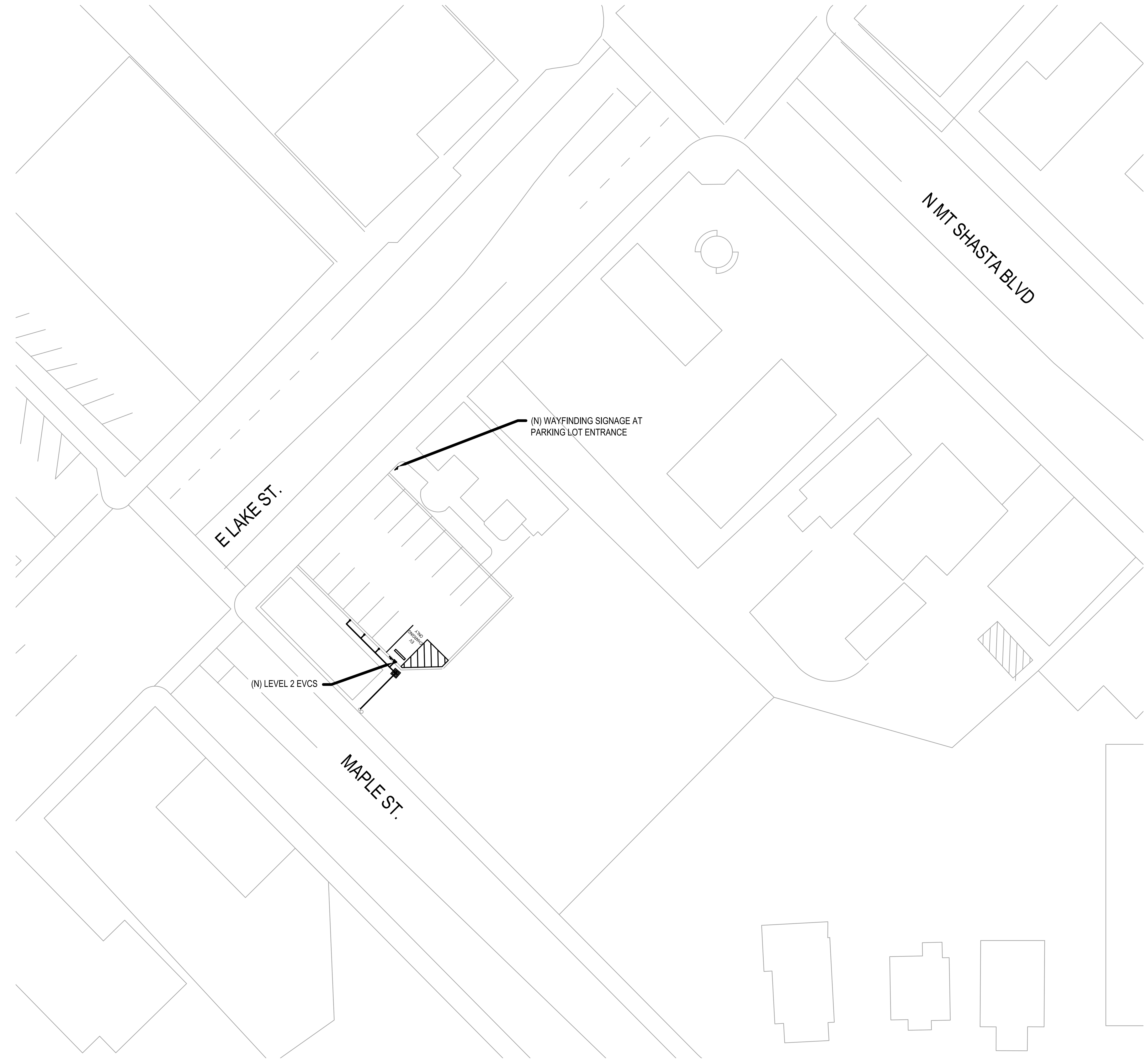
SHEET 3 OF 20

Plot Date: 9 October 2014 - 10:00 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\YREKA-JUNCTION-SHOPPING-CENTER-ENLARGEMENT.dwg



UPSTATE REGION: SISKIYOU, SHASTA, AND TEHAMA COUNTIES

REGIONAL LOCATION MAP



0 30' 60'
1"=30'

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

MT SHASTA CA
LAKE ST. PUBLIC PARKING LOT
L2 EVCS

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-3

SHEET 4 OF 20

Plot Date: 9 October 2014 - 10:00 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\MT SHASTA-PUBLIC LOT-LAKE-ST-VICINITY.dwg

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

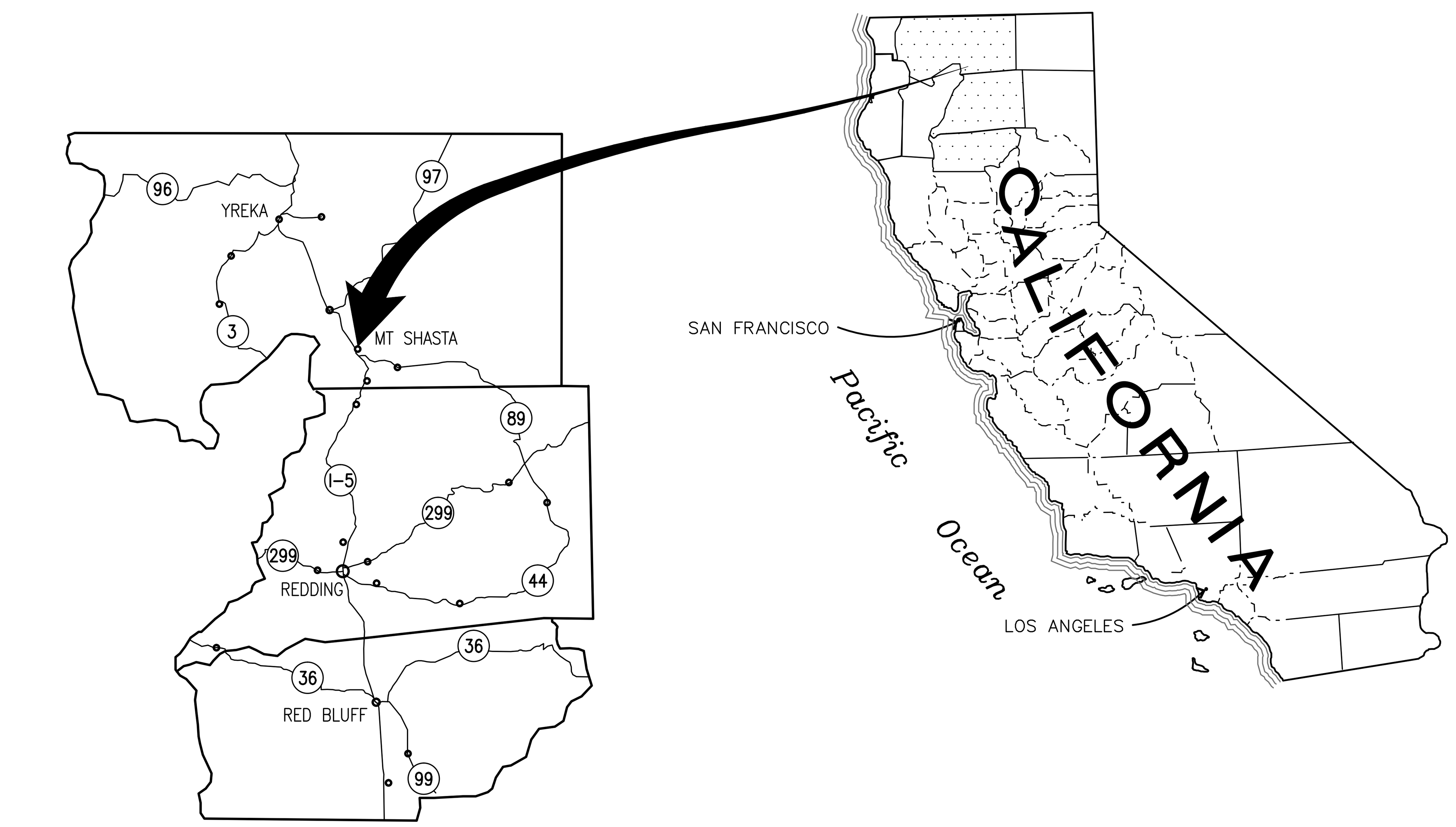
MT SHASTA CA
LAKE ST. PUBLIC PARKING LOT
L2 EVCS - ENLARGEMENT

PROJ NO: 8410693

DRWN: DC CHKD: ----

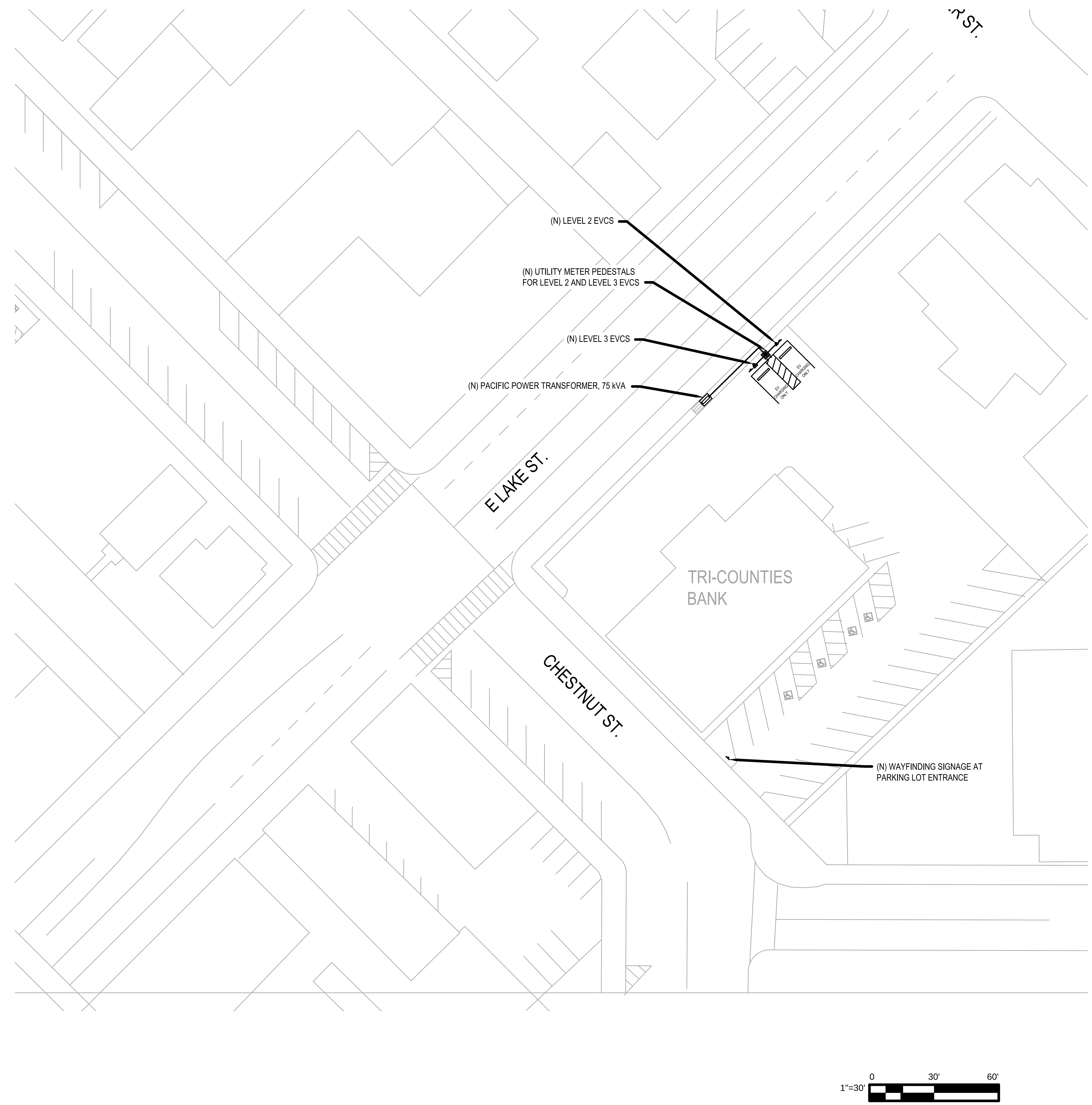
C-4

SHEET 5 OF 20



UPSTATE REGION: SISKIYOU, SHASTA, AND TEHAMA COUNTIES

REGIONAL LOCATION MAP



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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

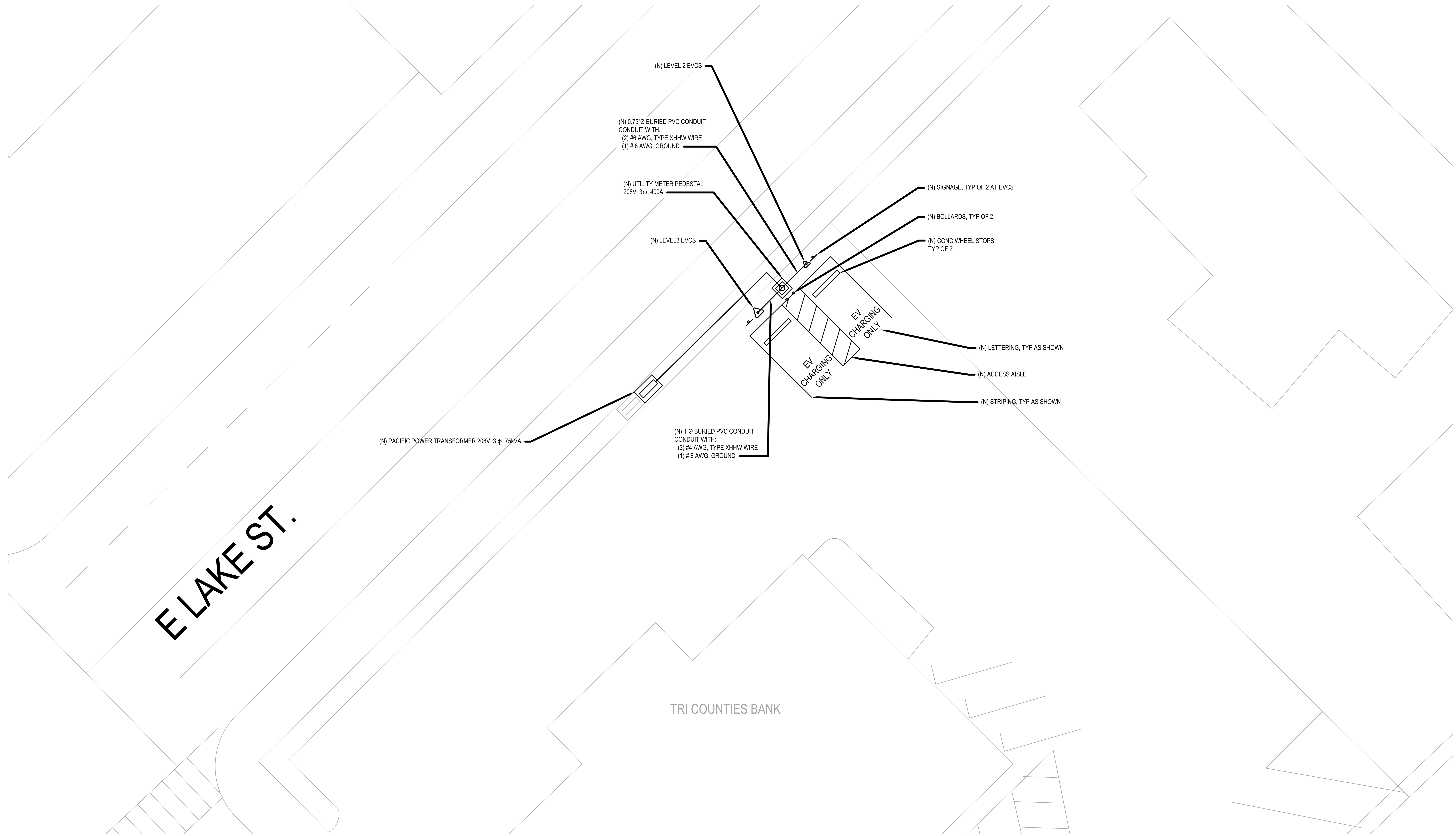
MT SHASTA CA
TRI COUNTIES BANK
L2 AND L3 EVCS

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-5

SHEET 6 OF 20

Plot Date: 9 October 2014 - 10:01 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\MT-SHASTA-TRI-COUNTIES-BANK-VICINITY.dwg



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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

MT SHASTA CA
TRI COUNTIES BANK
L2 AND L3 EVCS - ENLARGEMENT

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-6

SHEET 7 OF 20

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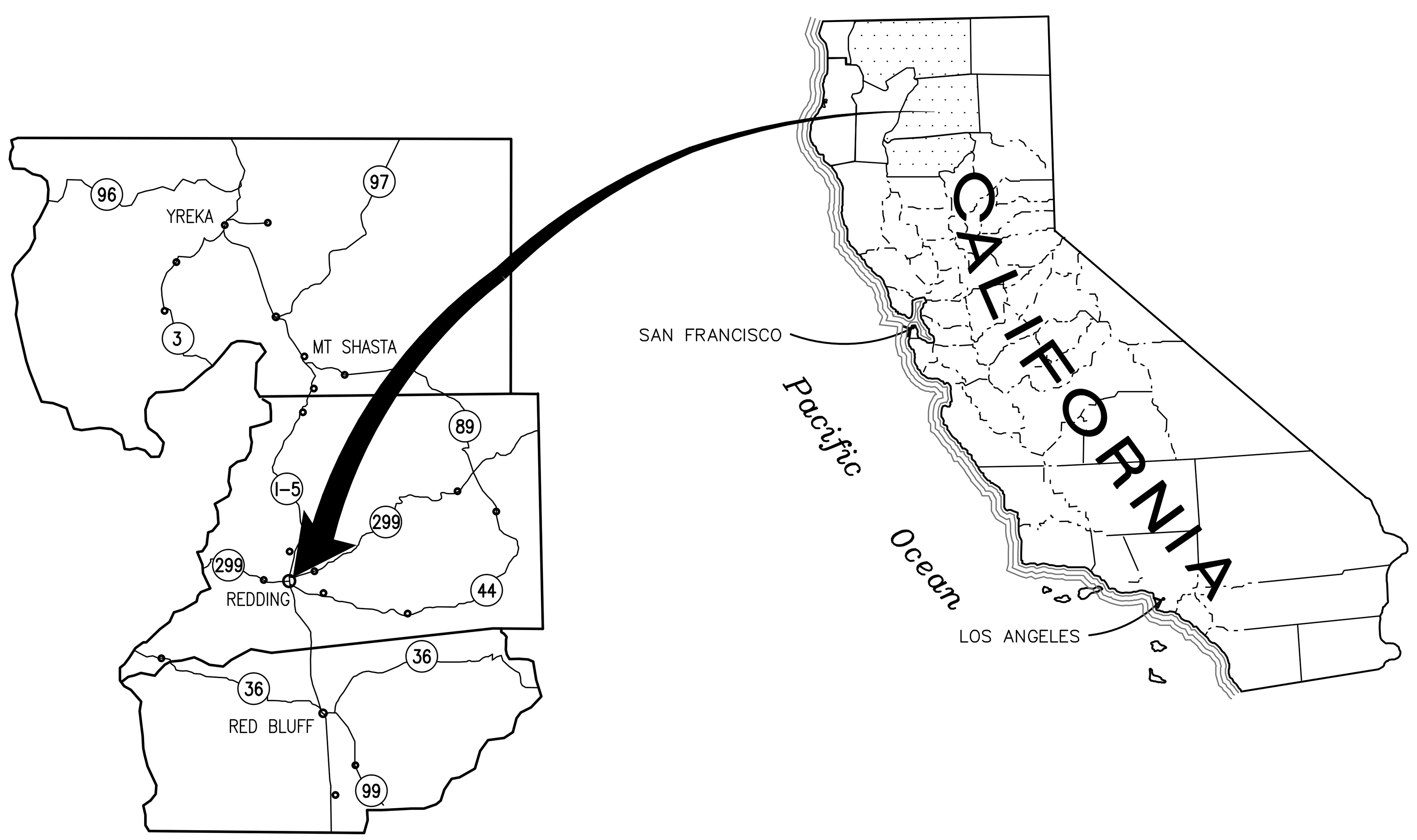
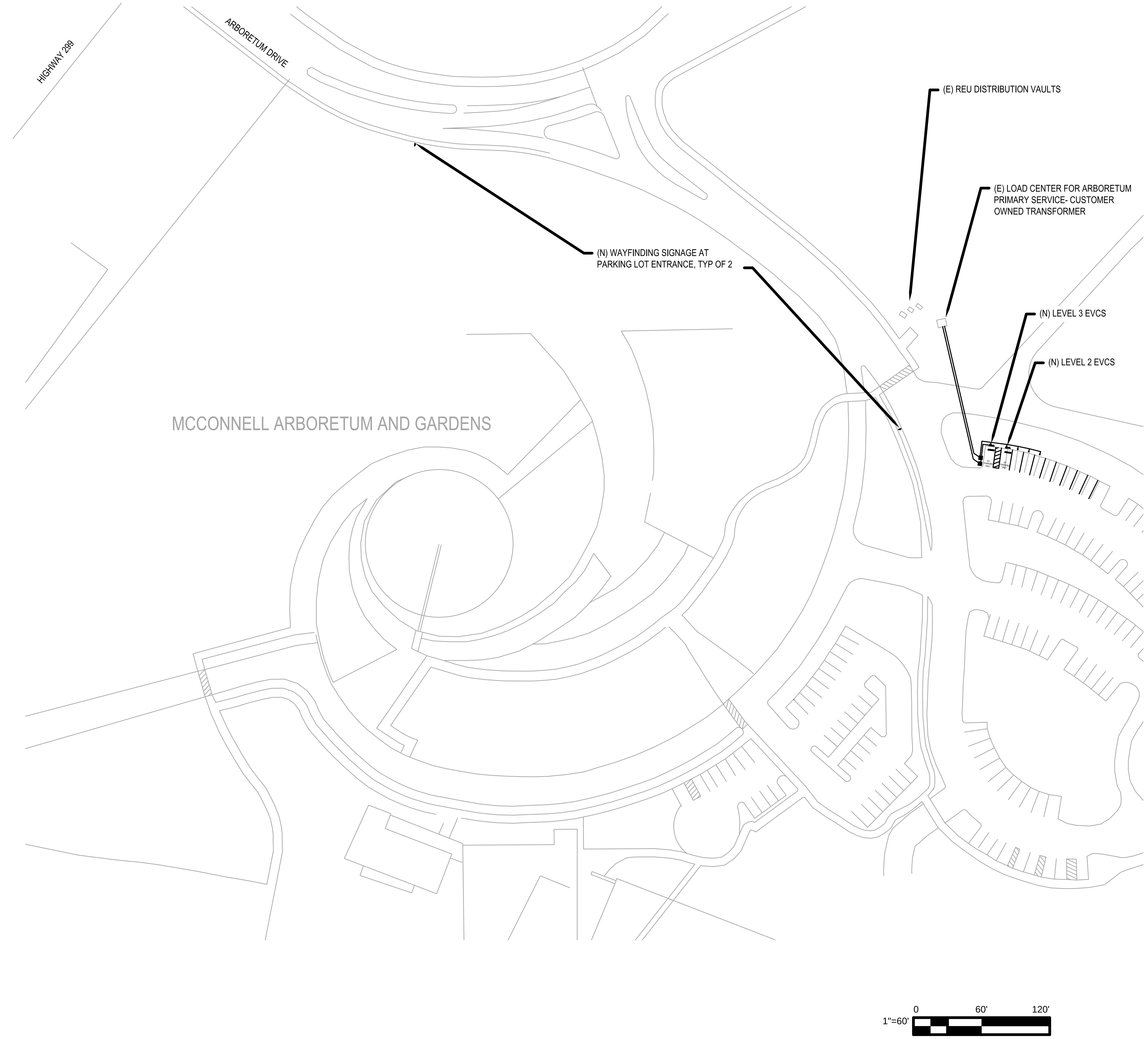


UPSTATE REGION: SISKIYOU, SHASTA, AND TEHAMA COUNTIES

REGIONAL LOCATION MAP



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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

REDDING CA
MCCONNELL ARBORETUM
L2 AND L3 EVCS

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-7

SHEET 8 OF 20

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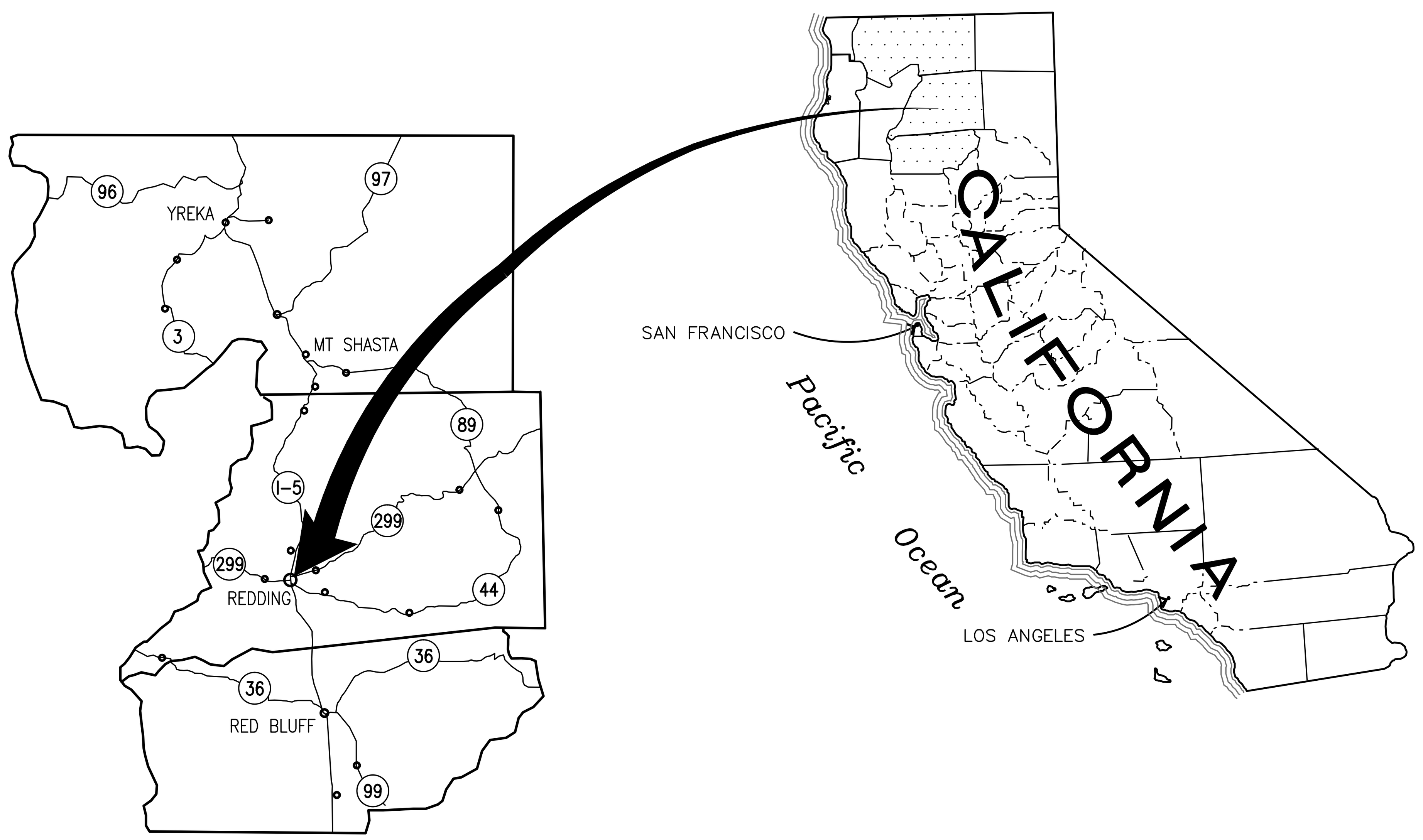
UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

REDDING CA
MCCONNELL ARBORETUM
L2 AND L3 EVCS - ENLARGMENT

PROJ NO: 8410693
DRWN: DC CHKD: ----

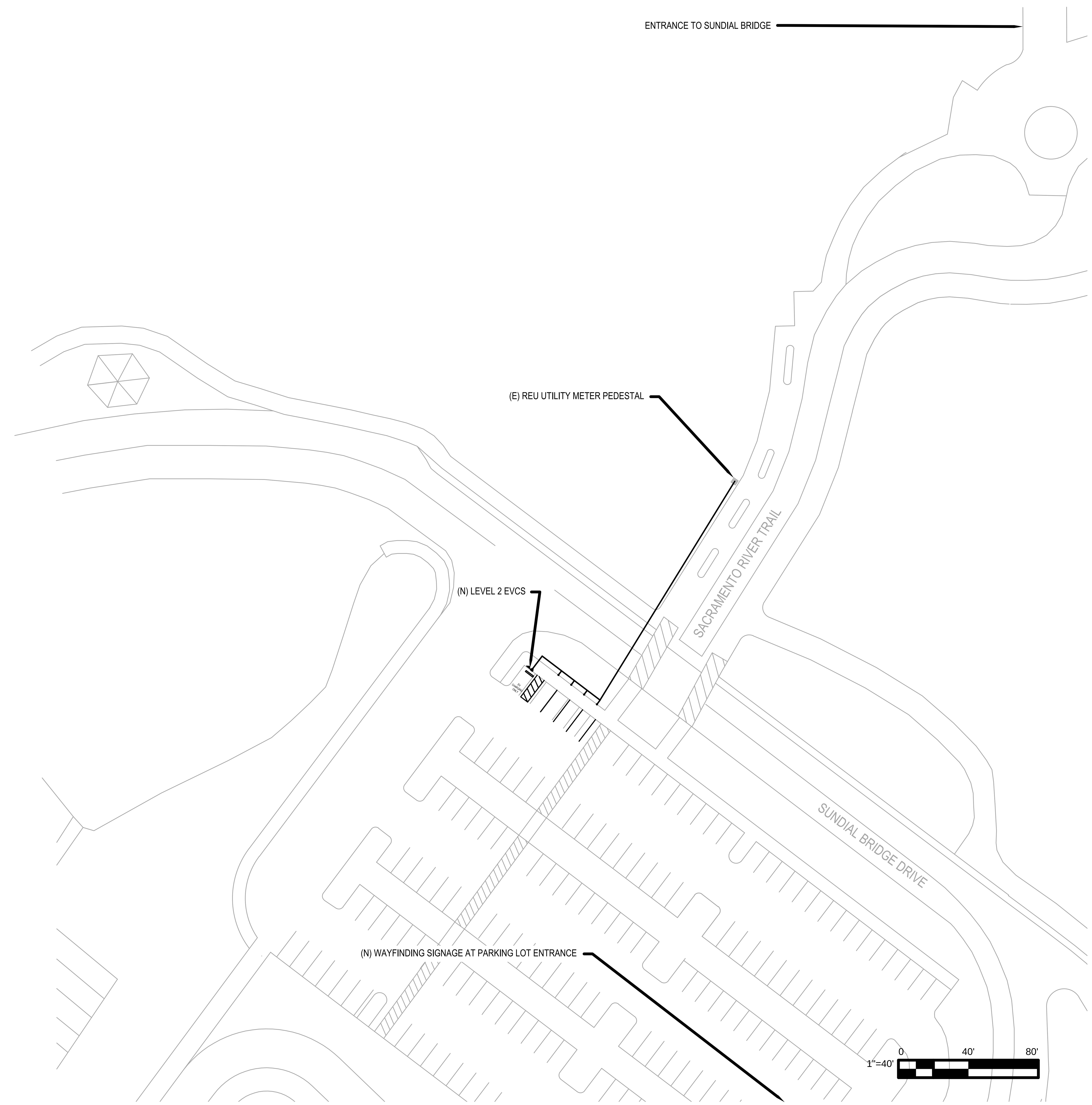
C-8

SHEET 9 OF 20



UPSTATE REGION: SISKIYOU, SHASTA, AND TEHAMA COUNTIES

REGIONAL LOCATION MAP



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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

REDDING CA
SUNDIAL BRIDGE
L2 EVCS

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-9

SHEET 10 OF 20

Plot Date: 9 October 2014 - 10:01 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\REDDING SUNDIAL BRIDGE- VICINITY.dwg

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

REDDING CA
SUNDIAL BRIDGE
L2 - ENLARGEMENT

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-10

SHEET 11 OF 20

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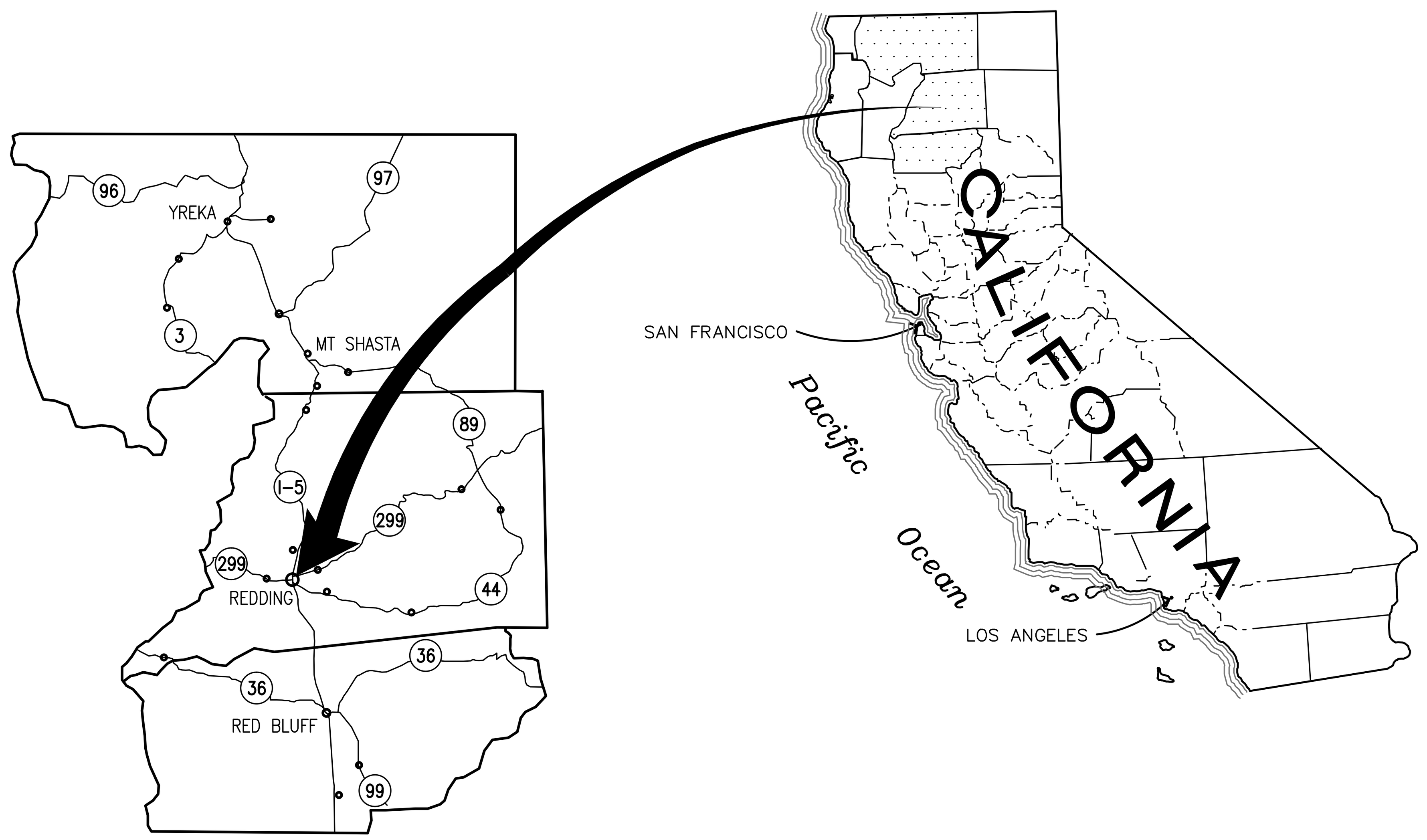
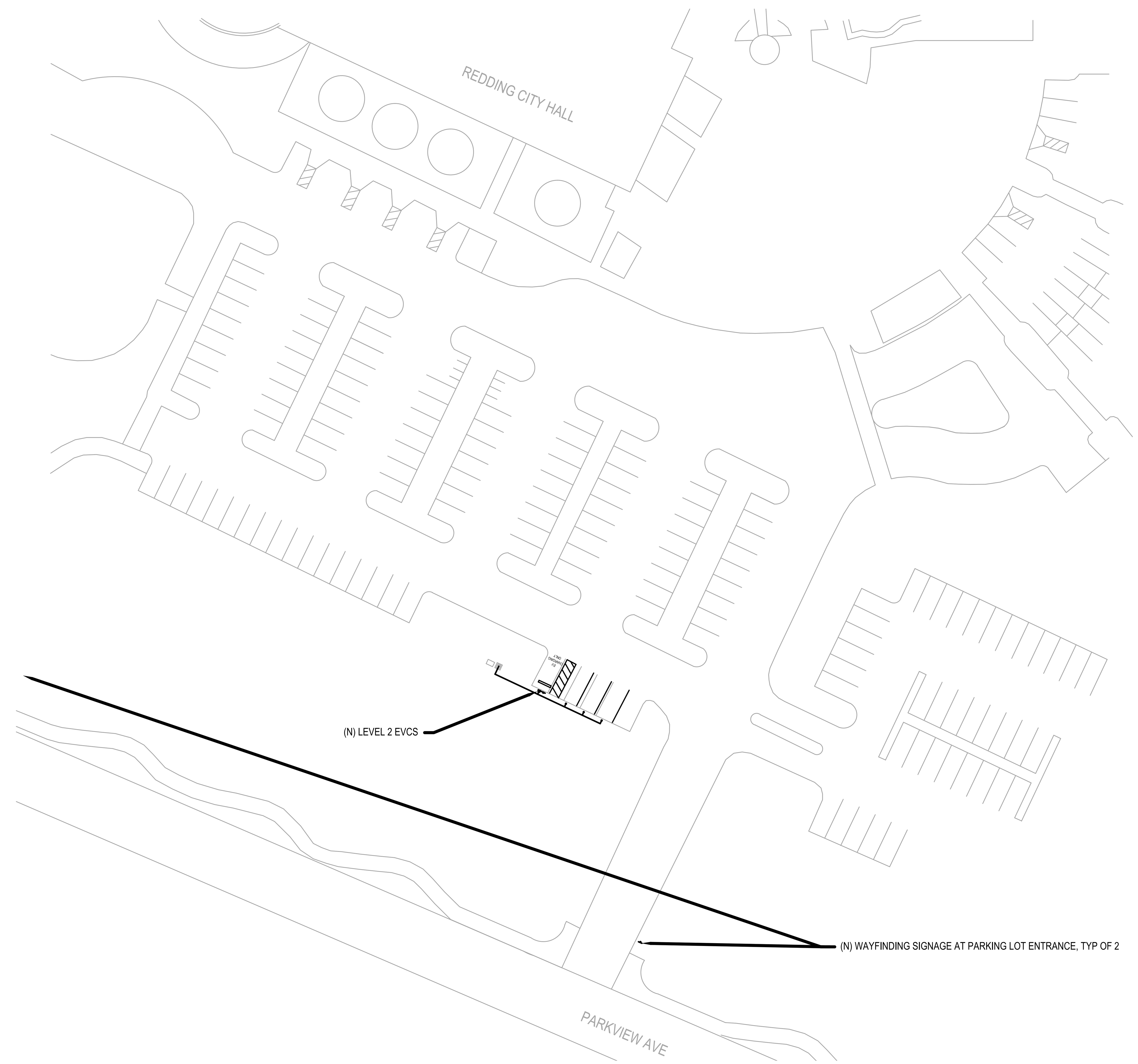


UPSTATE REGION: SISKIYOU, SHASTA, AND TEHAMA COUNTIES

REGIONAL LOCATION MAP



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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

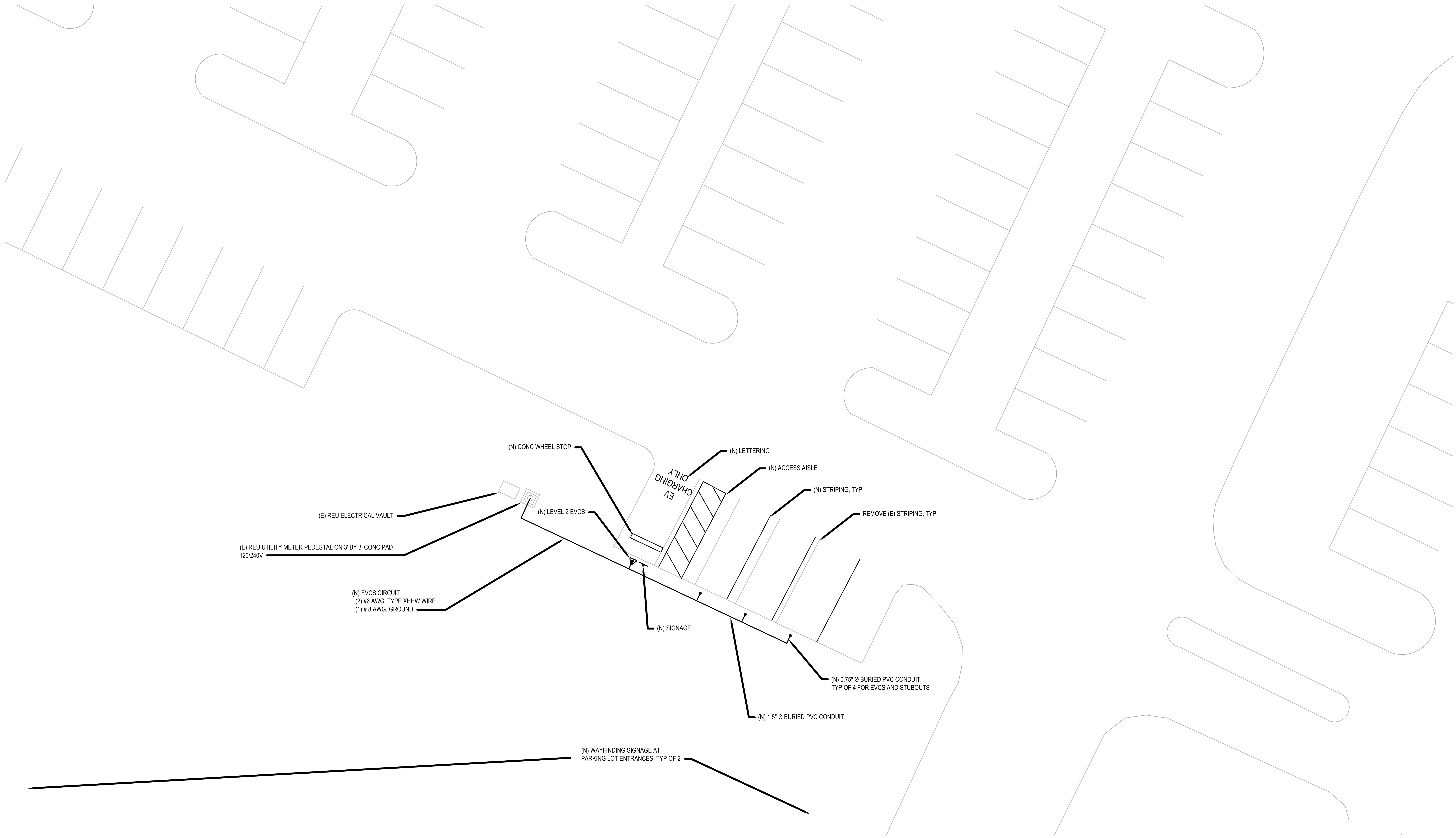
REDDING CA
CITY HALL
L2 EVCS

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-11

SHEET 12 OF 20

Plot Date: 9 October 2014 - 10:02 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\REDDING-CITY-HALL-VICINITY-2.dwg



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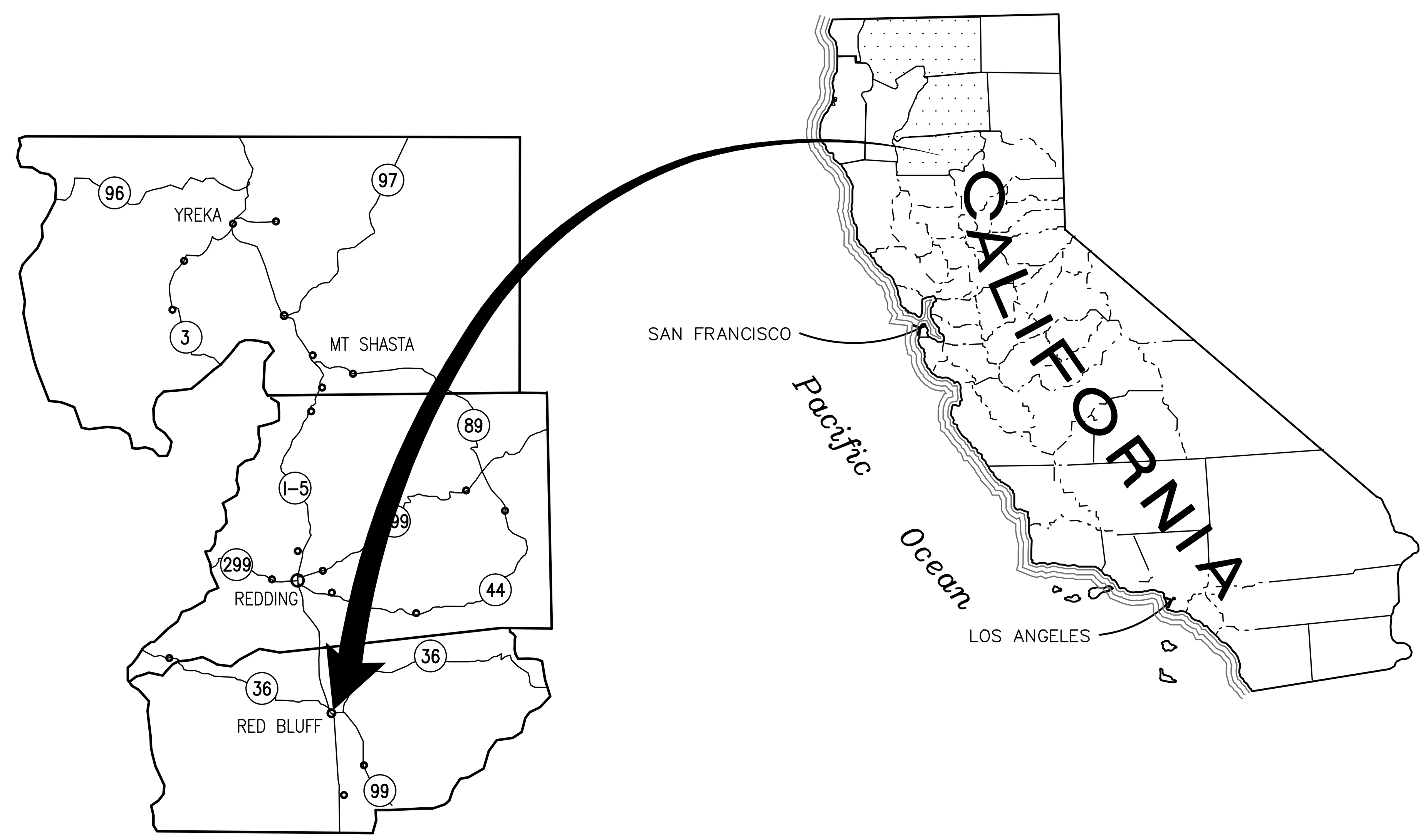
UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

REDDING CA
CITY HALL
L2 EVCS - ENLARGEMENT

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-12

SHEET 13 OF 20



UPSTATE REGION: SISKIYOU, SHASTA, AND TEHAMA COUNTIES

REGIONAL LOCATION MAP

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

RED BLUFF CA
DOWNTOWN- PINE ST
L2 EVCS

PROJ NO: 8410693

DRWN: DC CHKD: ----

C-13

SHEET 14 OF 20

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1	OCT 2014	PRELIMINARY CONCEPT DESIGN

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

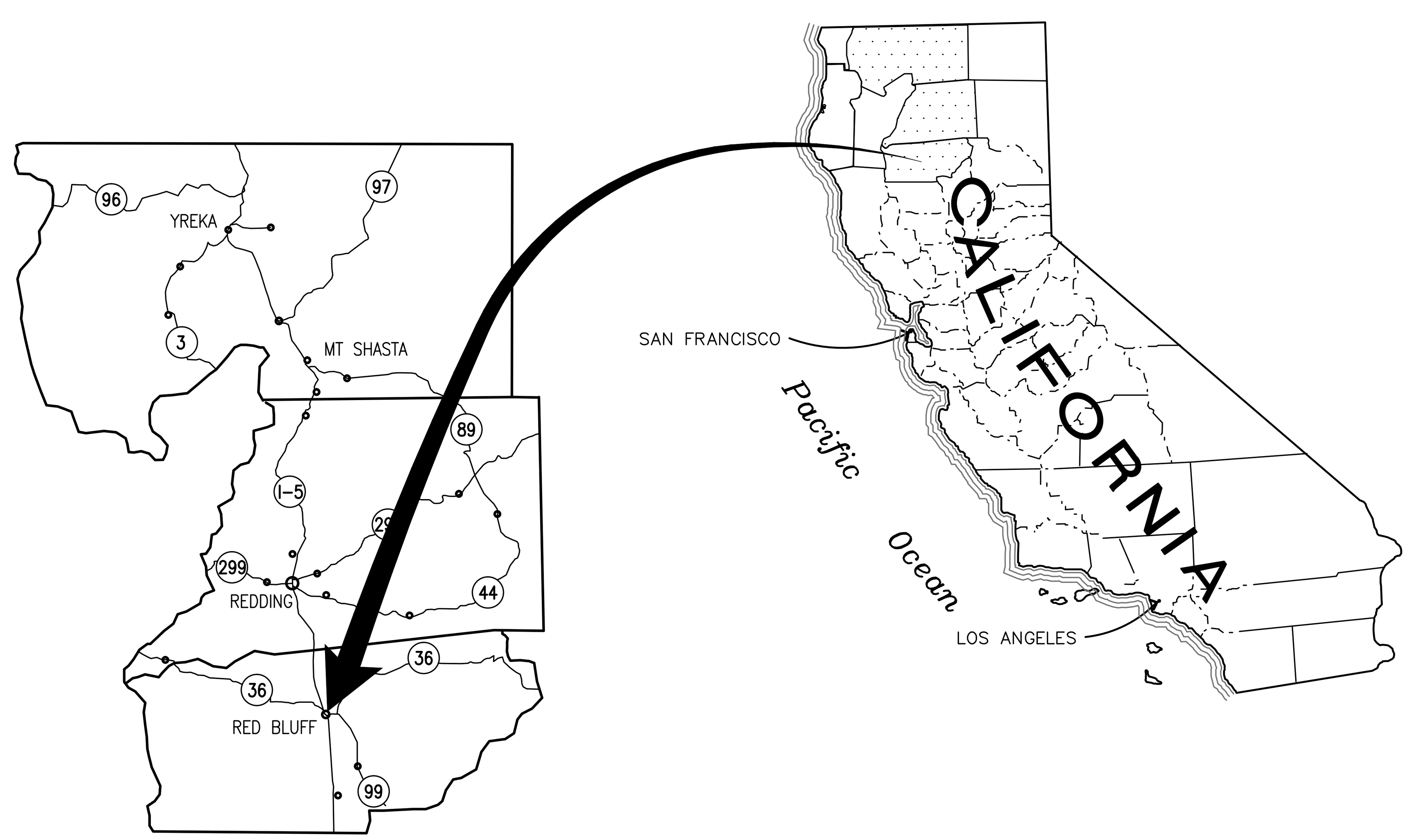
RED BLUFF CA
DOWNTOWN- PINE ST
L2 EVCS - ENLARGEMENT

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-14

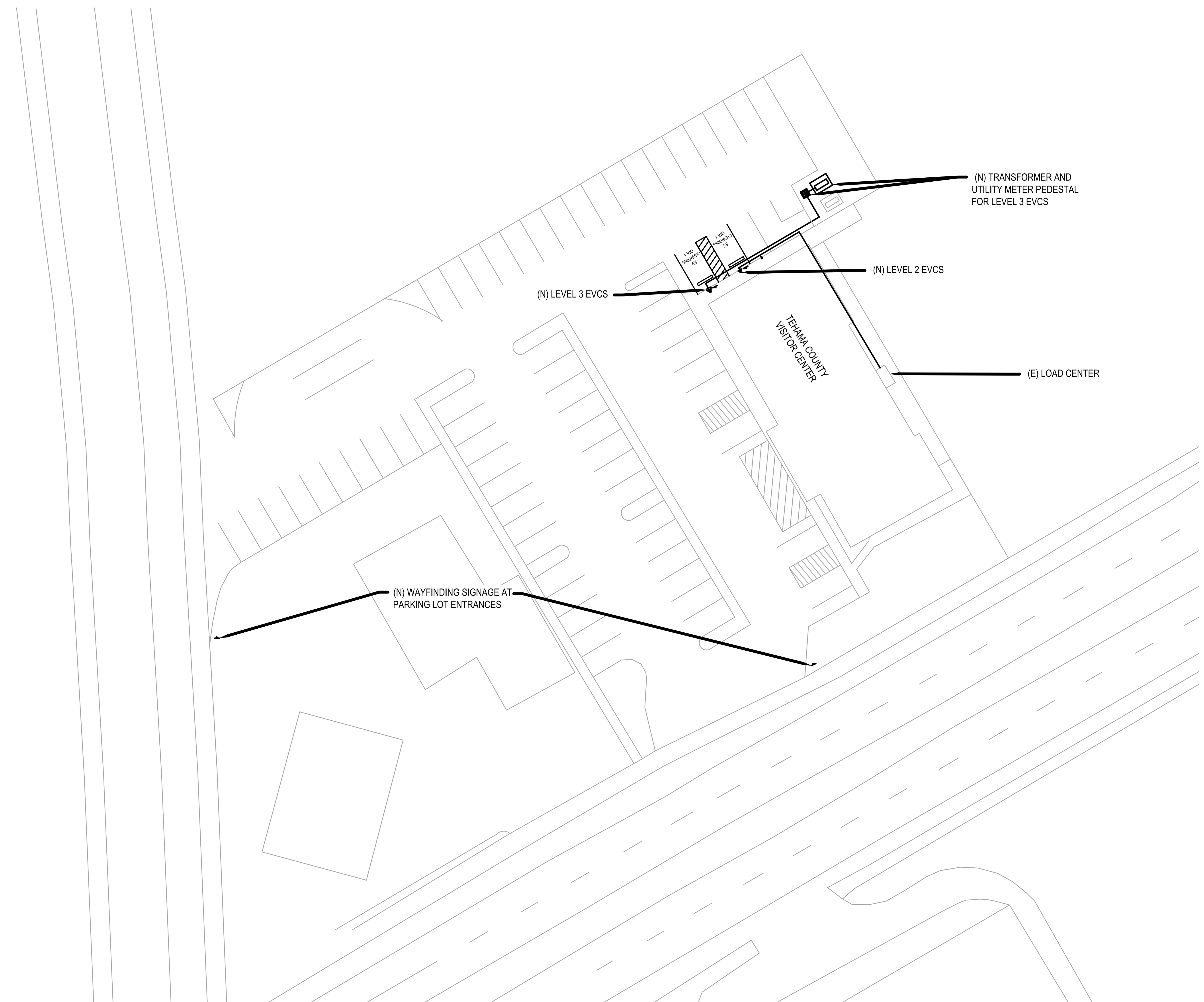
SHEET 15 OF 20

Plot Date: 9 October 2014 - 10:02 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\8410693-RB-PINE-ST.dwg



UPSTATE REGION: SISKIYOU, SHASTA, AND TEHAMA COUNTIES

REGIONAL LOCATION MAP



1"=30'
0 30' 60'

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

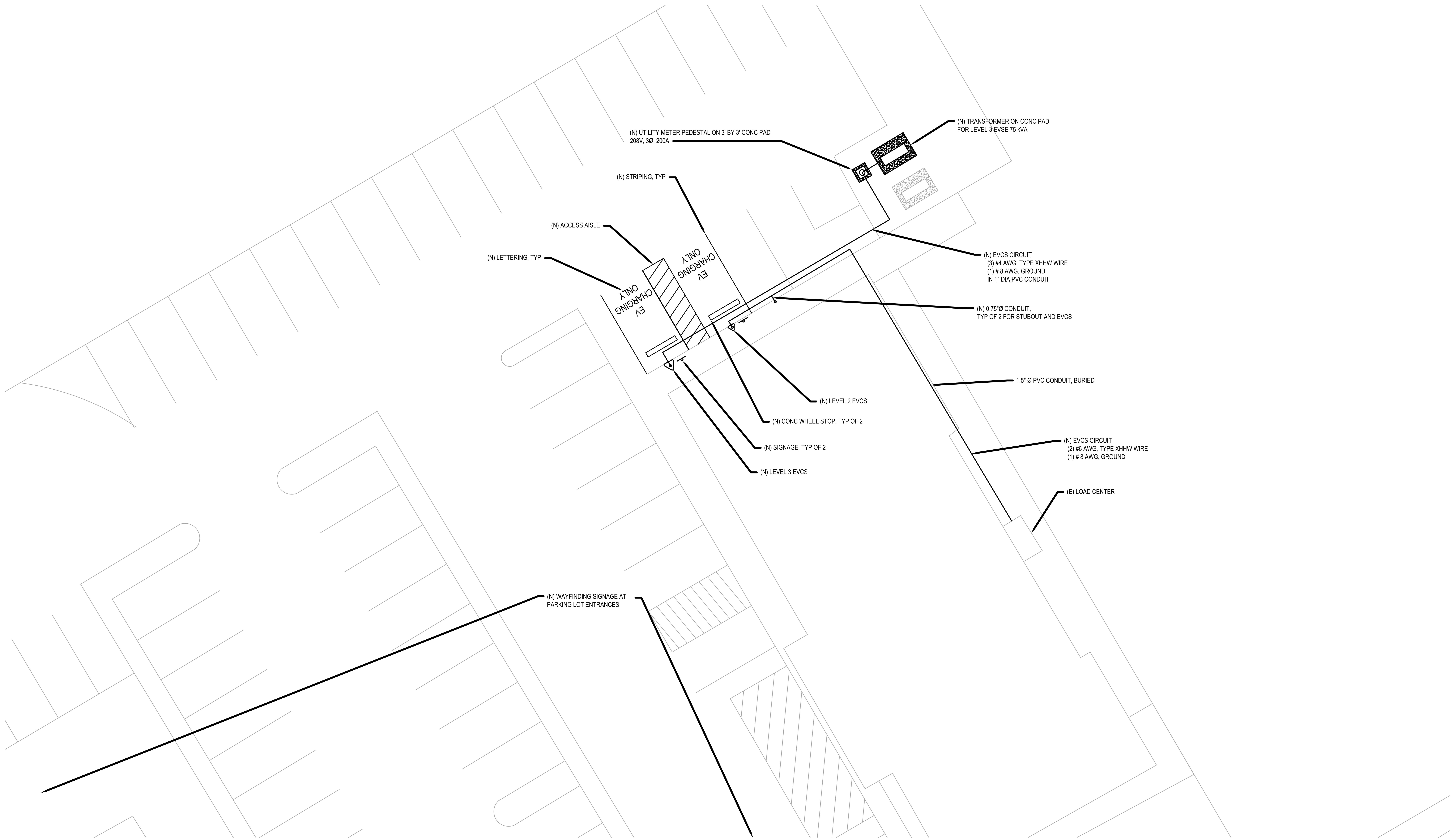
RED BLUFF CA
TEHAMA CNTY VISITOR CENTER
L2 AND L3 EVCS

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-15

SHEET 16 OF 20

Plot Date: 9 October 2014 - 10:02 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\RED-BLUFF-VISITOR-CENTER-VICINITY.dwg



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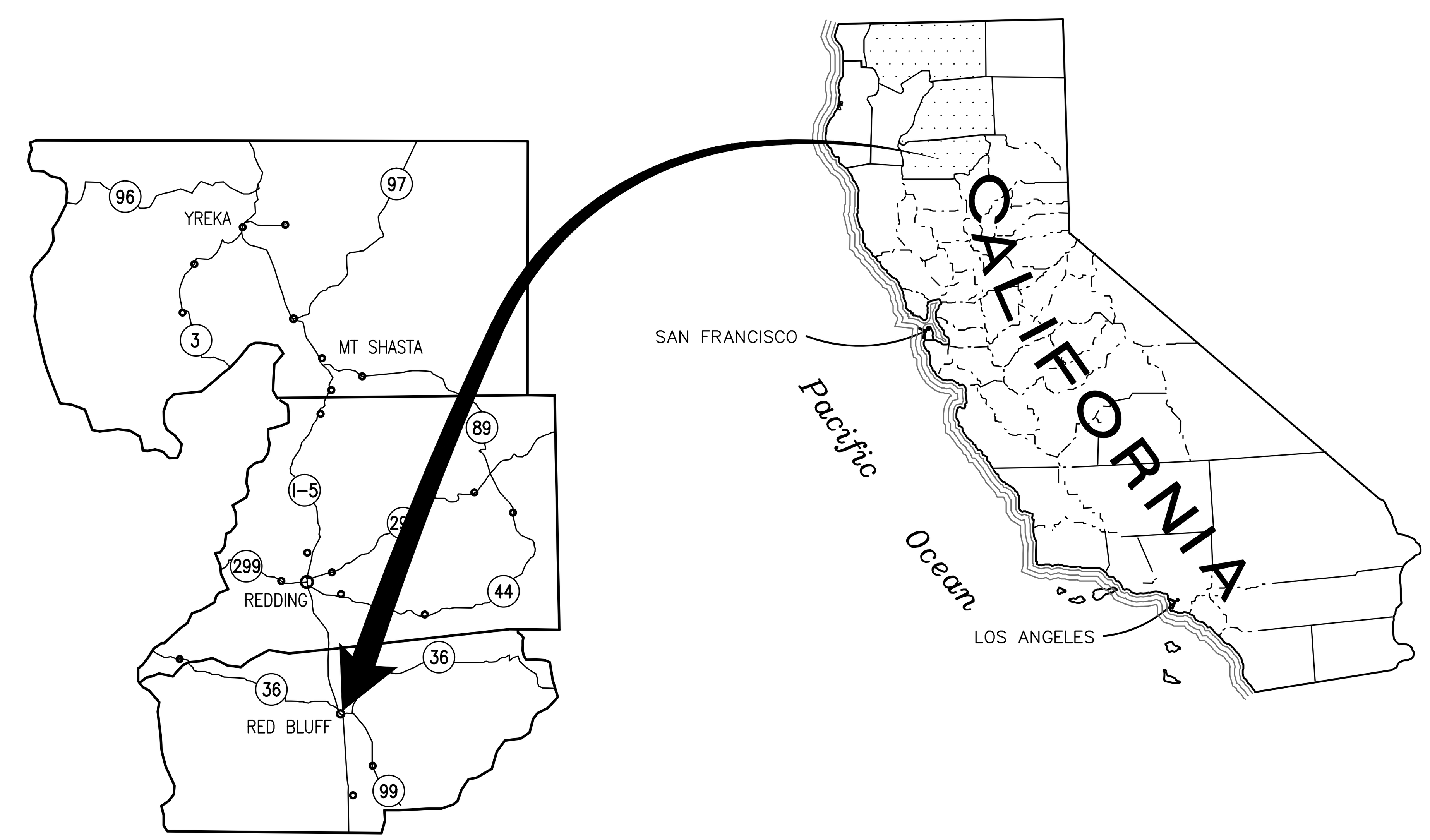
UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

RED BLUFF CA
TEHAMA CNTY VISITOR CENTER
L2 AND L3 EVCS - ENLARGMENT

PROJ NO: 8410693
DRWN: DC CHKD: ----

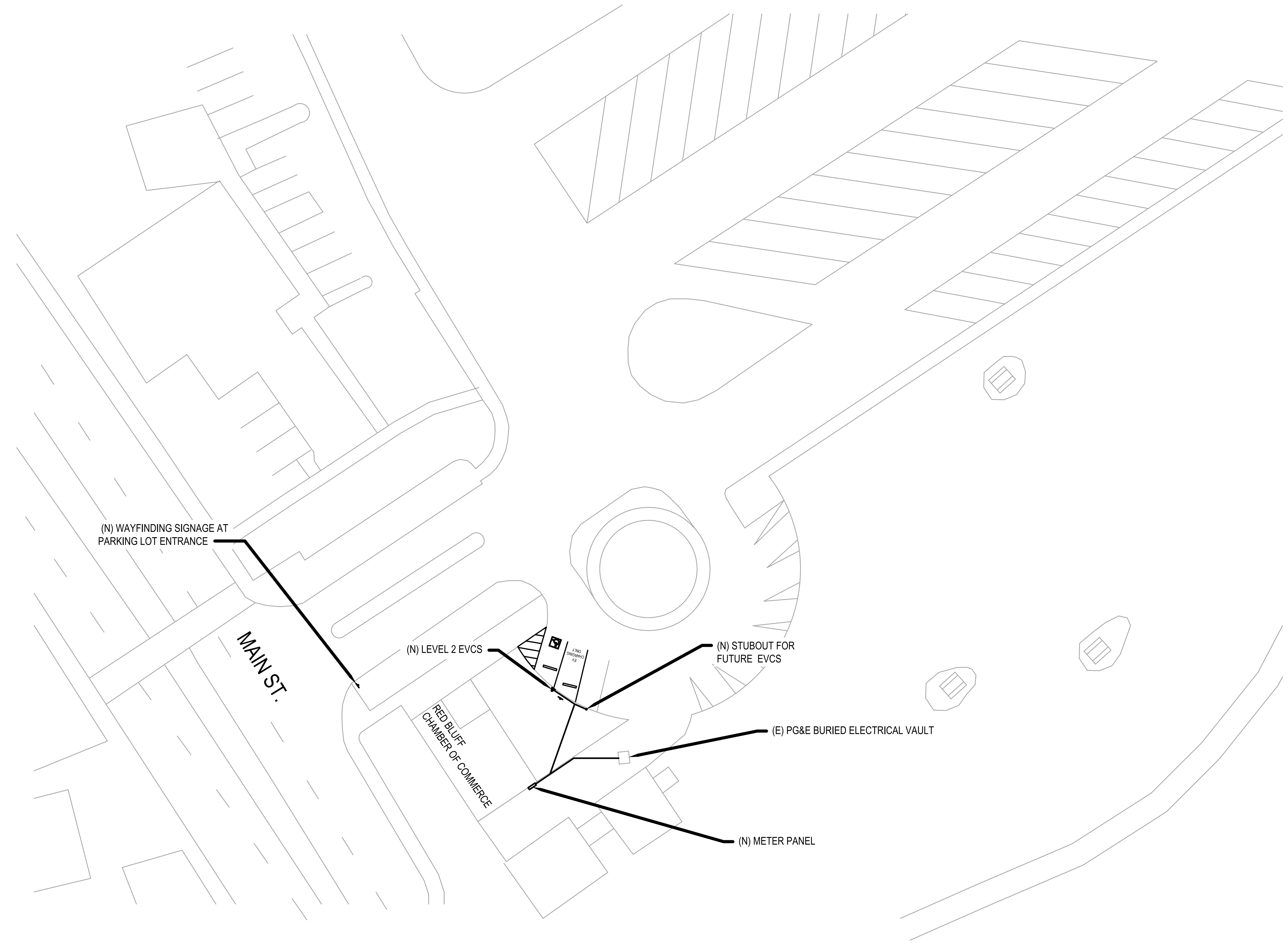
C-16

SHEET 17 OF 20



UPSTATE REGION: SISKIYOU, SHASTA, AND TEHAMA COUNTIES

REGIONAL LOCATION MAP



0 40' 80'
1"=40'

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

RED BLUFF CA
RIVER PARK
L2 EVCS

PROJ NO: 8410693
DRWN: DC CHKD: ----

C-17

SHEET 18 OF 20

Plot Date: 9 October 2014 - 10:03 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\RED-BLUFF-RIVER-PARK-VICINITY.dwg

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UPSTATE PLUG IN ELECTRIC VEHICLE READINESS PLAN PROJECT

RED BLUFF CA
RIVER PARK
L2 EVCS - ENLARGEMENT

PROJ NO: 8410693
DRWN: DC CHKD: ----

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SHEET 19 OF 20

Plot Date: 9 October 2014 - 10:03 AM Plotted By: David Carter Cad File No: C:\Users\djcarter\Desktop\140908_UpstatePEV\06-CAD\Sheets\RED-BLUFF-RIVER-PARK.dwg

Appendix C3 – Preliminary Engineer's Opinion of Probable Costs

Revision 141007djc

Yreka CA, Junction Center Shopping Center Level 2 and Level 3 EV Charging Stations and Stub Outs

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

Description	Qty	Unit	Unit Costs for GC, no markups: Material	Labor	Equipment	Subcontract (Total	Total
Demolish, remove pavementand curb, pavement removal, bitumous roads, 3" thick	2.0	SY		$ 2.65	$ 1.97		$ 9.22
Selective Demolition, Rubbish Handling, Load, Haul, Dump and Return, 50' haul hand carried	1.0	CY		$ 27.03			$ 27.03
Selective facility services demolition, haul per mile, up to 8 CY truck (CY times round trip miles)	10	CY-MI		$ 0.28	$ 0.58		$ 8.51
Selective Demolition, Dump Charges- Local disposal	1.4	Ton				$ 175.41	$ 236.80
Selective removal , pavement lines and markings, painted markings, does not include traffic control	18	SF		$ 1.50	$ 0.79		$ 41.19
						Divison 2 Subtotal	**$ 322.75**
Saw cut concrete/asphalt (sidewalk/parking lot), no reinforcement, up to 3" thick	30	LF	$ 0.28	$ 1.38	$ 0.94		$ 77.97
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE and meter pe	6	EA	$ 50.60	$ 53.48	$ 0.70		$ 628.66
						Divison 3 Subtotal	**$ 706.63**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	4	SET	$ 8.05	$ 21.33	$ -		$ 117.53
						Division 5 Subtotal	**$ 117.53**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	4	EA	$ 89.70	$ 13.51	$ -		$ 412.85
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84		$ 236.39
						Division 10 Subtotal	**$ 649.24**
Wire, 600 Volt, copper, stranded, #4 AWG	63	LF	$ 0.93	$ 2.00			$ 184.59
Wire, 600 Volt, copper, stranded, #6 AWG	152	LF	$ 0.60	$ 2.00			$ 395.20
Wire, 600 Volt, copper, stranded, #8 AWG	97	LF	$ 0.40	$ 2.00			$ 232.80
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	18	LF	$ 1.15	$ 3.16			$ 77.63
1" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	15	LF	$ 1.25	$ 3.16			$ 66.19
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	72	LF	$ 1.50	$ 3.16			$ 335.70
Commercial Meter Pedestal 1P, 3W, 120/240 Volt, 200 amp	0	EA	$ 1,500.00	$ 500.00			$ -
Commercial Meter Pedestal 3P, 4W, 480 Volt, 100 amp	1	EA	$ 4,000.00	$ 500.00			$ 4,500.00
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
70A, 480V, 3 Ph breaker	1	EA	$ 300.00				$ 300.00
New transformer installed by utility	1	LS				$ 20,000.00	$ 20,000.00
						Division 26 Subtotal	**$ 26,242.10**
Excavating Utility Trench, common earth, 1' wide, 18" deep	94	LF	$ -	$ 1.50	$ 4.25		$ 540.03
Backfill utility trench by hand including compaction	94	LF	$ -	$ 2.39	$ 4.25		$ 624.35
						Division 31 Subtotal	**$ 1,164.38**
Pavement Parking Marking, painted letter, 6"	28	EA				$ 11.50	$ 322.00
Asphalt Paving- Pavement replacement over trench, 4" thick	0.0	SY	$ 15.87	$ 29.33	$ 2.45		$ -
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	2	EA	$ 68.43	$ 13.63	$ -		$ 164.11
Mechanical turf seeding, hand push spreader, 4.5 lb per 1000 SF (MSF)	0	MSF	$ 20.47	$ 1.79	$ -		$ -
Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3	STALL				$ 120.75	$ 362.25
Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	3	EA	$ 500.00	$ 52.90	$ 19.21		$ 1,716.32
						Divison 32 Subtotal	**$ 2,564.67**
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
DC Fast Charger (budget level pricing for AV, Eaton, ABB)	1	EA	$ 40,000.00				$ 40,000.00
						Construction and Equipment Subtotals	**$ 79,337.81**
General Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 6,347.02
Sales Tax	8.25%						$ 4,168.03
						Subtotal	**$ 89,852.86**
Contingency	25%						$ 22,463.21
						Subtotal	**$ 112,316.07**
Bonds	$ 12.00	$/1000 per RS Means					$ 1,347.79
						Subtotal	**$ 113,663.86**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 7,160.82
		Grand Total				**Construction Total**	**$ 120,824.69**

Revision 141007djc

Mt Shasta CA, Lake Street Public Parking Lot Level 2 EV Charging Station and Stub Outs

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

			Unit Costs for GC, no markups				
Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total	Total
Selective Demolition, Rubbish Handling, Load, Haul, Dump and Return, 50' haul hand	0.3	CY		$ 27.03			$ 6.76
Selective facility services demolition, haul per mile, up to 8 CY truck (CY times round trip	2.5	CY-MI		$ 0.28	$ 0.58		$ 2.13
Selective Demolition, Dump Charges- Local disposal	0.3	Ton				$ 175.41	$ 59.20
						Divison 2 Subtotal	**$ 68.08**
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE and	3	EA	$ 50.60	$ 53.48	$ 0.70		$ 314.33
						Divison 3 Subtotal	**$ 314.33**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long,	2	SET	$ 8.05	$ 21.33	$ -		$ 58.77
						Division 5 Subtotal	**$ 58.77**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	2	EA	$ 89.70	$ 13.51	$ -		$ 206.43
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.30	$ 6.96	$ 3.84		$ 118.20
						Division 10 Subtotal	**$ 324.62**
Wire, 600 Volt, copper, stranded, #6 AWG	118	LF	$ 0.60	$ 2.00			$ 306.80
Wire, 600 Volt, copper, stranded, #8 AWG	59	LF	$ 0.40	$ 2.00			$ 141.60
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	18	LF	$ 1.15	$ 3.16			$ 77.63
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	55	LF	$ 1.50	$ 3.16			$ 256.44
Commercial Meter Pedestal 1P, 3W, 120/240 Volt, 200 amp	1	EA	$ 1,500.00	$ 500.00			$ 2,000.00
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
						Division 26 Subtotal	**$ 3,059.87**
Excavating Utility Trench, common earth, 1' wide, 18" deep	65	LF	$ -	$ 1.50	$ 4.25		$ 373.43
Backfill utility trench by hand including compaction	65	LF	$ -	$ 2.39	$ 4.25		$ 431.73
						Division 31 Subtotal	**$ 805.16**
Pavement Parking Marking, painted letter, 6"	14	EA				$ 11.50	$ 161.00
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	1	EA	$ 68.43	$ 13.63	$ -		$ 82.05
ent Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL				$ 120.75	$ 241.50
						Divison 32 Subtotal	**$ 484.55**
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
						Construction and Equipment Subtotals	**$ 12,685.88**
General Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 1,014.87
Sales Tax	8.25%						$ 794.24
						Subtotal	**$ 14,494.98**
Contingency	25%						$ 3,623.75
						Subtotal	**$ 18,118.73**
Bonds	$ 12.00	$/1000 per RS Means					$ 217.42
						Subtotal	**$ 18,336.15**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 1,155.18
		Grand Total				**Construction Total**	**$ 19,491.33**

Revision 141007djc

Mt Shasta CA, Tri Counties Bank Level 2 and Level 3 EV Charging Stations and Stub Out

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

			Unit Costs for GC, no markups				
Description	**Qty**	**Unit**	**Material**	**Labor**	**Equipment**	**Subcontract (Total**	**Total**
Demolish, remove pavementand curb, pavement removal, bitumous roads, 3" thick	20.0	SY		$ 2.65	$ 1.97		$ 92.23
Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh	0.3	SY		$ 7.19	$ 5.34		$ 4.17
Selective Demolition, Rubbish Handling, Load, Haul, Dump and Return, 50' haul hand	3.4	CY		$ 27.03			$ 91.58
Selective facility services demolition, haul per mile, up to 8 CY truck (CY times round trip	84.7	CY-MI		$ 0.28	$ 0.58		$ 72.10
Selective Demolition, Dump Charges- Local disposal	4.6	Ton				$ 175.41	$ 802.50
							$ -
						Divison 2 Subtotal	**$ 1,062.59**
Saw cut concrete/asphalt (sidewalk/parking lot), no reinforcement, up to 3" thick	34	LF	$ 0.28	$ 1.38	$ 0.94		$ 88.37
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE and	3	EA	$ 50.60	$ 53.48	$ 0.70		$ 314.33
						Divison 3 Subtotal	**$ 402.70**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long,	2	SET	$ 8.05	$ 21.33	$ -		$ 58.77
						Division 5 Subtotal	**$ 58.77**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	3	EA	$ 89.70	$ 13.51	$ -		$ 309.64
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	3	EA	$ 48.30	$ 6.96	$ 3.84		$ 177.30
						Division 10 Subtotal	**$ 486.93**
Wire, 600 Volt, copper, stranded, #4 AWG	51	LF	$ 0.93	$ 2.00			$ 149.43
Wire, 600 Volt, copper, stranded, #6 AWG	26	LF	$ 0.60	$ 2.00			$ 67.60
Wire, 600 Volt, copper, stranded, #8 AWG	30	LF	$ 0.40	$ 2.00			$ 72.00
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	14	LF	$ 1.15	$ 3.16			$ 60.38
1" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	11	LF	$ 1.25	$ 3.16			$ 48.54
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	10	LF	$ 1.50	$ 3.16			$ 46.63
Commercial Meter Pedestal 3P, 4W, 480 Volt, 100 amp	1	EA	$ 4,000.00	$ 500.00			$ 4,500.00
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
70A, 480V, 3 Ph breaker	1	EA	$ 300.00				$ 300.00
New transformer installed by utility	1	LS				$ 20,000.00	$ 20,000.00
						Division 26 Subtotal	**$ 25,394.57**
Excavating Utility Trench, common earth, 1' wide, 18" deep	24	LF	$ -	$ 1.50	$ 4.25		$ 137.88
Backfill utility trench by hand including compaction	24	LF	$ -	$ 2.39	$ 4.25		$ 159.41
						Division 31 Subtotal	**$ 297.29**
Pavement Parking Marking, painted letter, 6"	14	EA				$ 11.50	$ 161.00
Asphalt Paving- Pavement replacement over trench, 4" thick	20.0	SY	$ 15.87	$ 29.33	$ 2.45		$ 952.89
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	2	EA	$ 68.43	$ 13.63	$ -		$ 164.11
nt Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL				$ 120.75	$ 241.50
Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	2	EA	$ 500.00	$ 52.90	$ 19.21		$ 1,144.21
						Divison 32 Subtotal	**$ 2,663.71**
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
DC Fast Charger (budget level pricing for AV, Eaton, ABB)	1	EA	$ 40,000.00				$ 40,000.00
						Construction and Equipment Subtotals	**$ 77,937.04**
General Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 6,234.96
Sales Tax	8.25%						$ 4,124.30
						Subtotal	**$ 88,296.31**
Contingency	25%						$ 22,074.08
						Subtotal	**$ 110,370.38**
Bonds	$ 12.00	$/1000 per RS Means					$ 1,324.44
						Subtotal	**$ 111,694.83**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 7,036.77
		Grand Total				**Construction Total**	**$ 118,731.60**

Revision 141007djc

Redding CA, McConnell Arboretum Level 2 and Level 3 EV Charging Stations and Stub Outs

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

			Unit Costs for GC, no markups				
Description	**Qty**	**Unit**	**Material**	**Labor**	**Equipment**	**Subcontract (Total**	**Total**
Demolish, remove pavementand curb, pavement removal, bitumous roads, 3" thick	8.3	SY		$ 2.65	$ 1.97		$ 38.43
Selective Demolition, Rubbish Handling, Load, Haul, Dump and Return, 50' haul hand	2.0	CY		$ 27.03			$ 54.05
Selective facility services demolition, haul per mile, up to 8 CY truck (CY times round trip	20	CY-MI		$ 0.28	$ 0.58		$ 17.02
Selective Demolition, Dump Charges- Local disposal	2.7	Ton				$ 175.41	$ 473.61
Selective removal , pavement lines and markings, painted markings, does not include	180	SF		$ 1.50	$ 0.79		$ 411.93
						Divison 2 Subtotal	**$ 995.03**
Saw cut concrete/asphalt (sidewalk/parking lot), no reinforcement, up to 3" thick	50	LF	$ 0.28	$ 1.38	$ 0.94		$ 129.95
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE and	8	EA	$ 50.60	$ 53.48	$ 0.70		$ 838.21
						Divison 3 Subtotal	**$ 968.16**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long,	4	SET	$ 8.05	$ 21.33	$ -		$ 117.53
						Division 5 Subtotal	**$ 117.53**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	4	EA	$ 89.70	$ 13.51	$ -		$ 412.85
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84		$ 236.39
						Division 10 Subtotal	**$ 649.24**
Wire, 600 Volt, copper, stranded, #4 AWG	477	LF	$ 0.93	$ 2.00			$ 1,397.61
Wire, 600 Volt, copper, stranded, #6 AWG	162	LF	$ 0.60	$ 2.00			$ 421.20
Wire, 600 Volt, copper, stranded, #8 AWG	240	LF	$ 0.40	$ 2.00			$ 576.00
Wire, 600 Volt, copper, stranded, #2 AWG	131	LF	$ 1.45	$ 2.00			$ 451.95
Wire, 600 Volt, copper, stranded, 4/0 AWG	131	LF	$ 4.50	$ 2.00			$ 851.50
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	18	LF	$ 1.15	$ 3.16			$ 77.63
1" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	153	LF	$ 1.25	$ 3.16			$ 675.11
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	200	LF	$ 1.50	$ 3.16			$ 932.50
Commercial Meter Pedestal 1P, 3W, 120/240 Volt, 200 amp	1	EA	$ 1,500.00	$ 500.00			$ 2,000.00
Commercial Meter Pedestal 3P, 4W, 480 Volt, 100 amp	1	EA	$ 4,000.00	$ 500.00			$ 4,500.00
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
70A, 480V, 3 Ph breaker	1	EA	$ 300.00				$ 300.00
						Division 26 Subtotal	**$ 12,333.50**
Excavating Utility Trench, common earth, 1' wide, 18" deep	362	LF	$ -	$ 1.50	$ 4.25		$ 2,079.69
Backfill utility trench by hand including compaction	362	LF	$ -	$ 2.39	$ 4.25		$ 2,404.40
						Division 31 Subtotal	**$ 4,484.09**
Pavement Parking Marking, painted letter, 6"	14	EA				$ 11.50	$ 161.00
Asphalt Paving- Pavement replacement over trench, 4" thick	8.3	SY	$ 15.87	$ 29.33	$ 2.45		$ 395.45
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	2	EA	$ 68.43	$ 13.63	$ -		$ 164.11
nt Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL				$ 120.75	$ 241.50
Pavement Parking Markings, thermoplastic tape including layout, 4" width	144	LF				$ 4.84	$ 697.18
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
DC Fast Charger (budget level pricing for AV, Eaton, ABB)	1	EA	$ 40,000.00				$ 40,000.00
						Construction and Equipment Subtotals	**$ 68,777.29**
General Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 5,502.18
Sales Tax	8.25%						$ 4,224.18
						Subtotal	**$ 78,503.66**
Contingency	25%						$ 19,625.91
						Subtotal	**$ 98,129.57**
Bonds	$ 12.00	$/1000 per RS Means					$ 1,177.55
						Subtotal	**$ 99,307.12**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 6,256.35
		Grand Total				**Construction Total**	**$ 105,563.47**

Revision 140121djc

Redding CA, Sundial Bridge Level 2 EV Charging Station and Stub Outs

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total	Total
			Unit Costs for GC, no markups				
Demolish, remove pavementand curb, pavement removal, bitumous roads, 3" thick	14.0	SY		$ 2.65	$ 1.97		$ 64.56
Selective Demolition, Rubbish Handling, Load, Haul, Dump and Return, 50' haul hand	1.0	CY		$ 27.03			$ 27.03
Selective facility services demolition, haul per mile, up to 8 CY truck (CY times round trip	10	CY-MI		$ 0.28	$ 0.58		$ 8.51
Selective Demolition, Dump Charges- Local disposal	1.4	Ton				$ 175.41	$ 236.80
Selective removal , pavement lines and markings, painted markings, does not include	90	SF		$ 1.50	$ 0.79		$ 205.97
						Divison 2 Subtotal	**$ 542.86**
Saw cut concrete/asphalt (sidewalk/parking lot), no reinforcement, up to 3" thick	84	LF	$ 0.28	$ 1.38	$ 0.94		$ 218.32
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE and	3	EA	$ 50.60	$ 53.48	$ 0.70		$ 314.33
						Divison 3 Subtotal	**$ 532.65**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long,	1	SET	$ 8.05	$ 21.33	$ -		$ 29.38
						Division 5 Subtotal	**$ 29.38**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	2	EA	$ 89.70	$ 13.51	$ -		$ 206.43
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.30	$ 6.96	$ 3.84		$ 118.20
						Division 10 Subtotal	**$ 324.62**
Wire, 600 Volt, copper, stranded, #6 AWG	392	LF	$ 0.60	$ 2.00			$ 1,019.20
Wire, 600 Volt, copper, stranded, #8 AWG	196	LF	$ 0.40	$ 2.00			$ 470.40
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	18	LF	$ 1.15	$ 3.16			$ 77.63
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	192	LF	$ 1.50	$ 3.16			$ 895.20
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
						Division 26 Subtotal	**$ 2,612.43**
Excavating Utility Trench, common earth, 1' wide, 18" deep	202	LF	$ -	$ 1.50	$ 4.25		$ 1,160.49
Backfill utility trench by hand including compaction	202	LF	$ -	$ 2.39	$ 4.25		$ 1,341.68
						Division 31 Subtotal	**$ 2,502.17**
Pavement Parking Marking, painted letter, 6"	14	EA				$ 11.50	$ 161.00
Asphalt Paving- Pavement replacement over trench, 4" thick	14.0	SY	$ 15.87	$ 29.33	$ 2.45		$ 667.02
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	1	EA	$ 68.43	$ 13.63	$ -		$ 82.05
ent Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	1	STALL				$ 120.75	$ 120.75
Pavement Parking Markings, thermoplastic tape including layout, 4" width	72	LF				$ 4.84	$ 348.59
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
						Construction and Equipment Subtotals	**$ 15,494.03**
General Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 1,239.52
Sales Tax	8.25%						$ 694.59
						Subtotal	**$ 17,428.14**
Contingency	25%						$ 4,357.03
						Subtotal	**$ 21,785.17**
Bonds	$ 12.00	$/1000 per RS Means					$ 261.42
						Subtotal	**$ 22,046.59**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 1,388.94
		Grand Total				**Construction Total**	**$ 23,435.53**

Revision 140121djc

Redding CA,City Hall Level 2 EV Charging Station and Stub Outs

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

			Unit Costs for GC, no markups				
Description	**Qty**	**Unit**	**Material**	**Labor**	**Equipment**	**Subcontract (Total**	**Total**
Selective removal , pavement lines and markings, painted markings, does not include	72	SF		$ 1.50	$ 0.79		$ 164.77
							$ -
						Divison 2 Subtotal	**$ 164.77**
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE and	4	EA	$ 50.60	$ 53.48	$ 0.70		$ 419.11
						Divison 3 Subtotal	**$ 419.11**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long,	1	SET	$ 8.05	$ 21.33	$ -		$ 29.38
						Division 5 Subtotal	**$ 29.38**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	3	EA	$ 89.70	$ 13.51	$ -		$ 309.64
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	3	EA	$ 48.30	$ 6.96	$ 3.84		$ 177.30
						Division 10 Subtotal	**$ 486.93**
Wire, 600 Volt, copper, stranded, #6 AWG	144	LF	$ 0.60	$ 2.00			$ 374.40
Wire, 600 Volt, copper, stranded, #8 AWG	72	LF	$ 0.40	$ 2.00			$ 172.80
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	18	LF	$ 1.15	$ 3.16			$ 77.63
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	68	LF	$ 1.50	$ 3.16			$ 317.05
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
						Division 26 Subtotal	**$ 1,091.88**
Excavating Utility Trench, common earth, 1' wide, 18" deep	78	LF	$ -	$ 1.50	$ 4.25		$ 448.11
Backfill utility trench by hand including compaction	78	LF	$ -	$ 2.39	$ 4.25		$ 518.08
						Division 31 Subtotal	**$ 966.19**
Pavement Parking Marking, painted letter, 6"	14	EA				$ 11.50	$ 161.00
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	1	EA	$ 68.43	$ 13.63	$ -		$ 82.05
nt Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	1	STALL				$ 120.75	$ 120.75
Pavement Parking Markings, thermoplastic tape including layout, 4" width	54	LF				$ 4.84	$ 261.44
						Divison 32 Subtotal	**$ 625.24**
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
						Construction and Equipment Subtotals	**$ 11,354.00**
General Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 908.32
Sales Tax	8.25%						$ 685.81
						Subtotal	**$ 12,948.13**
Contingency	25%						$ 3,237.03
						Subtotal	**$ 16,185.16**
Bonds	$ 12.00	$/1000 per RS Means					$ 194.22
						Subtotal	**$ 16,379.38**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 1,031.90
		Grand Total				**Construction Total**	**$ 17,411.29**

Revision 140121djc

Red Bluff CA, Tehama County Visitor Center Level 2 and Level 3 EV Charging Stations and Stub Out

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

			Unit Costs for GC, no markups				
Description	**Qty**	**Unit**	**Material**	**Labor**	**Equipment**	**Subcontract (Total**	**Total**
Demolish, remove pavementand curb, pavement removal, bitumous roads, 3" thick	22.0	SY		$ 2.65	$ 1.97		$ 101.45
Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh	1.1	SY		$ 7.19	$ 5.34		$ 13.92
Selective Demolition, Rubbish Handling, Load, Haul, Dump and Return, 50' haul hand	4.0	CY		$ 27.03			$ 108.10
Selective facility services demolition, haul per mile, up to 8 CY truck (CY times round trip	100	CY-MI		$ 0.28	$ 0.58		$ 85.10
Selective Demolition, Dump Charges- Local disposal	5.4	Ton				$ 175.41	$ 947.21
						Divison 2 Subtotal	**$ 1,255.78**
Saw cut concrete/asphalt (sidewalk/parking lot), no reinforcement, up to 3" thick	132	LF	$ 0.28	$ 1.38	$ 0.94		$ 343.07
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE an	4	EA	$ 50.60	$ 53.48	$ 0.70		$ 419.11
						Divison 3 Subtotal	**$ 762.17**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" lon	4	SET	$ 8.05	$ 21.33	$ -		$ 117.53
						Division 5 Subtotal	**$ 117.53**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	4	EA	$ 89.70	$ 13.51	$ -		$ 412.85
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84		$ 236.39
						Division 10 Subtotal	**$ 649.24**
Wire, 600 Volt, copper, stranded, #4 AWG	237	LF	$ 0.93	$ 2.00			$ 694.41
Wire, 600 Volt, copper, stranded, #6 AWG	199	LF	$ 0.60	$ 2.00			$ 517.40
Wire, 600 Volt, copper, stranded, #8 AWG	179	LF	$ 0.40	$ 2.00			$ 429.60
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	12	LF	$ 1.15	$ 3.16			$ 51.75
1" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	73	LF	$ 1.25	$ 3.16			$ 322.11
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	97	LF	$ 1.50	$ 3.16			$ 452.26
Commercial Meter Pedestal 3P, 4W, 480 Volt, 100 amp	1	EA	$ 4,000.00	$ 500.00			$ 4,500.00
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
70A, 480V, 3 Ph breaker	1	EA	$ 300.00				$ 300.00
New transformer installed by utility	1	LS				$ 20,000.00	$ 20,000.00
						Division 26 Subtotal	**$ 27,417.54**
Excavating Utility Trench, common earth, 1' wide, 18" deep	171	LF	$ -	$ 1.50	$ 4.25		$ 982.40
Backfill utility trench by hand including compaction	171	LF	$ -	$ 2.39	$ 4.25		$ 1,135.78
						Division 31 Subtotal	**$ 2,118.18**
Pavement Parking Marking, painted letter, 6"	28	EA				$ 11.50	$ 322.00
Asphalt Paving- Pavement replacement over trench, 4" thick	22.0	SY	$ 15.87	$ 29.33	$ 2.45		$ 1,048.18
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	2	EA	$ 68.43	$ 13.63	$ -		$ 164.11
Sidewalks, driveways, patios, concrete, 3000 psi, CIP, mesh reinforcement, 6" thick	10	SF	$ 30.36	$ 21.97	$ -		$ 523.25
t Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL				$ 120.75	$ 241.50
						Divison 32 Subtotal	**$ 2,299.03**
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
DC Fast Charger (budget level pricing for AV, Eaton, ABB)	1	EA	$ 40,000.00				$ 40,000.00
						Construction and Equipment Subtotals	**$ 82,189.97**
ieneral Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 6,575.20
Sales Tax	8.25%						$ 4,107.59
						Subtotal	**$ 92,872.76**
Contingency	25%						$ 23,218.19
						Subtotal	**$ 116,090.95**
Bonds	$ 12.00	$/1000 per RS Means					$ 1,393.09
						Subtotal	**$ 117,484.04**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 7,401.49
	Grand Total					**Construction Total**	**$ 124,885.53**

Revision 140121djc

Red Bluff CA, River Park Level 2 EV Charging Station and Stub Out

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

			Unit Costs for GC, no markups				
Description	**Qty**	**Unit**	**Material**	**Labor**	**Equipment**	**Subcontract (Total**	**Total**
Demolish, remove pavementand curb, pavement removal, bitumous roads, 3" thick	11.7	SY		$ 2.65	$ 1.97		$ 53.80
Selective Demolition, Rubbish Handling, Load, Haul, Dump and Return, 50' haul hand	1.9	CY		$ 27.03			$ 52.55
Selective facility services demolition, haul per mile, up to 8 CY truck (CY times round trip	48.6	CY-MI		$ 0.28	$ 0.58		$ 41.37
Selective Demolition, Dump Charges- Local disposal	2.6	Ton				$ 175.41	$ 460.45
						Divison 2 Subtotal	**$ 608.17**
Saw cut concrete/asphalt (sidewalk/parking lot), no reinforcement, up to 3" thick	70	LF	$ 0.28	$ 1.38	$ 0.94		$ 181.93
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE and	3	EA	$ 50.60	$ 53.48	$ 0.70		$ 314.33
						Divison 3 Subtotal	**$ 496.26**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long,	1	SET	$ 8.05	$ 21.33	$ -		$ 29.38
						Division 5 Subtotal	**$ 29.38**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	2	EA	$ 89.70	$ 13.51	$ -		$ 206.43
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.30	$ 6.96	$ 3.84		$ 118.20
						Division 10 Subtotal	**$ 324.62**
Wire, 600 Volt, copper, stranded, #6 AWG	144	LF	$ 0.60	$ 2.00			$ 374.40
Wire, 600 Volt, copper, stranded, #8 AWG	72	LF	$ 0.40	$ 2.00			$ 172.80
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	22	LF	$ 1.15	$ 3.16			$ 94.88
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	67	LF	$ 1.50	$ 3.16			$ 312.39
Meter center and sockets, single position, 4 terminal, 100 amp	1	EA				$ 281.75	$ 281.75
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
						Division 26 Subtotal	**$ 1,386.21**
Excavating Utility Trench, common earth, 1' wide, 18" deep	81	LF	$ -	$ 1.50	$ 4.25		$ 465.35
Backfill utility trench by hand including compaction	81	LF	$ -	$ 2.39	$ 4.25		$ 538.00
						Division 31 Subtotal	**$ 1,003.35**
Pavement Parking Marking, painted letter, 6"	14	EA				$ 11.50	$ 161.00
Asphalt Paving- Pavement replacement over trench, 4" thick	12.0	SY	$ 15.87	$ 29.33	$ 2.45		$ 571.73
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	1	EA	$ 68.43	$ 13.63	$ -		$ 82.05
ent Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL				$ 120.75	$ 241.50
						Divison 32 Subtotal	**$ 1,056.29**
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
						Construction and Equipment Subtotals	**$ 12,474.78**
General Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 997.98
Sales Tax	8.25%						$ 687.94
						Subtotal	**$ 14,160.70**
Contingency	25%						$ 3,540.17
						Subtotal	**$ 17,700.87**
Bonds	$ 12.00	$/1000 per RS Means					$ 212.41
						Subtotal	**$ 17,913.28**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 1,128.54
	Grand Total					**Construction Total**	**$ 19,041.82**

Revision 140121djc

Red Bluff CA, Pine Street Level 2 EV Charging Station and Stub Out

Preliminary Engineer's Opinion of Probable Construction Costs, Prepared by David Carter PE, GHD Inc.

Description	Qty	Unit	Material (Unit Costs for GC, no markups)	Labor	Equipment	Subcontract (Total	Total
Demolish, remove pavementand curb, pavement removal, bitumous roads, 3" thick	9.7	SY		$ 2.65	$ 1.97		$ 44.58
Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh	0.3	SY		$ 7.19	$ 5.34		$ 4.17
Selective Demolition, Rubbish Handling, Load, Haul, Dump and Return, 50' haul hand	1.7	CY		$ 27.03			$ 45.04
Selective facility services demolition, haul per mile, up to 8 CY truck (CY times round trip	41.7	CY-MI		$ 0.28	$ 0.58		$ 35.46
Selective Demolition, Dump Charges- Local disposal	2.3	Ton				$ 175.41	$ 394.67
						Divison 2 Subtotal	**$ 523.92**
Saw cut concrete/asphalt (sidewalk/parking lot), no reinforcement, up to 3" thick	60	LF	$ 0.28	$ 1.38	$ 0.94		$ 155.94
Finished conc equipment pad (3000 psi), 3' x 3' x 6" thick, incl forms (one for each EVSE and	3	EA	$ 50.60	$ 53.48	$ 0.70		$ 314.33
						Divison 3 Subtotal	**$ 470.27**
Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long,	1	SET	$ 8.05	$ 21.33	$ -		$ 29.38
						Division 5 Subtotal	**$ 29.38**
Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	2	EA	$ 89.70	$ 13.51	$ -		$ 206.43
Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.30	$ 6.96	$ 3.84		$ 118.20
Note: concrete footing for sign system included in line 03 30 53.40 3540 above							$ -
						Division 10 Subtotal	**$ 324.62**
Wire, 600 Volt, copper, stranded, #6 AWG	88	LF	$ 0.60	$ 2.00			$ 228.80
Wire, 600 Volt, copper, stranded, #8 AWG	44	LF	$ 0.40	$ 2.00			$ 105.60
0.75" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	18	LF	$ 1.15	$ 3.16			$ 77.63
1.5" dia conduit, in trench, including terminations, fittings, supports, Sch 40 PVC	40	LF	$ 1.50	$ 3.16			$ 186.50
Commercial Meter Pedestal 1P, 3W, 120/240 Volt, 200 amp	1	EA	$ 1,500.00	$ 500.00			$ 2,000.00
40A, 240V, 1 Ph breaker	1	EA	$ 150.00				$ 150.00
						Division 26 Subtotal	**$ 2,748.53**
Excavating Utility Trench, common earth, 1' wide, 18" deep	50	LF	$ -	$ 1.50	$ 4.25		$ 287.25
Backfill utility trench by hand including compaction	50	LF	$ -	$ 2.39	$ 4.25		$ 332.10
						Division 31 Subtotal	**$ 619.35**
Pavement Parking Marking, painted letter, 6"	14	EA				$ 11.50	$ 161.00
Asphalt Paving- Pavement replacement over trench, 4" thick	9.7	SY	$ 15.87	$ 29.33	$ 2.45		$ 460.56
Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	2	EA	$ 68.43	$ 13.63	$ -		$ 164.11
nt Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	1	STALL				$ 120.75	$ 120.75
						Divison 32 Subtotal	**$ 906.42**
Level 2 EVCS Chargepoint CT 4021 with Gateway	1	EA	$ 7,570.50				$ 7,570.50
						Construction and Equipment Subtotals	**$ 13,192.99**
General Requirement of General Contractor, access control, project clean up, testing, etc.	8%						$ 1,055.44
Sales Tax	8.25%						$ 812.75
						Subtotal	**$ 15,061.18**
Contingency	25%						$ 3,765.29
						Subtotal	**$ 18,826.47**
Bonds	$ 12.00	$/1000 per RS Means					$ 225.92
						Subtotal	**$ 19,052.39**
Location Adjustment Factor per RS Means Cost Data Manual for Eureka CA	106.3						$ 1,200.30
	Grand Total					**Construction Total**	**$ 20,252.69**

APPENDIX D
Task 4 Plan to Collect Consumer Charging Data

Upstate Plug-In Vehicle Readiness Plan

Task 4 Draft Interim Report: Plan to Collect Consumer Charging Data

Prepared for

Siskiyou County Economic Development Council

Prepared by

GHD Inc.

June 2014

Revision: Internal Review Draft

Table of Contents

Introduction ... 1
Purpose ... 1
Need ... 1
Scope of Work ... 2
Uses for Consumer Charging Behavior ... 2
Types of Consumer Charging Behavior Data ... 2
Review of Available Technology ... 3
Open Charge Point Protocol ... 4
Available Data Acquisition Technology ... 4
Level 1, Level 2, and Level 3 EVSE ... 4
Networked Level 2 EVSE ... 4
EVSE Manufacturer Independent Solutions ... 5
Blink ... 6
ChargePoint ... 7
ChargePro ... 8
ClipperCreek ... 9
Eaton ... 10
EVSE Charge Ratings ... 10
EVSE Data Access ... 11
Consumer Outreach ... 11
Vehicle Telemetry ... 12
Comparison of Level 2 EVSE ... 13
Level 3 EVSE ... 13
AeroVironment ... 13
Nissan ... 14
Eaton ... 15
Terra 53 by ABB ... 16
Rollout Plan for Data Acquisition ... 17
EVSE Recommendations ... 18
References ... 19
Appendix D1 – Electric Vehicle Driver Survey ... 20

List of Tables

Table 1: Charging station and associated management network. 5
Table 2: Comparison of EVSE models and their charging rates 11
Table 3: Equipment costs for networked 7.2 kW EVSE including one year of service fees 12
Table 4: Comparison of currently available Level 2 EVSE 13

List of Figures

Figure 1: Hardware options for collecting consumer charging data. 3
Figure 2: Blink Level 2 EVSE Pedestal 7
Figure 3: ChargePoint Dual Level 2 EVSE Pedestal 8
Figure 4: ChargePro Level 2 EVSE Pedestal 9
Figure 5: ClipperCreek CS-Series Level 2 EVSE with Pedestal Mount, and with optional Liberty PlugIns access keypad 10
Figure 6: Eaton Level 2 EVSE Pedestal with ChargePoint contactless access pad 10
Figure 7. AeroVironment's public model DC fast charger. 14
Figure 8. Nissan DC fast charger manufactured by AeroVironment. 15
Figure 8. Eaton DC fast chargers. 16
Figure 9. The Terra 53 DC fast charger by ABB. 17

Introduction
The City of Mt. Shasta was awarded a grant from the California Energy Commission to develop the Upstate Plug-In Electric Vehicle Readiness Plan (UPEV Readiness Plan). The UPEV Readiness Plan presents a framework for installing, operating and maintaining electric vehicle charging infrastructure throughout Siskiyou, Shasta, and Tehama Counties. This report presents one element of the UPEV Readiness Plan: a Plan to Collect Consumer Charge Behavior.

Purpose
The purpose of this report is to present a plan to collect consumer charging data in California's Upstate Region that is based on what is currently understood about consumer charging behavior and what technologies and methods have the potential to collect consumer charging behavior.

Need
In recent years, modern, mass produced plug-in electric vehicles have entered the consumer marketplace. Federal and State governments have enacted policies that incentivize the production, sale, and use of these vehicles as part of a strategy to reduce greenhouse gas emissions from the transportation sector.

Since Plug-In Electric Vehicles (PEV) transportation and publically available electric vehicle support equipment (EVSE or charging stations) are in their nascent stages, there is some uncertainty about how best to roll-out the EVSE infrastructure so as to support PEV drivers, promote PEV adoption, and minimize stranded assets. Collecting consumer charge behavior data can be used to inform charging network administrators, transportation planners, and State officials about the efficacy of investments made to support publically available EVSE.

Collecting consumer charging behavior data can also be used in the process of identifying barriers to PEV adoption and develop strategies to remove them. One barrier to widespread PEV adoption is that the driving public is accustomed to the gas station model for vehicle fueling. Under this model, drivers can obtain hundreds of miles of driving range during a brief stop at a gas station. Gas stations are ubiquitous and a driver running out of gas is a relatively rare occurrence. Drivers of PEVs experience a different paradigm.

Charging PEVs takes longer and if additional range is needed when travelling, the number of publically available charging stations is low compared to the number of gas stations. Additionally, the distance that PEVs can travel on electric drive is typically about 1/3 of the range of a conventional vehicle. These generalizations speak to the paradigm shift faced by drivers who choose a PEV yet sales are currently exceeding the rates seen for hybrid cars when they were first introduced.

PEV sales data speak to a number of satisfying aspects to PEV transportation such as reduced emissions, less road noise, less maintenance, lower cost per mile for fuel, the potential for renewably powered transportation, freedom from the gas station, tax credits, rebates, and the ability to fuel your car at home, to name a few. Reinforcing the current level of satisfaction experienced by PEV drivers is one way to encourage adoption.

By collecting consumer charging behavior data and using it to inform strategies for installing, operating, and maintaining publically accessible charging infrastructure, the satisfaction that current PEV drivers feel can be maximized within the constraints of existing PEV and EVSE technologies. This satisfaction will be evident during the course of a PEV driver's life and through social interaction the idea that PEV transportation is satisfying will grow, which will in turn encourage adoption. The opposite effect could occur if the publically available charging infrastructure is poorly planned, operated, and maintained. In this case, PEV adoption rates could slow because public perception is that PEV transportation is associated with negative experiences.

Scope of Work

The scope of work for this report is to analyze the available technology and the effectiveness of that technology to collect consumer charging behavior data. The emphasis is on developing a consumer-friendly approach to data acquisition and to provide recommendations to stakeholders regarding the need for, value, and availability of various levels of data acquisition technology. The scope of work also includes the following activities:

- Develop a rollout plan for integrating data acquisition with the planned EVSE
- Providing recommendations for aggregating data acquisition with planned EVSE.
- Develop a consumer survey form

Uses for Consumer Charging Behavior

Consumer charging behavior data can be used to better understand the charging habits of PEV drivers in order to guide charging infrastructure rollout and encourage adoption. By understanding peoples charging habits, infrastructure can be placed more strategically, for example:

- Stranded assets can be reduced by learning what types of locations are unpopular for charging and then avoiding installing charging stations in those types of locations unless they are needed for safety purposes.
- PEV adoption can be encouraged by learning what types of locations are popular and installing more EVSE in those locations.

Consumer charging behavior data can show how sensitive PEV drivers are to pricing at publically owned stations when deciding where and when to charge. Network planners and administrators, and analysts can use consumer charging behavior data to learn whether or not pricing at publically accessible stations can support a for-profit charging station owner business model, or if a non-profit station owner business model or charge price subsidies are most effective in encouraging adoption. Consumer charging behavior data can be used to help funding agencies decide if available funds are best directed towards:

- Vehicle rebates to lower the cost of PEVs,
- Grants to install publically accessible charging stations,
- Subsidies to reduce the cost of charging at publically available charging stations,
- Or some combination of the above.

Consumer charging behavior data can also be used in the development of parking policies that promote fair use of parking and charging real estate in environment of parking scarcity.

Types of Consumer Charging Behavior Data

The following types of consumer charging behavior data are of interest for the uses described above:

- Number of charge events per day
- Energy transferred per charge event
- Duration of charge event
- Duration of transaction (can be different than charge duration)
- State of charge (SOC) upon arrival
- SOC upon departure
- Time of day each charge event occurs
- Price of electricity from the utility during the charge event
- Pricing structure of station (can vary with time and/or by user group)
- Number of events per week or month by specific vehicles
- Availability (percentage of time station is operable)
- Number of occurrences where charging station was occupied by conventional vehicle
- Number of occurrences where a driver was not able to charge because the charging station was occupied by another PEV

- Number of occurrences where a driver attempted to use a charging station but it was unavailable due to equipment failure

Some of these data can be collected by existing technologies; others can be collected by survey. Some of the data listed above may not be able to be collected with currently available technologies and methods.

Review of Available Technology

Technology for collecting consumer charge behavior is built in too many mass produced EVSE. A wide range of manufacturers offer networked systems that are capable of transmitting and receiving data to and from the internet via cell phone signal. This enables EV drivers to pay for charging and station administrators to manage the charger over the internet to set charging cost, monitor usage, download custom reports, and detect system faults.

Non-networked EVSE are also available with the most basic type being a smart relay box, a cord, and a plug configured to charge vehicles for free following safety and communication protocols contained in the Society of Automotive Engineers Standard (SAE) J1772. In order to monitor usage from this type of station additional metering hardware would need to be installed. Figure 1 below provides an overview of consumer charge data collection options from modern EVSE.

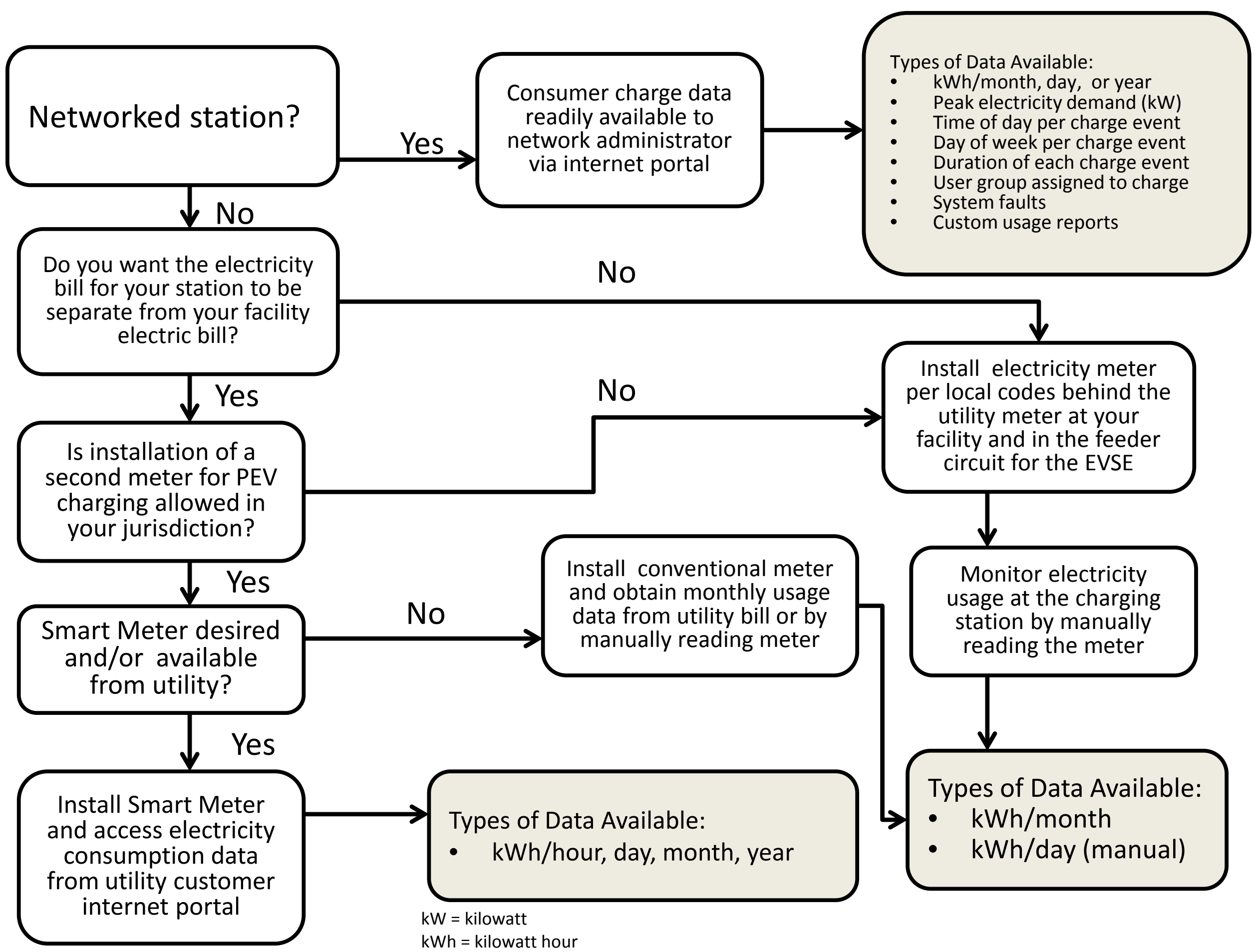

Figure 1: Hardware options for collecting consumer charging data

As can be seen in Figure 1, the most convenient method to collect consumer charging data is by choosing networked EVSE. Networked EVSE also provide the highest level of detail about consumer charge behavior because these systems are designed for the purpose of monitoring and administering networks of charging stations.

A utility smart meter that is installed as a dedicated meter for a single EVSE can provide kilowatt hour usage for the station by the hour, day, month, and year through an online web portal. The data can be downloaded in spreadsheet format for reporting and analysis. A utility smart meter installed for a bank of charging stations can provide usage data for the bank of chargers but will not be able to provide information about individual EVSE usage within the bank.

Pacific Gas and Electric allows a dedicated meter to be installed for PEV charging and has a specific rate set up for EV charging. Jurisdictions in the Upstate planning area generally allow separate meters to be installed for electric vehicle chargers with one known exception being Humboldt County. Humboldt County does not allow a separate meter to be installed for PEV charging in residential applications; however, separate meters for non-residential applications are allowed.

If a separate conventional electricity meter is installed for the EVSE then data, in units of kilowatt hours (kWh) per month, will be provided by PG&E on the monthly bill. To obtain data in terms of kWh per day, the meter would have to be read manually on a daily basis.

If a conventional meter was installed in the charging station circuit behind the facility's main meter, the data in units of kWh per month could be read manually over a time interval of choice.

Customized electricity metering and data logging hardware is available to allow more comprehensive and convenient metering of non-network charging stations. These types of systems would be most applicable for remote stations that are out of range of cellular network signals. In this scenario, the same parameters that are monitored by networked stations could be monitored and the data would be collected manually by swapping a data logging module or connecting a laptop computer and downloading the data on a regular basis.

Open Charge Point Protocol

Open Charge Point Protocol (OCPP) is a standard that applies to data transfer and communications for EVSE. The OCPP was implemented to address the challenge of interoperability of PEV charging across the diverse landscape of EVSE. EVSE that are OCPP compliant can be accessed by any PEV driver regardless of what charging networks they may or may not belong to and what network the EVSE is associated with. The OCPP also allows EVSE owners and administrators to reconfigure the software on the EVSE to support their particular business/operations model. Currently, EVSE that are installed using funding from the State of California are required to be OCPP compliant.

Available Data Acquisition Technology

There is a wide range of EVSE available on the commercial market and the technology is rapidly evolving. This section presents a summary of the most common types of EVSE available at the time of this writing.

Level 1, Level 2, and Level 3 EVSE

EVSE are available with different power ratings. Level 1 EVSE utilize a 120 volt, 20 amp, single-phase branch circuit. Level 2 EVSE utilize a 240 volt, up to 80 amp, single phase circuit. Level 3 EVSE utilize either a 208 volt or 480 volt three-phase circuit with a current rating up to 400 amps. Level 3 EVSE are also referred to as DC fast charge stations because there is a rectifier in the EVSE that converts alternating current to direct current, which is then supplied directly to the Battery.

Networked Level 2 EVSE

As described above, networked EVSE provide the most convenient means of collecting consumer charging behavior. EVSE wired to a network can be managed, monitored, and its usage can be tracked and reported on. Furthermore, as electric utility rates change, the EVSE owner can adjust the price of consumer charging. Networked EVSE facilitates versatility of use for both the owners and the consumers. Networked EVSE allows PEV drivers to readily access charging stations via a service plan, credit card, or a smart phone. Additionally, networked EVSE facilitates data collection and reporting of consumer charge behavior. This section highlights the most common networked EVSE available at the time of this writing. Since the technology is rapidly evolving, the reader will find that there are networked EVSE available in the commercial marketplace that are not summarized here.

To collect consumer charging behavior data, the EVSE must be supported by a management network. Many manufacturers pair their EVSE with a web-based network for management, monitoring, and control of their charging stations. Charging stations that currently use, or have the option to use, a web-based management network include AeroVironment, Blink, ChargePoint, ChargePro, ClipperCreek, and Eaton. The network associated each charging station is listed in Table 1.

Table 1: Charging station and associated management network.

EVSE	**Management Network/Software**
AeroVironment	AeroVironment, Liberty PlugIns
Blink	Blink
ChargePoint	ChargePoint
ChargePro	SemaCharge
Clipper Creek	PowerDash, Liberty PlugIns
Eaton	Sky Network (Greenlots), Liberty PlugIns,
General Electric WattStation	WattStation Connect

Networked EVSE allows the owner, host, or even in some cases the local utility company to manage their charging stations. The network is primarily accessible via internet access, but some networks also include smart phone access. On most EVSE networks, access to the web-based network allows an operator to set pricing, manage EV driver accounts of subscription plans, monitor the station, notify drivers of charge status, troubleshoot problems remotely, produce environmental reports (e.g. GHG reduction, fossil fuel displacement, etc.), track usage, and export data as available. When a utility company has access to the network, additional management may include assigning shedding groups, demand response, and blackout response.

Previously mentioned are the common features among most EVSE networks. This section highlights the differences between the EVSE and their networks.

EVSE Manufacturer Independent Solutions

A number of common networked EVSE solutions are described below. As mentioned previously, the commercially available EVSE space is dynamic and the reader will find that alternative EVSE are available that are not included herein. All of the technologies described below are OCPP compliant unless otherwise noted.

Liberty PlugIns Access Networking Solution

Liberty PlugIns is a third-party company that offers EVSE access solutions and payment methods. They offer keypad components for access the station for situations such as drivers of fleet vehicles, at multi-family dwellings, and at commercial office building with employee only access. They also offer pay station hardware, installed nearby, so as to make non-networked EVSE publicly available to guest EV drivers that aren’t associated with the business owner. In addition to the pay station, they offer pay-by-phone solutions for the same guest EV drivers. The Liberty PlugIns solution does not require that the EVSE have networking hardware installed on the EVSE because that capability is provided with the Liberty PlugIn hardware and software package. Manufacturers of EVSE that currently have used Liberty PlugIns access terminals are:

- AeroVironment
- ClipperCreek
- Eaton
- Schneider Electric

Blink

In 2009, ECOtality, the maker of Blink charging stations, was awarded a $99.8M grant from U.S. Department of Energy (DOE) to launch the EV Project, which installed thousands of grid-connected EVSE and implemented a data collection and analysis program to characterize electric vehicle use in diverse topography and climates, as well as to evaluate the effectiveness of charge infrastructure. With an additional DOE grant and fund matches, the total project fund reached $230M.

On September 16, 2013 ECOtality declared bankruptcy and the company's assets were sold to Car Charging Group for approximately $3.3M. Those assets included 12,450 installed Level 2 EVSE, 110 installed DC Fast charging stations, and the Blink network, which is the turnkey operating system for the EV drivers, commercial businesses, and utilities that services the Blink stations. Car Charging Group has re-branded the network as New Blink and will continue to operate the EVSE. However, there are a growing number of reports in the media of technical hardware problems with the Blink EVSE. A significant amount of useful data was collected under the EV Project to inform the rollout of EVSE in the Upstate Region.

Blink EVSE are now manufactured by Car Charging Group and use their proprietary Blink Network. The network can be accessed via a web terminal or a smart phone. Owners can assign role-based features of their network to manage information from different levels of access, with the future capability of having access controls for host user management. Also, the Blink Network anticipates the capability of the allowing charging station reservations (ECOtality, 2013b). Public charging stations are limited to Level 2 EVSE and DC fast chargers. Owners of Blink EVSE do not have to manage consumer billing. Blink manages user subscriptions and billing. Blink members (drivers) are automatically billed for their electric charges at the end of each month, unless their account balance reaches $100 at which point they are automatically billed (ECOtality, 2012a).

For drivers, the network is primarily membership based with flat charging rate for their Level 2 EVSE, while guests are allowed to use Blink EVSE for a premium rate. Stations owners cannot set pricing on Blink EVSE (ECOtality, 2012a). Level 2 pricing stays at a fixed rate, currently $1 per hour of charge for members and $2 per hour for guests. The pricing for Level 3 DC Fast Chargers depend on market prices. Since Blink EVSE owners cannot adjust pricing to recuperate the costs of power used by the EVSE, ECOtality automatically returns 40 percent of the revenue generated to the station owner on a monthly basis.

Figure 2: Blink Level 2 EVSE Pedestal

ChargePoint

ChargePoint EVSE are manufactured by Coulomb technologies and use the ChargePoint Network. The network allows owners to manage user subscriptions including price setting, monitor the health of their EVSE, and track usage. ChargePoint's Flex Billing Manager allows owners to establish pricing on a per time basis. Pricing can be set based on individuals or groups such as for fleet vehicles. Pricing can be set to free, for a fee, or to time of use policy (i.e. business hours, after business hours, weekends, etc.) Moreover, owners do not have to handle billing; ChargePoint's Flew Billing Manager automatically bills the drivers and payments are processed immediately.

Drivers can access ChargePoint EVSE with a contactless major credit card, a ChargePoint Smart Card, or by calling a toll-free phone number to obtain authorization (Coulomb, 2010). Drivers who wish to obtain a ChargePoint Smart Card have to pay a $4.95 fee per card.

ChargePoint offers their networking service to other EVSE manufacturers that aren't already connected to a proprietary network, or chose to use another network (when possible). Thus, owners of non-networked EVSE can opt to use ChargePoint's network if networking hardware is available for their charging station. Manufacturers that join ChargePoint's network do so under the OnRamp division of ChargePoint and have access to the software features available to a ChargePoint EVSE.

Figure 3: ChargePoint Dual Level 2 EVSE Pedestal

ChargePro

ChargePro EVSE are manufactured by SemaConnect and use the SemaCharge software network. The network allows the owner to monitor their EVSE, manage driver access and pricing, and track usage. SemaCharge allows owners to set pricing by individual, group, fleet, time of day, and tiered based on connection time. For example, an owner can set a rate for the first two hours of charging, and an increased rate for charging that exceeds two hours. Additionally, owners can assign host access account to a station, thereby allowing an EVSE host to monitor usage, produce reports, etc. Owners do not have to handle driver payments; SemaConnect's network manages payments for them. Owners are responsible for their increased electric utility charges, but they receive monthly revenue checks from SemaConnect from vehicle charging payments.

Unlike other EVSE networks, SemaConnect bills drivers for their "plug-in/plug-out" time rather than charge time, which encourages drivers to disconnect from the charger and move their vehicle when charge is complete. To ensure that drivers do not overpay for charging, drivers can be notified of charge completion via email or text message. Thus, data obtained from ChargePro's network will not reflect duration of charge, only duration of connection.

Figure 4: ChargePro Level 2 EVSE Pedestal

ClipperCreek

ClipperCreek EVSE are not natively manufactured with a management network, but networking solutions are available. PowerDash offers a networking solution, which includes networking and security hardware as well as subscriptions for their monitoring dashboard service as well as optional cellular/web-based connectivity to the EVSE. Liberty PlugIns also offers an access management network and billing solution for the ClipperCreek EVSE. More details on the Liberty PlugIns are provided in a previous section.

The advantages of ClipperCreek EVSE is their wide range of available charge ratings for their CS-Series EVSE, their long term presence in the market, and their reputation for reliability and cost effectiveness. They offer between 5.8 kW and 18.0 kW EVSE. Since the charging capability of future electric vehicles is expected to increase, ClipperCreek EVSE would be able to accommodate the need for higher charging rates. The disadvantage of ClipperCreek stations is that the available consumer charge data from their EVSE is limited; only energy in kilowatt hours per day is recorded. However, a base unit from ClipperCreek can be fitted with the PowerDash energy monitoring system and/or the Liberty PlugIns add-ons to provide a networked, OCPP compliant package.

Figure 5: ClipperCreek CS-Series Level 2 EVSE with Pedestal Mount, and with optional Liberty PlugIns access keypad

Eaton

Eaton EVSE are manufactured with networking software and payment systems and can be integrated into a building's existing energy management system via a Modbus networking module. Eaton EVSE also permits driver access via a Liberty PlugIns keypad, a RFID key fob, or an externally rated credit card reader. Eaton also offers a higher powered Level 2 EVSE option with power ratings ranging from 7.2 kW to 16.8 kW.

Figure 6: Eaton Level 2 EVSE Pedestal with ChargePoint contactless access pad

EVSE Charge Ratings

The most common Level 2 EVSE charge rating is only slightly larger than the capacity of the on-board charges in most PEVs. If not carefully considered, EVSE could fall behind the charging capabilities of electric vehicles. The charge ratings for current EVSE ranges between 5.8 kW and 18 kW, as noted in comparison in Table 2. It is important to note that the leading EVSE manufacturers only offer 7.2 kW Level 2 chargers, while a many of the electric vehicles on the market are capable of charging at 6.6 kW.

Furthermore, the Toyota RAV4 and Tesla Model S are capable of charging at 10 kW. Thus, if more PEV manufacturers follow the trend and move towards the capability of charging at 10 kW or greater, the EVSE that offer charging at or below 7.2 kW will limit their ability to minimize PEV driver charging time and therefore decrease driver satisfaction, which may discourage PEV adoption. Consequently, any EVSE infrastructure rated to 7.2 kW may need to be upgraded. Alternatively, if EVSE with a rating of at least 10 kW were selected initially, along with its supporting electrical infrastructure, increases in PEV charge ratings will be better supported. Stations that can charge at 19.2 kW would ensure that future increases in the capacity of on-board chargers would be support up to the limit of the allowable Level 2 charging current under the SAE J1772 standard.

Table 2: Comparison of EVSE models and their charging rates

EVSE Brand	Level 2 EVSE Model	Charge Ratings
Blink	Single Pedestal	7.2 kW
ChargePoint	CT4011-GW Single Pedestal	7.2 kW
ChargePro	Single Pedestal	7.2 kW
Clipper Creek	CS-Series Single Pedestal	5.8, 7.2, 9.6, 11.5, 13.4, 15.4, 17.3, or 18.0 kW
Eaton	Single Pedestal	7.2, 9.6, or 16.8 kW

EVSE Data Access

For independent agencies to obtain consumer charging data from EVSE owners, it is recommended that the owners sign a Disclosure Agreement with the entity seeking to collect the data. The agreement would permit the entity to periodically access the networked EVSE from a web-terminal and export consumer charging data that does not violate consumer privacy rights. The simplest approach to obtaining approval from the owner would be by presenting the agreement to the owner when he or she applies for an EVSE installation permit, for tax incentives, or during other application EVSE processes.

Consumer Outreach

Data exported from charging stations represents only a subset of data available for use in analysing consumer charging behavior. Charging station data indicates how an existing set of charging stations were utilized. However, it does not indicate consumer preference and/or response to the existing infrastructure. Another subset of behavior data could come from consumer outreach. Consumer outreach in the form of a survey could complement the data exported from charging stations and could explain what cannot be interpreted from raw data. For example, a survey might indicate that a majority of consumers want a charging station at a nearby recreation area. This information wouldn’t be gleaned from charge data alone. Furthermore, a survey could indicate whether or not a DC Fast Charger should be implemented instead of additional Level 2 chargers at a particular location.

To obtain consumer data via a survey, the survey could be presented through the vehicle registration renewal process, at a charging station, at the dealership, or in via a public outreach project. Ideally, the target demographic for consumer outreach would be drivers who have had time to get comfortable with their EV driving habits. Ideally, they have also had time to consider how and where the EVSE infrastructure might be improved. Vehicle registration renewal is typically performed via the USPS mail, and since it occurs after one year of EV ownership it would be an ideal avenue for obtaining information via a consumer survey. For those EV drivers within each county, the DMV could enclose a simple flyer within the renewal letter requesting consumer responses via a web-survey. Another avenue for outreach could be through an advertisement on the charging stations themselves. A station owner could offer, for a limited time, a discounted charging cost for those drivers who participate in a web-survey. In order for the latter approach to be effective, private EVSE owners may have to receive subsidies from the State or another agency accounting for the difference in lost charging revenue so that they are willing to offer this discount without incurring any losses.

To obtain consumer usage data via a survey, a both web-survey and hardcopy version were created for the EV drivers in the Upstate region (Appendix D1). The Electric Vehicle Driver Survey that was prepared seeks driver experience and feedback on the existing EVSE infrastructure in the region. The survey asks EV drivers to respond to questions such as where they charge, are there enough publicly accessible

EVSE, how much they are willing to pay for a charge event, and their general opinion and satisfaction about their EV charging experience. The goal of this survey is to determine how the utilization might be affected by location, pricing, and equipment, which cannot be obtained from the charge data alone.

Vehicle Telemetry

Additional charging behavior can be obtained through vehicle telemetry. Useful telemetry data from a vehicle may include:

- GPS route information including start and stop times and locations
- Number of trips per day
- Battery state of charge (SOC) at the beginning and end of trip

The data is useful because, for example, it may indicate where numerous drivers have depleted their batteries in attempts to make trips, but have been limited by insufficient public EVSE infrastructure. Hence, indicating where consumers need additional public EVSE. Additionally, inferences could be made from SOC at trip start and stop, which could be used to infer consumer confidence in their regional EVSE infrastructure. A major hindrance in obtaining telemetry from consumers is that it requires a PEV driver to allow the installation of a telemetry module in his or her electric vehicle and to allow the release of the driver's behavior to a third-party. Drivers may be sensitive to third-parties having knowledge of their whereabouts. Thus, drivers would need an incentive to be willing to release their potentially private driving information. The module may need to be subsidized by the State or other agency, and a Disclosure Agreement would be required so that the agency would be permitted to periodically export the driver's vehicle behavior data.

Some electric vehicle manufacturers have already set up telemetry web-interface systems as optional purchasing features. The telemetry systems allow drivers to monitor their energy usage, check SOC, remotely start and stop vehicle charging, track GHG reductions, and produce usage reports.

One example is that Nissan offers an optional telematics service through CARWINGS for vehicles that are equipped with navigational equipment. To use the service, an additional module is installed on the PEV and vehicle data is exported to a server. The data can be accessed via a web-terminal or smart phone. The data logged by the telematics system and includes (CARWINGS, 2013):

- Daily trip number
- Total electricity used
- Electricity used from consumption
- Electricity used from regeneration
- Distance travelled
- Energy economy in mi/kWh
- CO_2 tailpipe emission reduction

Currently, drivers of the Chevrolet Volt and the Honda Fit PEV have access to remote charge management via a web terminal or smart phone, but as of yet do not have the capability to log and export vehicle usage data.

The types of data that can be obtained from networked EVSE do not vary significantly between manufacturers. Thus, in order to obtain the largest set of consumer charge data from EVSE, the most cost effective EVSE should be considered. Table 3 lists the costs of 7.2 kW Level 2 that were available at the time of this report. As a result of the capital lower costs, more business owners and stakeholders may be willing to invest their capital into adopting the new technology. Additionally, the costs to the PEV driver should also be considered because they could impact the revenue associated with the EVSE ownership model. This section addresses the costs associated with investment of EVSE.

Table 3: Equipment costs for networked 7.2 kW EVSE including one year of service fees

EVSE	EVSE Model (Level 2)	Cost
Blink	Blink Pedestal Single	$ 4,755
ChargePoint	CT4011-GW Single Pedestal	$ 5,666
ChargePro	ChargePro Charging Station	$ 4,895
Clipper Creek	CS-40 (Pole mount)	$ 5,730

Comparison of Level 2 EVSE

The following table compares Level 2 EVSE that are currently on the market. Table 4 lists some EVSE that were not summarized in this report, but are worth noting. For more details on EVSE not mentioned, see the manufacturer's website.

Table 4: Comparison of currently available Level 2 EVSE

EVSE	Network	Smart Card	RFID	Credit Card	Keypad	Pedestal or Wall Mount	Single or Dual	Max Rated
AeroVironment[1]	Optional					Both	Both	7.2 kW
Blink	X	X			Touch screen	Both	Single	7.2 kW
ChargePoint[2]	X	X				Pedestal	Both	7.2 kW
ChargePro	X	X				Pedestal	Single	7.2 kW
ClipperCreek	Optional	X	Optional	Optional	Optional	Both	Both	18 kW
Eaton	X	X	Optional	Optional	Optional	Both	Single	16.8 kW
GE	Optional	X	X			Both	Dual	15.4 kW
GRIDbot	X				X	Both	Both	7.2 kW
Schneider	Optional		X		Optional	Both	Both	7.2 kW
ShorePower[1]	Optional			Optional[3]		Both	Dual	18 kW

Notes:
1. Limited data available
2. A Leviton EVSE exists as provided through Ford Motor Company and also as a rebranding of the ChargePoint EVSE
3. Any major credit card or proprietary card such as fleet and student ID cards

Level 3 EVSE

Level 3 EVSE (or DC fast charger) utilize 480 volt or 208 volt three phase AC circuits to deliver full PEV charges in shorter times than Level 2 EVSE. Typical charging times for Level 3 EVSErange between 20 and 40 minutes. Actual charge times depend in the state of charge of the vehicle at the time of charging event as well as the capacity of the DC fast charger. As with Level 2 EVSE, higher rated stations can charge PEVs faster than lower rates stations. Most level 3 EVSE utilize the unofficial standard CHAdeMO vehicle connection typical of most EVs on the market. A second Level 3 standard has recently emerged called the SAE J1772 Combo, which is a combination of the J1772 standard Level 2 connector with two additional connections for DC fast charging added to the connector assembly. Level 3 EVSE can be ordered with both CHAdeMO and J1772 Combo cord sets to accommodate drivers with both plug types. The most notable exception to typical Level 3 charging connections is Tesla PEVs. Tesla vehicles receive quick charging via a proprietary Tesla Supercharger connection.

AeroVironment

AeroVironment (AV) offers six types of DC fast charge stations. The charging stations are further broken out into public and fleet models, where in each category 30 kW, 50 kW, and 60 kW units are available. Figure 7 depicts the public version of an AV DC fast charger. The base model 50kW station costs approximately $45,000. If a volume is being considered, AV also offers volume pricing for the 50kW stations at $40,000. The cost per kW for single 50 kW units $900/kW and $800/kW for volume pricing.

Figure 7. AeroVironment's public model DC fast charger.

Point of sale options for the AV models are limited to RFID smart cards or "key fobs." However, credit card RFIDs cannot be used point of sale transactions. Furthermore, the stations do not meet California requirements for open credit card access. Thus, access to AV stations is limited to drivers who have purchased RFID key fobs, which are available for $50 each. If, however, the owner wants to permit open access to the station, the RFID access would not be necessary and would be disabled. The pricing or usage feels of the station are set by the station owner, but AV manages and processes payment transactions remotely. AV doesn't charge anything for facilitating the transactions or processing payments. However, a small fee transaction fee is charged by the credit card company before any payments are returned to the owner.

Network communication with the station is offered through AT&T cellular service provider for $240/yr. Unlike many of the EVSE on the market, AV EVSE are not OCPP compliant. If an owner were to manage both a non-AV Level 2 and an AV Level 3 station, he or she would have to use two different network and payment systems to manage the stations.

The main disadvantages to the AV stations are that the base models require 480V three-phase service and that they are not OCPP compliant. If the existing service the desired location is a only 208V three-phase, a service upgrade and step up transformer are required to meet the required 480V three-phase connection, which increases installed cost. Additionally, since AV stations are not on the OPCC, the California Energy Commission will not fund projects utilizing these technologies because they do support goals for interoperability and do not permit owners to use their own business model.

Nissan

The Nissan DC Quick Charger (Figure 8) is made by AeroVironment, but manufactured and branded for Nissan, which offers charging at 44 kW. The key advantages of the Nissan charger are its low cost and networking capabilities, while the disadvantages are its elevation limitations.

Figure 8. Nissan DC fast charger manufactured by AeroVironment.

A networked Nissan station is available for $17,500, if paid up front. This cost is considerably lower than the AV stations, which on a per kW basis amounts to less than $400/kW or less than half the cost of an AV station.

The second advantage of the Nissan station is that it's capable of utilizing the ChargePoint's On Ramp program. This makes the Nissan station more attractive because a large portion of the existing EVSE infrastructure already utilize ChargePoint's network management protocol. As described in the ChargePoint section, this network is a highly versatile network management and price setting protocol that permits the monitoring and control of all ChargePoint accessible stations.

The principle disadvantage of the Nissan station is its elevation limitation. Due to the cooling requirements, the high elevation air is too thin to provide sufficient cooling of the station. Therefore, the AV will not sell a Nissan station to an owner if the station is to be installed at a location above 1,000 meters (3,280 feet). This is a significant disadvantage because it excludes several Northern California transportation hubs along the I-5 corridor from adopting this attractive technology. For example, the mean elevation of the City of Mount Shasta is 1,099 m. However, the City of Redding for example is under the elevation limit.

An additional limitation to the Nissan station is its maximum operating temperature. The Nissan station can operate at temperatures of up to 104°F (40°C). For most places, the high temperature will not be reached. However, in dry climates inland such as Redding, if the extreme temperatures of up to 120°F are reached, the station may shut down to avoid damage.

Eaton

Eaton DC fast chargers range between 20 and 50 kW, with corresponding vehicle charge times of 36 and 23 minutes, respectively (Eaton, 2013a). Eaton did not provide cost data on their Level 3 EVSE for this report.

The key limitations of the Eaton station are similar to that of the previously discussed Nissan station. First, it suffer from the same 1000 meter elevation limitation. As a result, the application of the Eaton station is limited to lower elevation locales. The Eaton station is also limited to maximum temperature of 104°F (40°C).

The Eaton station's primary advantage is that it requires a service connection of 208V three-phase rather than 480V three-phase. The implications are that installation costs will likely be lower in most cases because 208V three-phase power is more common. Therefore, the installation time and cost associated with the Eaton DC fast chargers may be less than with stations that require 480 three-phase in some cases.

Access and payment for the use of the Eaton DC fast chargers are managed by USA Technologies ePort credit card reader and their USALive website. However, Eaton offers an optional ChargePoint payment and access control system instead of the standard model system via USA Technologies. The standard model payment payment system is managed by the ePort credit card swipe reader. The station owner can choose to set driver charging fees as time-based or session-based. For the time-based configuration, the driver pays for access in 5-minute increments. For the session-based configuration, the driver pays a one-time fee for the entire charge session. The station owner can access the usage data via the website, where the data is transmitted via a standard Modbus remote terminal unit over a built-in CDMA cellular connection.

All Eaton stations are fully compliant with the Open Charge Point Protocol (Eaton, 2013b). Therefore, station owners may choose to use the standard remote management protocol via USA technologies, utilize ChargePoint's management system, or integrate the station with an existing energy management system.

Figure 9. Eaton DC fast chargers.

Terra 53 by ABB

ABB offers a 50kW DC fast charging station utilizing either the SAE Combo (CCS) or CHAdeMO charge connection or both. The Terra 53 station's electric service requirement of 480V three-phase is similar to that of the Nissan and AeroVironment DC fast charging stations and thus, has the same service limitations. ABB did not provide cost data on their Level 3 EVSE for this report.

Management of the Terra 53 is performed using the ABB's standard Galaxy web based management software. However, the station is also compliant with the Open Charge Point Protocol, so it may be integrated with any existing management network. The Galaxy system permits monitoring, maintenance and functional upgrades providing customers with the tools necessary to gather usage statistics and reports.

The Terra 53 has various hardware options for methods of driver payment. Owners have the option choosing point of sale hardware for public access payment or hardware for fleet vehicle access. Public access point of sale hardware includes a credit card reader, but may also include smart phone access through the networking protocol. Fleet vehicles may access the station via and RFID card or a key pad.

One primary advantage of the Terra 53 is that is has an equipment option that permits operation of up to 131°F (55°C). Limited information is available on the Terra 53 because it is new to the US market.

Figure 10. The Terra 53 DC fast charger by ABB.

Rollout Plan for Data Acquisition

The information presented above was used to develop a recommended rollout plan for collection consumer charge behavior data. The plan is consists of the following elements:

1. Select OCPP compliant, networked EVSE
2. Distribute a PEV Driver Feedback Survey
3. Create Database
4. Update Database on a quarterly basis
5. Report out to the stakeholders on an annual basis

Selecting OCPP compliant, networked EVSE will enable the collection of the following data:

- Number of charge events per day
- Energy transferred per charge event
- Duration of charge
- Duration of transaction
- Time of day each charge event occurs
- Cost to EV driver to charge
- Availability (percentage of installed time that station is operational)

These data will allow the network administrator to determine:

- Station Utilization
    - This will help determine what types of locations are popular and when it is time to install another station at a popular location
- Frequency of PEVs remaining plugged in after their battery has been completely charged
    - This will help determine when it may be advantageous to implement a charging policy that requires PEVs drivers to move their vehicles within a certain period after their battery has been fully charged, which will free up the EVSE for another PEV to charge.
- Frequency of overnight charging
    - This will help administrators understand demand for overnight charging opportunities for residents that do not have access to a dedicate parking space such as urban apartment and multifamily housing development dwellers
- The relationship between charging price and station utilization
    - This will help administrators understand how effective their marketing campaign is in explaining the actual costs of operating and maintaining the network and the justification for the pricing structure
    - This will also help administrators balance pricing and utilization by providing a feedback mechanism from PEV drivers

- The reliability of various types of EVSE
    - If availability of a particular brand of EVSE is low and externalities such as vandalism have not occurred then the administrator will be able to avoid that brand of EVSE for subsequent charging station installations
- The prevalence of vandalism in particular locations
    - From recent experience in the Upstate region, certain locations are more prone to vandalism than others. Vandalism can affect the availability of stations and it will be useful for the administrator to know which areas are more prone to vandalism.
    - If utilization of stations in vandalism prone areas is low then the administrator may elect to remove the EVSE to avoid incurring repeated expenses associated with repairs.
    - If the location is highly utilized or important for safety reasons then the administrator can either harden the existing EVSE or install a new vandal resistant EVSE, if one becomes commercially available

Distributing a PEV Driver Feedback Survey and managing the data received will provide the network administrator with data that cannot be obtained from EVSE directly. A survey form was developed for the Upstate PEV Readiness Plan project and a copy is included in Appendix D1 of this report. The survey form was created using Google Forms, a free online tool that allows users to create surveys, create links to the survey for use on websites and in documents, and analyze survey results. The survey can be distributed by embedding a link on the websites of stakeholder organizations, by including the web address of the survey on printed promotional materials associated with the Upstate PEV Readiness Plan and the Upstate Plug-In Electric Vehicle Charging Network. Partnering with local auto dealers to provide handouts or business cards with each purchase of a PEV would make PEV drivers aware of the survey and the local charging station network, which could result in valuable feedback. The types of data that can be collected with the survey include the following:

- Frequency of use for each station in the network by individual drivers
- Additional locations where drivers would like to see EVSE
- Frequency of occurrences where a driver was not able to charge because the charging station was occupied by another PEV
- Frequency of occurrences where a driver attempted to use a charging station but it was unavailable due to equipment failure
- Frequency of occurrences where charging station was occupied by conventional vehicle

Once the type of EVSE to be purchase has been selected and the consumer survey has been finalized, the network administrator can design a database to store the data to be collected in a way that will facilitate analysis and reporting. A Microsoft Excel template can be created for monthly or quarterly data download/input from the EVSE and survey result tracking spreadsheet. The template can include graphs and tables to be used in reporting out to stakeholders the results of the consumer charge behavior data acquisition program. The results can be used for public outreach and to guide procurement and management decisions by the network administrator to maximize quality, value, and convenience to the PEV driver within the constraints of a non-profit cost recovery business model.

EVSE Recommendations

Networked EVSE that are OCPP compliant and capable of payment by credit card should be selected for deployment. In areas where vandalism is a concern, EVSE that are hardened with features such as a locking cord retraction system should be considered, if and when such units become commercially available.

For Level 2 EVSE, units with the highest power rating should be selected where practical so as to prevent the need for future upgrades as onboard PEV battery charger capacities increase over time towards the 1819.2 kW limit as per the SAE J1772 standard. However, the highest charge rate is not necessarily the most feasible option for all situations because this choice may trigger service upgrades that could make the project economically infeasible. SCEDC should consider installing the largest capacity Level 2 EVSE possible in a given location without triggering service upgrades. If a service upgrade is unavoidable, consider upgrading the service to support a high power Level 2 EVSE to support growth in vehicle on-board chargers in the coming years.

ClipperCreek Level 2 EVSE with the Liberty PlugIns add on seems to provide the most flexibility for installing high power, networked, OCPP compliant charging stations across a wide variety of electrical service sizes. This configuration also lends itself to development of hardened EVSE through the addition of a cord retraction system or automated locker/kiosk arrangement that could be triggered by the Liberty PlugIns system.

For Level 3 EVSE, units with both CHAdeMo and J1772 Combo plugs should be deployed on each unit to accommodate all PEVs with DC fast charge capability, except for Tesla, which has its own DC Fast Charge network specific to its cars. The additional cost to include both cords will likely be small compared to the overall project cost to install the EVSE. The voltage of the closest three-phase power connection should be considered when selecting the EVSE. Installation costs can be reduced if the EVSE input voltage and the voltage of the nearest three-phase power connection are matched. Additionally, care should be taken to deploy EVSE designed for the altitude and temperatures at the site.

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Appendix D1 – Electric Vehicle Driver Survey

Electric Vehicle Driver Survey

Thank you for taking the time to complete this survey for California's Upstate region! We hope that the information you provide will help us to improve our EV charging infrastructure in this region.

* Required

1. **What is the Make, Model, and Year of your vehicle? ***

   ....

2. **Regarding driving distances... ***
   Mark only one oval per row.

	Less than 20 miles	20 to 40 miles	40 to 60 miles	60 to 80 miles	Greater than 80 miles
How many miles do you typically drive your electric car each day?	⬭	⬭	⬭	⬭	⬭
How many miles are you comfortable driving on one charge?	⬭	⬭	⬭	⬭	⬭

3. **Please indicate how often you use the publicly available EV chargers in the Upstate Region**
   A station map can be found here: www.carstations.com
   Mark only one oval per row.

	Never	Up to once per month	Up to once a week	More than once a week
Redding, School of the Arts	⬭	⬭	⬭	⬭
Corning, Tesla Supercharger	⬭	⬭	⬭	⬭
Mt. Shasta, Tesla Supercharger	⬭	⬭	⬭	⬭
Redding, Red Lion Hotel	⬭	⬭	⬭	⬭
Yreka, Comfort Inn	⬭	⬭	⬭	⬭

4. **Are there enough publicly accessible EV charging stations in the region? ***
   If not, select "Other" and tell us where you would like to see additional EV charging stations.
   Mark only one oval.

   ⬭ Yes

   ⬭ Other: ....

5. **How much would you be willing to pay per charge event at a publicly accessible quick charge station?** *
   Note that a quick charger can charge your car from empty to 80% state of charge in 20-30 minutes.
   Mark only one oval.

   - Less than $5 per charge event
   - Between $5 and $10
   - Between $10 and $15
   - Between $15 and $20
   - Greater than $20

6. **What is the maximum amount you would pay per hour for regular charging at a publicly accessible Level 2 EV charger?** *
   Charging at home ranges from $0.10 / kWh to $0.30 / kWh, depending on the time of day and rate schedule.
   Mark only one oval.

   - $0.20 / kWh (~$7 for 100 miles of range)
   - $0.30 / kWh (~$10 for 100 miles of range)
   - $0.40 / kWh (~$13 for 100 miles of range)
   - $0.50 / kWh (~$17 for 100 miles of range)

7. **How satisfied are you with your decision to become an electric vehicle driver?**
   Mark only one oval.

	1	2	3	4	5	
Very Dissatisfied						Very Satisfied

8. **Do you have a preferred manufacturer of EV charging equipment?**
   If yes, please specify which manufacturer and why. Otherwise leave blank.

9. **Do you think a pricing structure designed to recover the cost of electricity and charging station maintenance/administration overhead is fair for publically accessible EV charging stations?** *

Mark only one oval.

- Yes
- No
- I'm not sure, I charge at home

10. **Are you willing to participate in future surveys on this topic to help guide the rollout of EV charging infrastructure in the region? If so, please enter your email address below.**
Please note that your email address will not be sold, shared, or distributed to third parties.

11. **Comments / Questions / Experiences**
Please share anything else about EV charging in Humboldt that you think is important.

APPENDIX E
Task 7 Plan for Streamlining EVSE Permitting, Installation, and Inspection

Upstate Plug-In Vehicle Readiness Plan

Task 7 Plan for Streamlining EVCS Permitting, Installation, and Inspection

Prepared for

Siskiyou County Economic Development Council

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October 2014

Revision: Draft

Table of Contents

Introduction 1
Purpose 1
Need 1
Scope of Work 1
Summary of the EVCS Permitting Process 2
Electric Utility 2
Building Department 3
Planning Department 4
CEQA 4
Zoning 4
General Plan Considerations 4
Current Practice for EVCS permitting in the Upstate Region 6
Siskiyou County, Yreka, Weed, Mt. Shasta, and Dunsmuir 6
Shasta County 7
Tehama County 7
City of Redding 7
City of Red Bluff 7
City of Corning 8
Best Practices Examples from Other Communities 8
Minor Work Designation 8
Online Permitting 8
Over the Counter Permitting 8
Plan Check 9
City of Sebastopol 9
City of Sacramento 9
City of San Diego 10
Atlanta Permitting Process 10
Recommendations for Streamlining EVCS Permitting Processes in the Upstate Region 10
Recommended EVCS Permitting and Installation Guide 11
Residential Installations 11
Multifamily Residential Installations 11
Publically Accessible Installations 12

List of Tables

Table 1: Summary of Electrical Codes Applicable to EVCS Installations 3
Table 2: Electric Vehicle Inclusion in Local General Planning Documents 5
Table 3: Summary of language supporting PEVs from Siskiyou County Community Planning Documents 5
Table 4: Summary of language supporting PEVs from Shasta County Community Planning Documents .. 5
Table 5: Summary of language supporting PEVs from Tehama County Community Planning Documents 6
Table 6: Summary of language supporting PEVs from City of Redding Community Planning Documents . 6

List of Figures

Figure 1: Flowchart of EVCS Permitting Process 2

List of Appendices

Appendix E1: City of Irvine EVCS Permit Worksheet
Appendix E2: Sample Level 2 EVCS Load Calculation
Appendix E3: Publically Available EVCS Accessibility Guidelines

Introduction

The City of Mt. Shasta was awarded a grant from the California Energy Commission to develop the Upstate Plug-In Electric Vehicle Readiness Plan (Plan). The Plan presents a framework for installing, operating and maintaining electric vehicle charging infrastructure throughout Siskiyou, Shasta, and Tehama counties (Upstate Region). The overall Readiness Plan is highlighted through a series of reports developed for this project. A separate report identified potentially preferred locations for the installation of charging stations. This report presents a Plan for Streamlining Electric Vehicle Charging Station (EVCS) Permitting, Installation, and Inspection to aid in the implementation process.

This report summarizes the EVCS permitting process, describes the roles of the various authorities involved in the approval process, describes the current practices in the Upstate Region, summarizes best practices from the experiences of other communities, and provides recommendations for streamlining EVCS permitting processes.

For reference, EVCS are available at three different power levels that support different rates of plug-in electric (PEV) charging. The permitting requirements for the three different charging levels vary due to differences in the character of the required electrical service. The three charging levels are defined as follows:

- Level 1 (L1) charging provides alternating current (AC) electricity to the PEV from a 120 volt (V), 20 amp (A) circuit.
- Level 2 (L2) charging provides AC electricity to the PEV from a 240 V circuit with currents up to 80 A[1].
- Level 3 (L3) charging is also referred to as DC fast charging, provides direct current electricity to the PEV and the AC feeder capacity to the EVCS is typically 208 or 480 V, 3 phase with currents up to 400 amps.

These three charge levels are referred to throughout this document.

Purpose

The purpose of this report is to present a plan to streamline EVCS permitting, installation and inspection in the Upstate Region that is based on an assessment of current practices in the region and lessons learned from other communities.

Need

In recent years, modern, mass produced plug-in electric vehicles have entered the consumer marketplace. Federal and State governments have enacted policies that incentivize the production, sale, and use of these vehicles as part of a strategy to reduce greenhouse gas emissions from the transportation sector. Since PEV transportation and EVCS are relatively new to the mass market, local planning and building department staff are often unfamiliar with the technology, which can lead to delays and increased costs for permitting EVCS. These delays and increased costs can constitute a barrier to PEV adoption as potential PEV and EVCS owners could become discouraged by unnecessarily difficult permitting and installation processes and elect to stay with the internal combustion vehicle and fueling paradigm. In order to help meet Federal and State PEV adoption targets, it is important to streamline the ECVS installation process and reduce disincentives to consumers as much as is practical.

Scope of Work

The scope of work for this report is to review the current status of EVCS permitting in the major jurisdictions within the Upstate Region, provide a summary of model EVCS permitting practices from communities outside the region, and develop a plan to streamline EVCS permitting in the Upstate Region.

[1] Typically Level 2 charging occurs at 30 A; however, up to 80 A is allowed under the Society of Automotive Engineers J1772 Standard

Summary of the EVCS Permitting Process

The general process of EVCS permitting involves the steps illustrated in the below flowchart.

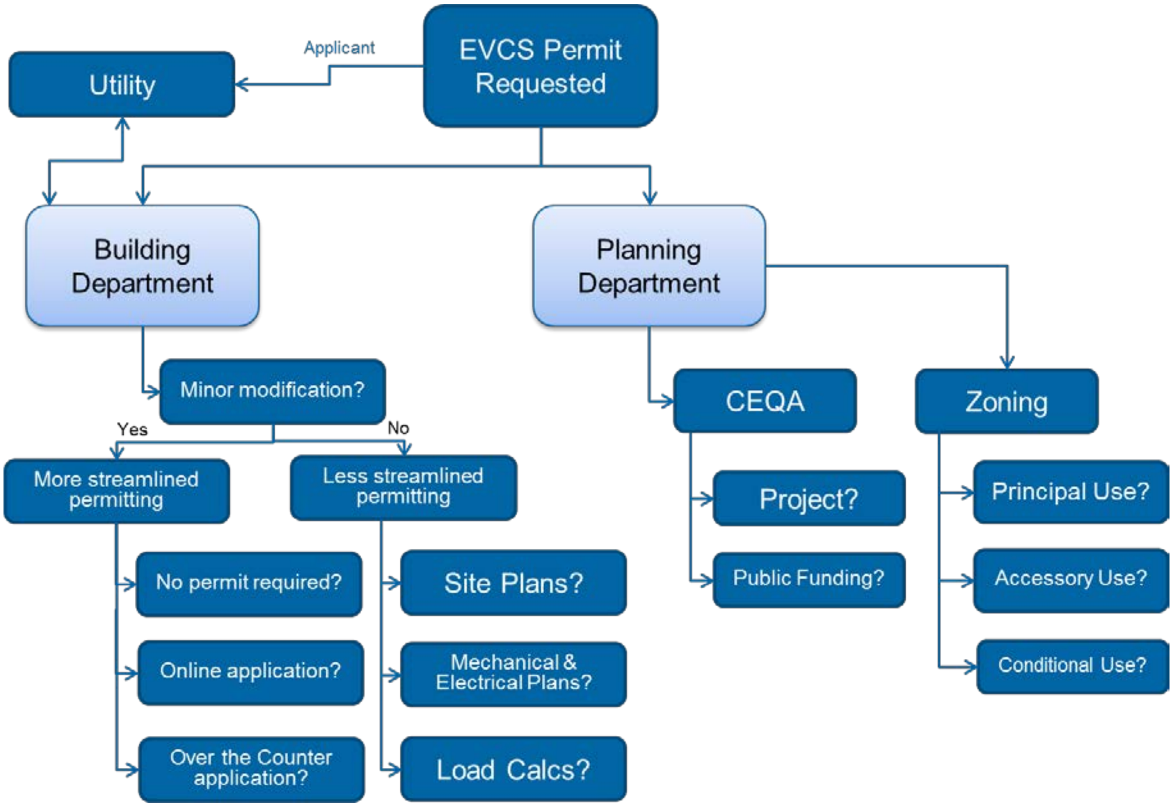

Figure 1: Flowchart of EVCS Permitting Process

Note: CEQA is an acronym for the California Environmental Quality Act.

As shown in Figure 1, the permitting process starts with the applicant notifying the building department and the electric utility (EU). Notifying the EU may be overlooked by the applicant because the building department will involve the EU as appropriate for the type of EVCS installation under consideration. The building department will guide the applicant through the process and determine to what extent the planning department needs to be involved in the process. Ideally, for simple installations, the permit may be issued over the counter without involvement of other entities. In practice, building department staff may have difficulty guiding consumers through the process because they are unfamiliar with the technology. The roles of the entities shown in Figure 1 are described in further detail below.

Electric Utility

The EU will become involved in the permitting process anytime there are modifications required upstream of a given customer's meter to support the EVCS and, generally speaking, the EU needs to be informed when a customer's load changes significantly. This can occur when the addition of EVCS at a given facility triggers a need for a service upgrade to accommodate the increased load, or when a new service is requested at a specific location to support the installation of EVCS. In the former case, the EU may upgrade their electrical infrastructure as needed to support the expanded service requirements at no cost to the customer or cost share participation may be required. In the latter case, the EU will typically evaluate the request and estimate the potential revenue from the new load. If the potential revenue to the EU is high, the cost to the owner of the new load is low. If the potential revenue to the EU is low, the cost to the owner is higher. If the EU is involved in a given EVCS installation, the building department will not close the permit until all of the checks and inspections required by the EU have been completed.

Building Department

The building department is responsible for issuing a permit for the EVCS installation after verification that all applicable requirements have been met. For private commercial and residential installation of L1 and L2 EVCS, the character of the work is analogous to installing an additional electrical outlet. The primary purpose of the permitting process in this case to verify that the existing electrical service has the capacity to safely support additional load from the EVCS as per the National Electric Code and any local codes that are applicable.

For publically accessible L2 EVCS additional considerations can arise such as land use zoning, environmental impacts of construction, encroachment on required dimensions for sidewalks and parking stalls, accessibility guidelines, and illumination requirements among others. For L3 EVCS, the EU is typically involved throughout the permitting process due to the intensity and character of the new electrical load.

As shown in Figure 1, the key differentiator is whether or not the EVCS can be considered a “minor modification” by the building department. If this is the case then it becomes relatively easy to streamline the permitting process for the applicant. Examples of permitting processes in other communities where installation of EVCS is considered minor work are provided in a subsequent section below.

If a given EVCS installation involves an electrical service upgrade or significant site work, for example, then the building department may not consider the installation to be “minor work” and a more complex and costly permitting process could result. Site plans, electrical plans, load calculations and zoning reviews could be required to allow the building department to fully evaluate a permit application for certain installation. For residential load calculations, Article 220 of the California Electric Code (CEC) is used to determine if the addition of the EVCS installation will result in an increase in service capacity for the host facility.

A summary of the electrical codes applicable to EVCS installations are shown in Table 1 below.

Table 1: Summary of Electrical Codes Applicable to EVCS Installations

CEC Section #	Summary of Requirements
625.13	Cords and plugs may not have exposed parts
625.24	Cords and plugs must be grounded
625.9	EV connectors shall not be interchangeable with other receptacles and shall have a grounding pole that connects first and disconnects last
625.15	EVSE[1] shall be marked “For use with Electric Vehicles”
625.23	If the EVSE is 60 A or larger and greater than 150 V to ground, then a disconnect must be installed within site of the EVSE and be capable of being locked in the open position.
625.30	EVSE connector shall be mounted at least 2 feet but not more than 4 feet above ground
625.17	EVSE cable shall not be longer than 25 feet unless equipped with a cable management system that is part of the listed EVSE
Notes: 1) EVSE stands for Electric Vehicle Support Equipment	

A building department may request a mechanical plan as part of the permit application. Such a request would reflect a historic need to provide mechanical venting for interior spaces used for PEV charging when battery chemistries allowed venting of explosive gases during charging. Due to advances in battery technology, venting is very rarely required for interior spaces used for charging commercially available PEVs. In general, building department staff are aware that requiring mechanical venting plans is not applicable to modern EVCS installations.

Planning Department

The planning department will become involved in the EVCS permitting process upon request of the building department. This typically occurs when the proposed installation may cause environmental impacts or conflict with zoning ordinances.

CEQA

In California, the environmental review is conducted under the CEQA framework and the first step is to determine whether or not the proposed installation is a “project.” Jurisdictions often consider typical EVCS installations to be minor modifications and therefore not “projects” under CEQA, in which case no further environmental analysis is required. However, if public funding is being used for the installation, then the CEQA process must be followed regardless of whether or not the installation is considered a project.

The next step in the process is to determine whether or not the installation is exempt from further analysis under CEQA. A reviewer may consider a given installation a “project” under CEQA and then determine that it qualifies for one of several possible exemptions such as: The project is ministerial in nature, there is no possible significant effect from the project, or the project qualifies for either a statutory or categorical exemption. Commonly filed exemptions for EVCS are:

- 15301 (Class 1) for Existing Facilities
- 15303 (Class 3) for Small Structures
- 15304 (Class 4) for Minor Alterations to Land

If a given installation is considered a non-exempt project then there is the potential for a significant environmental impact and a CEQA document is required. An initial study would be prepared to determine whether a mitigated negative declaration or an environmental impact report would be required.

Zoning

Zoning ordinances describe what types of uses are permissible on a given real property based on the community’s general plan document. Zoning ordinances will list principal uses for each type of land use zone in the community. If the proposed use is not listed as a principal use then, it may be considered an accessory use to a listed principally permitted use, or a conditional use permit would typically be required to allow the proposed use. As an alternative to the conditional use permit, the project proponent can request that the zoning type for the property in question be changed to a zoning type that includes the intended use among its principally permitted uses. Obtaining a conditional use permit is significantly less involved than re-zoning a property; however both processes are lengthy and costly in most cases.

Since PEV transportation and EVCS are new to the mass market, electric vehicle charging is rarely listed as a principally permitted use in zoning ordinances. Common best practice is for EVCS to be considered an accessory or similar use to a variety of principally permitted uses, whenever possible. This is reasonable because any use that involves vehicle traffic through the site is supported by EVCS when vehicular traffic is comprised of both conventional vehicles and PEVs. EVCS support the principally permitted use by enabling PEV drivers to use the site. PEVs generally require longer “fuelling” times at destination locations as opposed to the current gasoline station model for conventional vehicles. EVCS can be considered an accessory to the principally permitted use of the destination.

In the event where the sole purpose of a given property becomes PEV charging, for example a niche commercial facility catering specifically to charging needs of PEV drivers, a conditional use permit would likely be required since PEV charging is too new to be listed as a principally permitted use under any zoning classification.

General Plan Considerations

A community’s general plan can play an important role in streamlining EVCS permitting processes. If the general plan includes policies to promote the adoption of PEVs then it is more likely that PEV charging will be listed as a principally permitted use across a wide range of zoning types. Also, the building and planning departments have a stronger foundation for making the permitting process as fast and inexpensive as possible.

Incidence of Language Supporting PEV Transportation in Local General Plans

A review of the general plans for the jurisdictions in the Upstate Region was conducted and the results are presented below.

Table 2: Electric Vehicle Inclusion in Local General Planning Documents

Jurisdiction	EVs or alternative fueled vehicles mentioned in General Plan?
Siskiyou County	Yes
Shasta County	Yes
Tehama County	Yes
City of Yreka	No
City of Weed	No
City of Mt. Shasta	No
City of Dunsmuir	No
City of Redding	Yes
City of Red Bluff	No
City of Corning	No

As can be seen in Table 2, the general plans for four jurisdictions in in the Upstate Region contain mention of PEVs or alternative fueled vehicles. Table 3 through Table 6 provide summaries for these instances.

Table 3: Summary of language supporting PEVs from Siskiyou County Community Planning Documents

Section	Summary
Energy Element, pp 66	Efficiency Potentials, Transportation. Opportunity identified for increasing the efficiency of transportation fuel use and shifting to cost-effective alternative fuels.

Table 4: Summary of language supporting PEVs from Shasta County Community Planning Documents

Section	Summary
Climate Action Plan	Reference to State Low Carbon Fuel Standard
Energy Section of General Plan	Role of Government: As a large consumer of energy, government can use its own actions as models for energy conservation and planning. Through its actions local government may elect to act as a provider of incentives that encourage energy conservation. For example, conversion of an agency's vehicle fleet to alternative fuels could stimulate other firms to do the same.
Policy 6.4.4, E-j	The County should continue to implement plans to convert more of its vehicle fleet to hybrid or alternative fuels that meet or exceed air quality standards.

Table 5: Summary of language supporting PEVs from Tehama County Community Planning Documents

Section	Summary
Air Quality Impact Mitigations	Promote Transportation Alternatives, Support Green Fuels, Reduce GHG emissions from transportation. Consider model clean vehicle requirements.
Implementation Measure OS-2.6g	Support vehicle improvements and the use of clean vehicles that reduce emissions and improve air quality.
Implementation Measure OS-2.6h	Replace the County's fleet vehicles with new vehicles that utilize the lowest emission technology available, whenever economically feasible.

Table 6: Summary of language supporting PEVs from City of Redding Community Planning Documents

Section	Summary
Air Quality Element	While the electrical car has the greatest potential for addressing air quality issues, its omnipresence on the roads and general public acceptance parallel to that of the combustion vehicle is probably many years away.
Policy 13	New Transportation Technology, Implementation Strategy: The City will monitor advancements in new technology regarding electric vehicles and cleaner burning combustion vehicles to ensure that future land-use and transportation systems can easily interface with technology when it is available and where reasonable. The City will pursue the development of Joint Venture projects involved in new technology.
Policy 15	The City should adopt a schedule to replace or convert conventional fuel vehicles with alternative fuel vehicles as rapidly as feasible based on available funds.
Section F. Level B measures, Item 4:	Convert fleet vehicles to clean-burning fuel as appropriate

This supporting language in local community planning documents is valuable for use in encourage policy development to streamline the EVCS permitting processes in these communities.

Current Practice for EVCS permitting in the Upstate Region

Current EVCS permitting practices for jurisdictions in the Upstate Region were reviewed and the results are summarized in this section. None of the jurisdictions in the region have permitting processes specific to EVCS installations.

Siskiyou County, Yreka, Weed, Mt. Shasta, and Dunsmuir

Richard Kinsman, the Planning Director, was contacted to discuss EVCS permitting in Siskiyou County. Mr. Kinsman indicated that he was making a list of code revisions and that revisions for EVCS permitting could be included such as including them as a conditionally permitted use for some commercial zoning classifications. Currently EVCS would be allowed by right in the highway commercial zoning classification.

Mr. Kinsman also spoke with building official Mike Crawford, who related that he hadn't had any applications for electrical service upgrades to accommodate in-home EV charging, though he also acknowledged that these types of minor service upgrades don't typically result in permit requests. Mr. Crawford indicated that he hasn't had any inquiries regarding commercial charging stations yet.

Mr. Crawford subsequently called the City of Yreka's building official and a contract building official for the cities of Mount Shasta, Dunsmuir, and Weed and they reported that the only EV-related permits they've issued were for the one L2 Tesla charging station in Yreka at the Comfort Inn and the four Tesla charging stations at the Tree House Inn in Mount Shasta. The contract building official also reported that there have been no permit requests for residential EV charging stations in Yreka, Mt. Shasta, Dunsmuir, and Weed.

Shasta County

Building Division Manager Dale Fletcher was contacted to discuss EVCS permitting in Shasta County. Mr. Fletcher indicated that no commercial permits have crossed his desk yet and he has completed "a couple of residential permits." Mr. Fletcher related that for typical EVCS installation the process would be "over the counter" with a plan review and the permit fee would be on the order of $200. The process would include a quick zone review where the particular parcel would be reviewed. Shasta county has a policy that requires a property to be brought up to code if are any code violations are noted during the permitting and inspection processes. Mr. Fletcher did not see any additional permitting requirements for L3 installations but noted that each permit application would be reviewed on a case by case basis.

Tehama County

Bob Halpin of the Tehama County Planning Department and John Stover, the Building Official for Tehama County were consulted regarding EVCS permitting processes in Tehama County. Neither Mr. Halpin nor Mr. Stover has had an EVCS permit application come to their attention.

City of Redding

Development Services Supervisor, Erich Mayne, was contacted regarding EVCS permitting in the City of Redding. Mr. Mayne indicated that to his knowledge his department had not processed any permit applications for EVCS. Mr. Mayne indicated that permitting a typical residential EVCS installation should be a routine over the counter process and that permit fees would depend on the cost of the project and would follow the department's fee schedule. Since the City of Redding has its own electric utility, Redding Electric Utility, there is some streamlining for EVCS built into the process. The EU will, by default, be involved in the permitting process and their input on a given permit application will under one jurisdiction rather than two. As for new measures to streamline the permitting process, some experience processing permits for EVCS within the department would be helpful in identifying potential opportunities.

City of Red Bluff

The City of Red Bluff Building Department was contacted and staff recommended talking to Eduardo Griego (surname not provided), the counter technician. Mr. Griego related that the department had not had any commercial or residential EVCS permit applications to date. After a discussion regarding the technology, Mr. Griego related that it sounded like the permitting process for L2 EVCS would be routine. For L3 EVCS it may be more involved due the higher operating voltage. For both L2 and L3 EVCS Mr. Griego indicated that they would likely need to process a few permits before opportunities for streamlining could be discussed.

The City of Red Bluff Planning Department Director, Scot Timboe was contacted to discuss EVCS permitting from a planning perspective. Mr. Timboe indicated that he would likely handle the zoning review using a "similar use" finding unless the subject project involved exclusive use of a property for EV charging. Mr. Timboe indicated that the Community Development Director can make the decision to issue a similar use finding or, if an application is controversial, then they could put it on the Planning Commission's agenda, in which case the City Manager would also be consulted. Mr. Timboe stated that he did not see a reason to create a new regulation adding to the complexity of the process because, based on his understanding, EVCS are not radically different than other technology currently being permitted and it would be more efficient to use the existing regulatory framework.

City of Corning

Efforts were made to contact Terry Huford and John Stoffer of the City of Corning to discuss EVCS permitting from both planning and building department perspectives however no contact had been made at the time of this writing.

Best Practices Examples from Other Communities

There are several communities throughout the United States that have taken steps to streamline their EVCS permitting processes. This section presents a number of examples of such efforts beginning with examples where the installation of EVCS is considered minor work.

Minor Work Designation

The following two examples demonstrate cases where EVCS permitting was streamlined by categorizing certain installations as “minor work.”

- In the state of New Jersey, the installation of residential EVCS is considered “minor work.” The applicant is required to provide verbal notification to the code enforcement agency prior to commencing installation. Then a permit application must be filed within five days of the notification.
- The state of Oregon has expanded its “minor label” program to include EVCS installations. Licenced electricians can purchase a booklet of 10 minor installation labels for EVCS.
    - Certain design restrictions apply.
    - The cost is approximately 10% of the cost for a standard permit.
    - One tenth of the minor installations get inspected.

Online Permitting

Allowing permits for EVCS installations to be issued through an online process is a recent development that speeds up the process and reduces costs. The following examples demonstrate online permitting process being used in other communities.

- The city of Houston Texas offers online express permitting for EVCS installations. Online permits are issued automatically and instantaneously for standard EVCS installations and inspection typically occurs on the day of installation.
- The city of Los Angeles California offers online permitting for EVCS installations. Owners are allowed to start using their EVCS immediately upon installation and inspection typically occurs within 24 hours after installation.
- In San Francisco California, electricians that are registered with the building department can obtain permits for EVCS installation instantly online.
- In Charlotte North Carolina, there are two options for online EVCS permits; one for homeowners and one for contractors. The introduction of these processes has reduced the turnaround time for permits to between one and two days.

Over the Counter Permitting

Providing over-the-counter permits for EVCS installations is common practice in many communities across the United States. In this process, the applicant is typically walked through the permitting process by building department staff and the permit can be issued in about one hour. Inspections are then scheduled to coincide with the installation. The following examples demonstrate over the counter EVCS permitting processes used in other communities.

- Raleigh North Carolina applied its existing “stand alone” permitting process to EVCS permitting. The applicant is walked through the process at the counter and the process typically takes approximately one hour. Inspection can occur as early as the following day.
- The San Francisco building department issues same-day over the counter permits for residential EVCS
- The City of Irvine has developed an over the counter permit worksheet. The worksheet provides a streamlined permitting process for residential EVCS installations where the sub panel servicing

the installation is rate at 100 A or more. The worksheet requires that the applicant have basic knowledge of the size of the electrical service panel, the nameplate rating of the EVCS they wish to install, the square footage of their home, and the number and type of lighting circuits and major appliances in their home. The City of Irvine EVCS permitting worksheet is included in Appendix E1.

Plan Check

In the case where some aspect of the EVCS installation causes the need for a more thorough review of the proposed work, a more involved process involving a plan check is typically required. This process will typically include the following requirements:

- Building permit application
- Site Plan
- Electrical Plan
- Load Calculations
- Inspection

The building permit application itself is similar to what would be filled out under the online and over the counter permitting scenarios however it will be less specific to EVCS installations. The site plan will show the property boundary, outlines of structures, locations of existing utilities, dimensions, and location of proposed EVCS and feeder circuit. The electrical plan will include a single line diagram, a panel schedule, load calculations, and a plan showing the circuit layout, conduit and wire size and type, and any details relevant to the installation. Depending on the requirements of a given building department, it may be required to have an appropriately licenced professional prepare the electrical plan for the EVCS installation

Examples of specific permitting processes for EVCS installations that have been specified by other jurisdictions are summarized below.

City of Sebastopol

The City of Sebastopol provides some guidance to the permitting process for installation of EVCS. The steps they suggest are:

1. Determine level of service required (level 1 or 2 charging station).
2. Evaluate existing electrical service, include load and circuit size, and determine if upgrade is required.
3. Produce wiring plan.
4. Determine if second meter will be required.
5. Determine installation location.
6. Obtain Permit.
7. Perform installation.
8. Inspect installation.
    a. A copy of the manufacturers installation guide is required on site for inspector.

City of Sacramento

The City of Sacramento has a guide to EVCS permitting. The following steps are provided by the streamline guide:

1. Determine level of charging required.
2. Have an electrical contractor evaluate the load of the place of installation.
3. Determine if a new meter or sub-meter will be required.
    a. Time-of-Use rates apply in the City based on Sacramento Municipal Utility District "Residential Time-of-Use Electric Vehicle (RTEV) rates. In order to receive these rates a separate meter or a sub-meter must be installed which requires a building permit.
4. Submit application, fees and required documents to the City Permit Center.

    a. Required documents include: load check/evaluation, electrical plans (wiring), specifications of EVCS to be installed, and mechanical plans (if required for ventilation).
5. Obtain building permit.
6. Complete installation.
7. Schedule and complete installation inspection.
8. Connect to existing utility.

City of San Diego

The City of San Diego issued an Information Bulletin providing guidance to how to obtain proper permitting for EVCS. The City also provides a general idea of the cost of the permitting and inspection process in the bulletin. The process they suggest is:

1. Complete general application.
2. Gather necessary documents and plans.
    a. Site plan, floor plan, electrical plan and load calculations are required.
    b. If in publicly accessible area, disabled accessibility plans are required.
3. Obtain electrical/building permit(s).
4. Install EVCS.
5. Complete inspection.

Atlanta Permitting Process

The City of Atlanta has a permitting process in place for installation of EVCS. The City does not require a permit for the standard level 1 charging station, as the standard 120 volt outlet will not require modifications to the electrical system. Level 2 charging stations that require wiring to the electrical system require a permit for installation, and the following steps have been outlined to streamline the permitting process.

1. Select licensed electrical contractor to make installation.
2. The party fills out “Atlanta’s Electrical Permit Form” along with the contractor.
3. Contractor submits the completed from and fees to the Office of Buildings.
4. Applications will then be reviewed and permits issued.
5. Electrical contractor can then perform the installation.
6. Installation is inspected by the Office of Buildings.
    a. Failed inspections can be re-inspected at a fee of $50, for up to three times.

Recommendations for Streamlining EVCS Permitting Processes in the Upstate Region

The follow actions are recommended to streamline the EVCS Permitting process in the Upstate Region:

1. Include policies to encourage PEV transportation in community planning documents as part of document update cycles
2. List PEV charging as a permitted use across a broad range of zoning classifications
3. If a zoning review is triggered, consider the EVCS as an accessory or similar use to another permitted use whenever possible.
4. Develop a standard EVCS permitting process that can be used across the Upstate Region for typical residential installations that meet the following criteria:
    a. EVCS is not accessible to the public
    b. EVCS is located within 25 feet of main electrical panel
    c. Results of load calculation worksheet indicates that the existing main electrical panel for the building is adequate
        i. A sample load calculation worksheet developed by the Governor’s Office of Planning and Research (OPR) is included in Appendix E2

    d. Advertise the standardized process for residential permits at car dealerships, building department counters and websites.
    e. Allow the standardized process to be completed using an over-the-counter permitting approach
5. Establish a permit fee structure specifically for EVCS installations making fees as low as possible for each jurisdiction
6. Allow second meters for EVCS to enable PEV driver access to lower rates for PEV charging provided by utilities

Note that implementing an online permitting process for EVCS installations does not appear to be a practical goal in the Upstate Region because online permitting is not currently used in the region and establishing such a system solely for EVCS permitting is not warranted.

Recommended EVCS Permitting and Installation Guide

The following brief guide summarizes the recommended steps for installing EVCS in residential, multifamily, and publically accessible commercial settings.

Residential Installations

1. Determine specifics of vehicle charging requirements from manufacturer of your specific vehicle
2. Check with Electric Utility regarding rate schedules, metering, and electrical service requirements
3. Check with your building department to:
    a. Determine what the permitting requirements for your EVCS installation
    b. Determine whether or not a second electricity meter is allowed for your vehicle
4. Decide where you want to place your EVCS at your residence
    a. If you decide on an outdoor location, make sure that you select an EVCS that is rated for outdoor service
5. Determine whether or not your home's existing electrical service is adequate to supply the selected EVCS
    a. EVCS are considered continuous duty loads so circuit breaker must be rated for 125% of nameplate rating on EVCS
6. Select an electrical contractor if required or desired
    a. Check to make sure their license for electrical work is current
7. Develop installation plans if required by building department for your installation
    a. Site plan, electrical plan with single line diagram and panel schedule, and specification sheet for your EVCS are typically required
8. Apply for building permit
9. Order EVCS and any additional required materials
10. Install EVCS
11. Notify building department that you are ready for an inspection
    a. Make any required changes as a result of the inspection
    b. Building department will notify electric utility when the installation has passed inspection

Multifamily Residential Installations

There are additional considerations for EVCS installations at multifamily unit (MFU) dwellings. If the owner of the MFU decides to install the EVCS as part of the infrastructure offered to tenants, then the process above can be followed. While the property owner will not know the specifics of the types of vehicles that will be use the EVCS, the connections between today's commercially available PEVs and EVCS are standardized to allow interoperability.

If a tenant living in the MFU wishes to install EVCS to support a PEV they have purchased or intend to purchase, then they must obtain permission of the owner of the facility. If the owner will not finance the installation and the tenant obtains approval and proceeds with the installation, then the tenant will need to accept that when they move away from the MFU, the electrical circuit installed to support the EVCS will remain the property of the owner. Level 1 chargers are most applicable in this situation since they are inexpensive to install and can be used for other purposes besides PEV charging.

Publically Accessible Installations

Commercial businesses, municipalities, and institutions may desire to install publically accessible charging stations to increase patronage or as a public service. These types of installations follow a similar process as described above for residential EVCS. However, the following additional considerations are likely to apply:

1. Determine whether or not you want to the PEV drivers using the station to pay for use or not.
    a. If yes, then select EVCS that has pay by credit card capability
    b. If no, then any EVCS can be used
2. Determine whether to install Level 2 or Level 3 chargers
3. Determine where in parking lot to install the EVCS accounting for accessibility guidelines as published by the OPR
    a. The first of 25 publically accessible EVCS installed in a given parking lot should be designed for accessibility, including a parking space and access aisle with specific dimensions
    b. Complete details are available in the OPR's guidelines entitled " Plug-in Electric Vehicles: Universal Charging Access Guidelines and Best Practices", which is attached as Appendix E3.
4. Develop site plan with civil engineer, contractor, or other appropriately licenced entity
    a. Include way finding signage at ingress to parking lot
5. Develop electrical plan with electrical engineer, electrical contractor, or other appropriately licensed entity
    a. EVCS are considered continuous duty loads so circuit breaker must be rated for 125% of nameplate rating on EVCS.
6. Apply for permit
7. Make any changes to plans required upon review of permit application by building department
8. Obtain permit
9. Construct project

Appendix E1: City of Irvine EVCS Permit Worksheet

COMMUNITY DEVELOPMENT
Building and Safety

ELECTRIC VEHICLE SERVICE EQUIPMENT OVER THE COUNTER PERMIT WORKSHEET

This worksheet may be used to obtain an electrical permit to install Electric Vehicle Service Equipment (EVSE) in a garage or carport serving a single family home, or within a private garage serving a condominium provided the electrical service or subpanel serving the installation is rated for 100 Amps or more.

NOTE:

1. Permits for battery chargers or EVSE installations within common area garages or parking areas require a plan to be submitted for review.
2. Installations served by an electrical service of subpanel rated for less than 100 Amps can not be permitted using this worksheet as justification, using the Standard Method of Part III Feeders and Service Load Calculations of Article 220 of the California Electrical Code is required.

PROJECT ADDRESS

THE PROPOSED INSTALLATION WILL SERVE (Check one)

☐ SINGLE FAMILY DWELLING; The location of the EVSE is within a private garage or carport.

☐ CONDOMINIUM; The location of the EVSE is within a private garage.

ELECTRIC SERVICE (Check the size of the electric service or subpanel serving the proposed installation)

☐ 100 Amps ☐ 200 Amps ☐ OTHER; Specify: ____________________

ELECTRIC VEHICLE SERVICE EQUIPMENT - The EVSE must be listed and installed per its listing and rated for outdoor use if not within an enclosed garage.

EVSE NAMEPLATE RATING (Check one)

☐ 20 Amps/120 volts ☐ 20 Amps/240 volts ☐ 40 Amps/240 volts

If the service size is 100 Amps or greater, and the EVSE does not exceed 20 Amps, no additional information is necessary.

If the EVSE exceeds 20 Amps, complete the following EVSE LOAD CALCULATION WORKSHEET to demonstrate the current electrical service or subpanel capacity is sufficient.

____________________ ____________________
SIGNATURE PRINT NAME

____
DATE

EVSE LOAD CALCULATION WORKSHEET

PROJECT ADDRESS

GENERAL LIGHTING LOAD Your home's square footage: ____________ X 3 VA = ____________

Small appliance branch circuits (2 min.) 1500 VA X ____________ circuits ____________

Laundry circuit 1500 VA X ____________ circuit(s) ____________

APPLICANCES AND EQUIPMENT - Values are minimums, use actual values if known to be greater. Enter N/A if not present at project site.

Microwave (in dedicated space)	*1300*	____________
Compactor	*1000*	____________
Dishwasher	*1200*	____________
Disposal	*800*	____________
Proposed EVSE circuit	*7200*	____________
Pool/Spa Pump 1 horsepower	*1920*	____________
Pool/Spa Pump 1.5horsepower	*2400*	____________
Pool/Spa Pump 2 horsepower	*2880*	____________
____________		____________
____________		____________
____________		____________

*Attach additional sheets if needed

Subtotal (A) ____________

Subtotal (A) minus 10,000 VA ____________ **X 0.40 =** ____________

plus 10,000

Subtotal (B) ____________

Total A/C Load, use nameplate rating or A/C circuit breaker rating (C) ____________

D = (B) + (C) ____________

Total demand is D / 240V = ____________ Amps. If this value is less than the rating of the existing electrical service or subpanel NO service or subpanel upgrade is necessary. If the value is greater, an EVSE permit may only be issued if a panel upgrade is included with the work; a subpanel upgrade requires a plan submittal.

PLAN CHECKER NOTES

Appendix E2: Sample Level 2 EVCS Load Calculation

Plug-In Electric Vehicle Load Calculator for Level 2 Charging

INSTRUCTIONS: Review the list of electrical loads in the table below and check all that exist in your home (don't forget to include the proposed Level 2 charger). For each item checked, fill in the corresponding "Watts Used" (refer to the "Typical Usage" column for wattage information). Add up all of the numbers that are written in the "Watts Used" column and write that number in the "TOTAL WATTS USED" box at the bottom of the table, then go to the next page to determine if your existing electric service will accommodate the new loads.

(Loads shown are rough estimates; actual loads may vary. For a more precise analysis, use the nameplate ratings for appliances and other loads and consult with a trained electrical professional.)

Check all Applicable Loads (✓)	Description of Load	Typical Usage	Watts Used
	GENERAL LIGHTING AND RECEPTABLE OUTLET CIRCUITS		
✔	Multiply the square footage of house x 3	3 watts/sq. ft.	4500
	KITCHEN CIRCUITS		
✔	Kitchen circuits	3,000 watts	3000
☐	Electric oven	2,000 watts	
☐	Electric stove top	5,000 watts	
✔	Microwave	1,500 watts	1500
✔	Garbage disposal under kitchen sink	1,000 watts	1000
✔	Automatic dish washer	3,500 watts	3500
☐	Garbage compactor	1,000 watts	
☐	Instantaneous hot water at sink	1,500 watts	
	LAUNDRY CIRCUIT		
✔	Laundry circuit	1,500 watts	1500
☐	Electric clothes dryer	4,500 watts	
	HEATING AND AIR CONDITIONING CIRCUITS		
☐	Central heating and air conditioning	6,000 watts	6000
☐	Window mounted air conditioning	1,000 watts	
☐	Whole-house or attic fan	500 watts	
☐	Central electric furnace	8,000 watts	
☐	Evaporative cooler	500 watts	
	OTHER ELECTRICAL LOADS		
☐	Electric water heater (storage type)	4,000 watts	
☐	Electric tankless water heater	15,000 watts	
☐	Swimming pool or spa	3,500 watts	3500
☐			
☐			
☐			
	ELECTRIC VEHICLE CHARGER CIRCUIT		
	Level 2 electric vehicle charger wattage rating		
		TOTAL WATTS USED	24500

INSTRUCTIONS: Using the "TOTAL WATTS USED" number from the previous page, check the appropriate line in column 1 and follow that line across to determine the minimum required size of the electrical service panel shown in column 3. In column 4, write in the size of your existing service panel (main breaker size). If your existing service panel (column 4) is smaller than the minimum required size of the existing service (column 3), then you will need to install a new upgraded electrical service panel to handle the added electrical load from the proposed Level 2 charger.

The table below is based on CEC 220.83(A), 230.42 and Annex D.

1	2	3	4
Check the appropriate line (✓)	**Total Watts Used (from previous page)**	**Minimum Required Size of Existing 240-Volt Electrical Service Panel (Main Service Breaker Size)**	**Identify the Size of Your Existing Main Service Breaker (Amps)****
☑	up to 48,000	100 amps	100
☐	48,001 to 63,000	125 amps	
☐	63,001 to 78,000	150 amps	
☐	78,001 to 108,000	200 amps	
☐	108,001 to 123,000	225 amps	

***Note that the size of your existing service (column 4) MUST be equal to or larger than the Minimum Required Size (column 3) or a new larger electrical service panel will need to be installed in order to satisfy the electrical load demand of the EV charger.*

STATEMENT OF COMPLIANCE

By my signature, I attest that the information provided is true and accurate.

Job Address: ____

(Print job address)

Signature: ______________________________________ ________________________

(Signature of applicant) (Date)

In addition to this document, you will also need to provide a copy of the manufacturer's installation literature and specifications for the Level 2 charger you are installing.

Note: This is a voluntary compliance alternative and you may wish to hire a qualified individual or company to perform a thorough evaluation of your electrical service capacity in lieu of this alternative methodology. Use of this electrical load calculation estimate methodology is at the user's risk and carries no implied guarantee of accuracy. Users of this methodology and these forms are advised to seek professional assistance in determining the electrical capacity of a service panel.

Appendix E3: Publically Available EVCS Accessibility Guidelines

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices

These draft guidelines have been developed in conjunction with the Division of the State Architect (DSA) to assist the Governor's Office of Planning and Research with physical accessibility standards and design guidelines for the installation of plug-in electric vehicle charging stations throughout California. This initiative supports the Governor's Zero Emission Vehicle Executive Order, B-16-2012, which establishes a target of 1.5 million ZEVs in California by 2025.

These guidelines are intended to supersede and expand upon the current DSA "Interim Disabled Access Guidelines for Electric Vehicle Charging Stations 97-03", dated 5 June 1997. While 97-03 is a policy statement and only applicable to facilities under DSA's regulatory jurisdiction, it is possible that these voluntary 2013 guidelines will eventually become regulations within *California Building Code Chapter 11B Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing*.

For clarity and usability, the guidelines and any subsequent regulations should reflect the format and organization of the California Building Code. The 2013 Chapter 11B accessibility provisions use the Americans with Disabilities Act Guidelines as their model code with amendments to implement more stringent California specific requirements. These draft guidelines use the same format and are organized with separate scoping and technical provisions. The designation EVG (for Electric Vehicle Guidelines) is used as a prefix for the guideline provisions and the prefix 11B is used before sections from the 2013 California Building Code's accessibility provisions. These Guidelines are focused on physical accessibility standards and information about Section 508 of the Rehabilitation Act for Self-Contained Closed System Products will be provided in future guidance.

The guidelines address accessible plug-in electric vehicle charging stations on both public and private sites and within public rights of way. Making charging stations within public rights-of-way fully accessible can be challenging, as illustrated by the examples in the Plug-in Electric Vehicle Collaborative's "Accessibility and Signage for Plug-in Electric Vehicle Charging Infrastructure Report and Recommendations" of May 2012. Similar provisions from the proposed federal Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way related to parking have been adapted as the basis for on-street installations. Signage and identification of the accessible electric vehicle charging stations is raised but not yet fully resolved in this public draft.

Dennis J. Corelis, Deputy State Architect
Division of the State Architect

Table of Contents

Guidelines for the Provision of Electric Vehicle Charging Stations 3

Electric Vehicle Charging Stations (EVG-250) 3

On-Site Electric Vehicle Charging Stations (EVG-812) 8

On-Street Electric Vehicle Charging Stations (EVG-813)...12

Electric Vehicle Charging Station Equipment (EVG-814) 15

Related 2013 CA Building Code Chapter 11B Accessibility Regulations.............................17

Path of Travel Provisions for Alterations 17

Reference from EVG-814.1.2 Electric Vehicle Charging Stations
Pedestals and Pay Stations 21

Reference from 11B-309 Operable Parts to 11B-305 Clear
Floor or Ground Space..21

Reference from 11B-305 Clear Floor or Ground Space to
11B-302 Floor or Ground Surfaces 23

Reference from 11B-707 Automatic Teller Machine,
and Fare Machines and Point-of-Sale Devices 23

Guidelines for the Provision of Electric Vehicle Charging Stations

The following scoping sections of these guidelines are designed to present best practices for electric vehicle charging station accessibility and eventually may become part of the California Building Code's Chapter 11B Division 2: Scoping Requirements.

ADVISORY: EVG-250 Electric Vehicle Charging Stations. A reasonable portion of Electric Vehicle Charging Stations are required to be accessible. If provided by a state or local government on public property or on-street within the public right of way, vehicle charging is considered a program or service that must be accessible to and useable by individuals with disabilities. Accessibility covers not just the physical dimensions of the charging station, and operable parts of the device, but also the functionality of the 'self-contained, closed product' charging system. If provided at privately owned or operated public accommodations they must also be accessible as a service provided to the general public.

EVG-250 Electric Vehicle Charging Stations

ADVISORY: EVG-250.1 General. While there is no positive requirement to provide electric vehicle charging stations, when they are provided a portion of them should be accessible. When co-located with parking spaces, electric vehicle charging is considered the primary function of these stations, not parking. Accessible electric vehicle charging stations are not to be reserved exclusively for the use of persons with disabilities. They should not be identified with signage that would mistakenly indicate their use is only for vehicles with placards or license plates for individuals with disabilities.

EVG-250.1 General

Where provided, electric vehicle charging stations shall comply with EVG-250.

EXCEPTION: Restricted Electric Vehicle Charging Stations not available to the general public and intended for use by a designated vehicle or driver, such as public or private fleet vehicles, vehicles assigned to an employee or by an electric vehicle owner at home may but shall not be required to comply with EVG-250 and EVG-812.

ADVISORY: EVG-250.1 General. Existing conditions, terrain, electric infrastructure and other factors dictate that not every electric vehicle charging station can be fully accessible. With electric vehicle charging stations being functionally similar to and usually integrated with parking, the ratios of accessible to standard electric vehicle charging stations in these guidelines are the same as those for accessible to standard parking in the 2010 ADA standards and the 2013 California Building Code. The numbers of required accessible electric vehicle charging stations for both on-site and public rights-of-way locations are shown in Tables EVG-250.2 On-site Electric Vehicle Charging Stations and EVG-250.3 On-street Electric Vehicle Charging Stations.

EVG-250.2 Minimum Number for On-site Locations
On publically owned or privately owned sites electric vehicle charging stations complying with EVG-812 shall be provided in accordance with Table EVG-250.2.

Table EVG-250.2 On-Site Electric Vehicle Charging Stations

Total Number of Electric Vehicle Charging Stations Provided at a Site	Minimum Number of Required Physically Accessible Electric Vehicle Charging Stations
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 and over	4, plus 2 for each 100, or fraction thereof, over 100

EVG-250.2.1 Minimum Number for Residential Facilities
Electric vehicle charging stations to serve residential facilities and sites shall comply with EVG-250.2.1.

EVG-250.2.1.1 Electric Vehicle Charging Stations for Residents
Where at least one parking space is provided for each residential dwelling unit and electric vehicle charging services are provided in conjunction with that parking, five percent, but no less than one, of the electric vehicle charging stations provided shall comply with EVG-812.

EVG-250.2.1.2 Additional Electric Vehicle Charging Stations for Residents
Where additional parking spaces beyond one for each residential dwelling unit is provided and electric vehicle charging services are provided in conjunction with that parking, two percent of the additional parking spaces, but no fewer than one, of the additional electric vehicle charging stations provided shall comply with EVG-812.

EVG-250.2.1.3 Electric Vehicle Charging Stations for Guests, Employees and Other Non-Residents
Where parking spaces are provided for persons other than residents and electric vehicle charging services are provided in conjunction with that parking, electric vehicle charging stations for guests, employees and other non-residents shall be provided in accordance with Table EVG-250.2 and shall comply with EVG-812.

EVG-250.3 Minimum Number for On-Street Locations
Within the public right-of-way of a state or local government jurisdiction on-street electric vehicle charging stations complying with EVG-812 shall be provided in accordance with Table EVG-250.3.

Table EVG-250.3 On-Street Electric Vehicle Charging Stations

Total Number of Electric Vehicle Charging Stations Provided within a Jurisdiction's Public Right of Way	Minimum Number of Required Physically Accessible Electric Vehicle Charging Stations
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 and over	4, plus 2 for each 100, or fraction thereof, over 100

EVG-250.4 Electric Vehicle Charging Stations for Vans. Reserved.

ADVISORY: EVG-250.4 Electric Vehicle Charging Stations for Vans. The guidelines do not include provisions for van accessible electric vehicle charging stations. As of the date of these guidelines there are no plug-in electric vans being manufactured and providers of electric plug-in vehicle conversions indicate that van style vehicles are not currently available due to technical and cost factors. When future developments make electric plug-in vans feasible, provisions for van accessible electric vehicle charging stations can be included in the guidelines.

EVG-250.5 Locations

Electric Vehicle Charging Stations shall be located in compliance with EVG-250.5.

ADVISORY: EVG-250.5 Location. For new construction, accessible electric vehicle charging stations should be close to a major facility, public way or accessible route on the site, with 200 feet recommended as a maximum distance. However, electric vehicle charging stations need not be provided immediately adjacent to the facility since charging services, not parking, is their primary purpose. For installations at existing sites and locations, the accessible electric vehicle charging stations may not be located in close proximity to other services due to technical factors such as the availability of electric power or terrain, but they should be on an accessible route to the maximum extent feasible.

EVG-250.5.1 On-Site Locations

Electric vehicle charging stations on public and private sites shall be dispersed within each separate type of parking facility providing electric vehicle charging to the maximum extent feasible.

EVG-250.5.1.1 Proximity to Buildings, Facilities or Sites Served

Electric vehicle charging stations complying with EVG-812 that serve a particular building, facility or site shall be located in close proximity to the facility, public way or major circulation path on the site.

EVG-250.5.1.2 Proximity to Accessible Routes
Electric vehicle charging stations complying with EVG-812 that serve a particular building, facility or site shall be on an accessible route to an entrance complying with 11B-206.4 of the current edition of the California Building Code. Electric vehicle charging stations that do not serve a particular building or facility shall be on an accessible route to an accessible pedestrian entrance to the functional area within which they are located.

ADVISORY: EVG-250.5.2 On-Street Locations. Provision of fully accessible on-street electric vehicle charging stations within the public right of way can be very difficult due to constraints posed by terrain, available right of way and other factors. The technical requirements for accessible parking, when applied electric vehicle charging stations, can be in direct conflict with roadway and sidewalk grades, right-of–way widths, and functional requirements for curbs, gutters and other right of way improvements. While many of these issues can be addressed during new construction or re-construction of the public improvements, solutions providing full accessibility may not be possible. EVG-250.5.2 allows a public entity to provide accessible electric vehicle charging on a programmatic basis. This involves using additional on-site accessible electric vehicle charging stations to meet the combined requirements for the number of both on-street and on-site locations within the public entity's jurisdiction.

EVG-250.5.2 On-Street Locations Within a Public Right-of-Way
The required total number of electric vehicle charging stations complying with EVG-250.2 and EVG-250.3 may be provided on a combined basis using both on-site locations and on-street locations within a public right-of-way owned or controlled by a state or local governmental jurisdiction. On-street **e**lectric vehicle charging stations within the public right of way shall be integrated with on street parking to the maximum extent feasible.

EVG-250.5.3 Accessible Route Between Vehicle Space and Charging Equipment
An accessible route complying with the California Building Code Chapter 11B Division 4 Accessible Routes shall connect the electric vehicle charging station vehicle space to the electric vehicle charging equipment.

EVG-250.6 Electric Vehicle Charging Stations at Existing Facilities
Alterations solely for the purpose of installing electric vehicle charging stations shall be limited to the actual scope of work of the project and shall not be required to comply with section 11B-202.4 of the current edition of the California Building Code.

> **EXCEPTION:** Alterations solely for the purpose of installing electric vehicle charging stations at sites where vehicle parking or storage is the sole and primary use of the facility shall comply with the 2013 California Building Code section 11B-202.4 Path of Travel Requirements in Alterations, Additions and Structural Repairs to the maximum extent feasible. The cost of compliance with 11B-202.4 shall be limited to twenty percent of the cost of the work directly associated with the installation of the electric vehicle charging equipment.

ADVISORY: EVG-250.6 Electric Vehicle Charging Stations at Existing Facilities. The majority of electric vehicle charging stations being installed in the foreseeable future will occur at existing on-site or on-street parking facilities where the source of electric power, location of accessible parking, natural terrain, landscaping and other features are existing. Under the California Building Code these projects would be considered alterations. Alteration projects generally require accessibility improvements, if needed to comply with current requirements, to certain "path of travel" elements serving the area of alteration. The California Building Code provides exceptions to the "path of travel" upgrade requirements for projects that do not affect the usability or accessibility of the facility. It also recognizes the inherent difficulty in altering certain existing facilities for full compliance with the accessibility requirements through provisions for situations where strict compliance is technically infeasible.

EVCS installations at existing facilities fall into three categories:

1. Within an existing public right-of-way – With no specific "path of travel" elements serving the area being altered there would be no accessibility upgrades outside the area of work.

2. On building and facility sites where parking / vehicle storage is incidental to the primary function – Under the federal 2010 ADA Standards these projects would be alterations not affecting a primary function area and "path of travel" upgrades would not be required. This is the approach used in the prior DSA Access Policy Statement 97-03 and is most probably based upon classification of electric vehicle charging stations as electrical projects not involving the placement of receptacles or switches. These proposed guidelines continue the same approach as the prior DSA policy.

3. Installations of electric vehicle charging stations at sites where vehicle parking or storage is the sole or primary use of the facility are alterations affecting the usability of or access to a primary function area. The 2010 ADA Standards require that, to the maximum extent feasible, the path of travel to the altered area, including restrooms, telephones, and drinking

fountains, is readily accessible to and usable by individuals with disabilities. Additional alterations to upgrade non-compliant path of travel elements outside of the project's area of work are required, unless those alterations are disproportionate to the overall alterations in terms of cost and scope, which is defined as exceeding twenty percent (20%) of the cost of the primary alterations. When the cost of full compliance for path of travel elements would exceed twenty percent (20%), compliance is required to the greatest extent possible within the twenty percent (20%) limitation. California law prohibits the State Architect's regulations and building standards from prescribing a lesser standard of accessibility or usability than that provided by the 2010 ADA Standards. 2013 California Building Code section 11B-202.4 reflects similar requirements with the addition of signage to the designated path of travel elements. For projects with basic costs above the CBC valuation threshold of $139,964, the cost above which path of travel alterations would become disproportionate has been aligned with the federal requirements of twenty percent (20%).

The following technical sections for the electric vehicle charging station guidelines are designed to eventually be located within the California Building Code's Chapter 11B Division 8: Special Rooms, Spaces and Elements.

EVG-812 On-Site Electric Vehicle Charging Stations

EVG-812.1 General

On-site electric vehicle charging stations shall comply with EVG-812.

EVG-812.2 Electric Vehicle Charging Station Spaces

The vehicle space designated for on-site electric vehicle charging stations shall be 216 inches (5486 mm) long minimum and 108 inches (2743 mm) wide minimum and shall have an adjacent access aisle complying with EVG-812.3.

EVG-812.2.1 Vehicle Space Marking

Car and van electric vehicle charging stations shall be marked to define their width, Where Electric Vehicle Charging Stations are marked with lines, width measurements of electric vehicle charging stations and access aisles shall be made from the centerline of the markings.

EXCEPTION: Where electric vehicle charging stations or access aisles are not adjacent to another parking space or access aisle, measurements shall be permitted to include the full width of the line defining the parking space or access aisle.

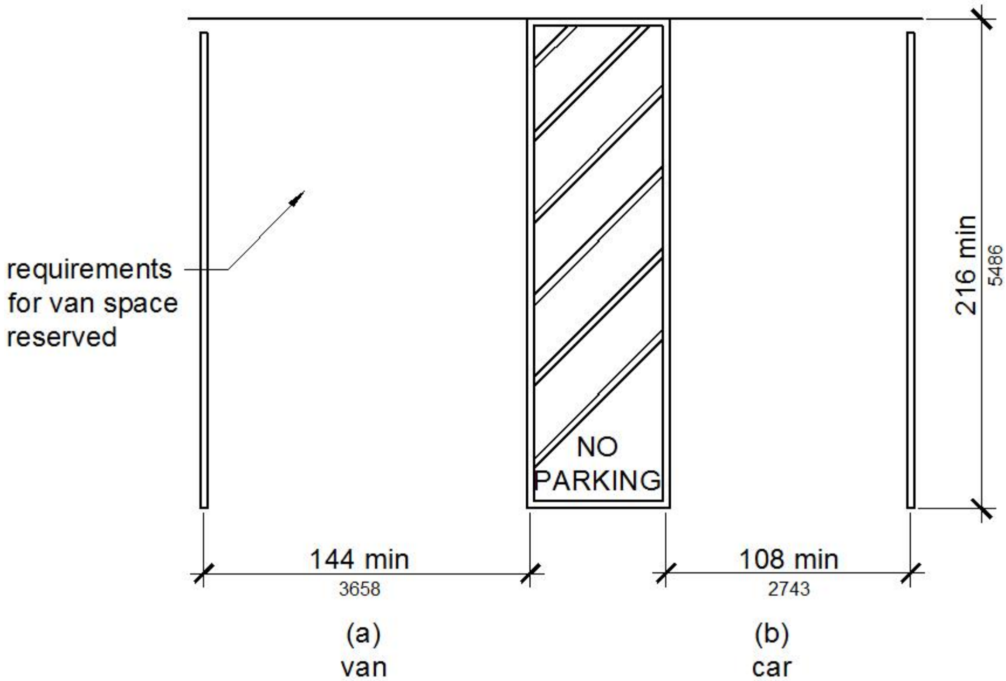

Figure EVG-812.2
On-site Electric Vehicle Charging Station Spaces Dimensions

EVG-812.2.2 Electric Vehicle Charging Only Lettering
The words "ELECTRIC VEHICLE CHARGING ONLY" or "EV CHARGING ONLY" may be painted on the surface within each charging space letters a minimum of 12 inches (305 mm) in height and located to be visible from the adjacent vehicular way.

EVG-812.3 Access Aisle

Access aisles serving vehicle spaces at on-site electric vehicle charging stations shall comply with EVG-812.3. Access aisles shall adjoin an accessible route. Two electric vehicles charging stations or one electric vehicle charging station and one accessible parking space shall be permitted to share a common access aisle.

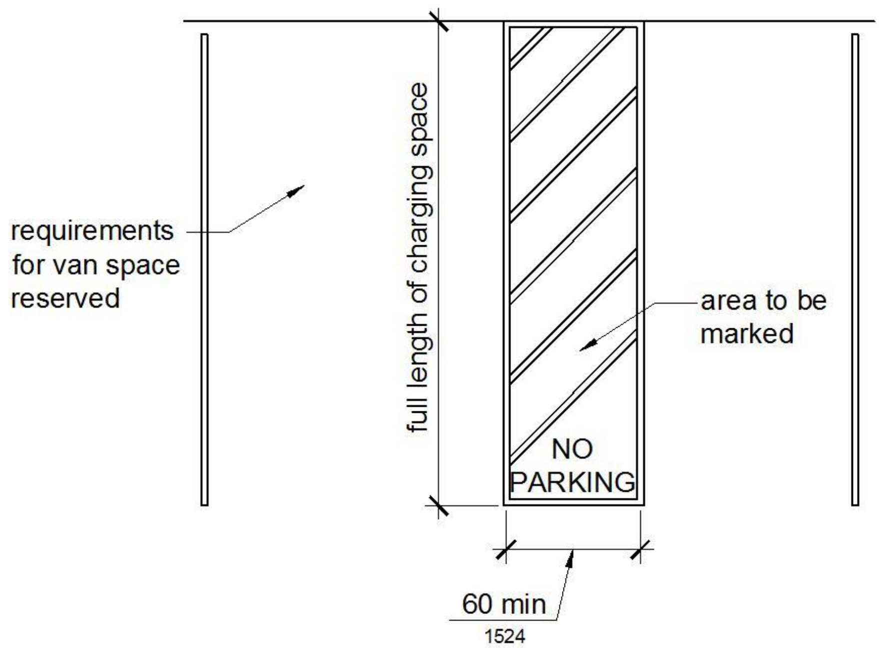

Figure EVG-812.3
Electric Vehicle Charging Station Space Access Aisle

EVG-812.3.1 Width

Access aisles serving on-site electric vehicle charging station car spaces at shall be 60 inches (1524 mm) wide minimum.

EVG-812.3.2 Length

Access aisles at on-site electric vehicle charging stations shall extend the full required length of the vehicle spaces they serve.

EVG-812.3.3 Marking

Access aisles at electric vehicle charging stations shall be marked-with a painted borderline around their perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36 inches (914 mm) on center. The color of the borderlines, hatched lines, and letters shall contrast with that of the surface of the access aisle, with white being the preferred color. The blue color required for the identification of access aisles for accessible parking shall not be used.

EVG-812.3.4 No Parking Lettering

The words "NO PARKING" shall be painted on the surface within each access aisle in letters a minimum of 12 inches (305 mm) in height and located to be visible from the adjacent vehicular way.

EVG-812.3.5 Location
Access aisles at on-site electric vehicle charging station spaces shall not overlap the vehicular way and may be placed on either side of the vehicle space they serve.

EVG-812.4 Floor or Ground Surface
On-site electric vehicle charging station spaces and access aisles serving them shall comply with 11B-302 Floor and Ground Surfaces. Access aisles shall be at the same level as the electric vehicle charging station space they serve. Changes in level or slopes exceeding 1:48 are not permitted.

EVG-812.5 Vertical Clearance
On-site Electric vehicle charging station spaces, access aisles and vehicular routes serving them shall provide a vertical clearance of 98 inches (2489 mm) minimum.

EVG-812.6 Identification
On-site electric vehicle charging stations shall be identified with a sign complying with EVG-812.6 and shall not be identified as or provided with signage required for accessible parking spaces.

EVG-812.6.1 Language
Provide a sign containing language stating “Designed for Disabled Access - Use Last” in addition to the signage identifying standard electrical vehicle charging stations. Where only one electric vehicle charging station is provided the sign shall contain language stating “Designed for Disabled Access”.

EVG-812.6.2 Mounting Height
Signs shall be 60 inches (1524 mm) minimum above the finish floor or ground surface measured to the bottom of the sign and shall be the uppermost sign when co-located with “No Parking except for Electric Vehicle Charging” and “Parking Time Limit” word message signs or electric vehicle charging symbol signs.

EXCEPTION: Signs located within an accessible route shall be a minimum of 80 inches (2032 mm) above the finish floor or ground surface measured to the bottom of the lowest sign.

EVG-812.6.3 Size and Finish
Signs shall be reflectorized with a minimum area of 70 square inches (45161 mm^2).

EVG-812.6.4 Color
Signs shall be white symbols and letters on a blue background.

EVG-812.6.5 Location
Signs shall be permanently posted immediately adjacent to and visible from each space, and shall be located within the projected width of the vehicle space.

EVG-812.7 Relationship to Accessible Routes
Electric vehicle charging station vehicle spaces and access aisles shall be designed so that when occupied the required clear width of adjacent accessible routes is not obstructed.

EVG-812.7.1 Arrangement
Electric vehicle charging stations and access aisles shall be designed so that persons using them are not required to travel behind electric vehicle charging stations other than to pass behind the vehicle space in which their vehicle has been left to charge.

EXCEPTION: Electric vehicle charging stations installed in existing facilities shall comply with EVG-812.7.1 to the maximum extent feasible.

EVG-812.7.2 Accessible Route Encroachment
A curb, wheel stop, bollards or other device shall be provided if required to prevent encroachment of vehicles over the required clear width of adjacent accessible routes.

ADVISORY: EVG-813 General. EVG-250.3 specifies how many accessible electric vehicle charging stations must be provided within the public right of way of a state or local governmental entity's area of jurisdiction. Accessible electric vehicle charging stations are not parking for purposes of accessibility and should be identified by signs that do not create the impression they are reserved for vehicles displaying disabled persons license plates or placards. While accessible electric vehicle charging stations are ideally located where the street has the least crown and grade and close to key destinations, other factors, such as proximity to electric service and connections, may control their location.

EVG-813 On-Street Electric Vehicle Charging Stations

EVG-813.1 General
On-street electric vehicle charging stations shall comply with EVG-813.

EVG-813.2 Parallel Electric Vehicle Charging Stations
Parallel Electric vehicle charging station spaces shall comply with EVG-813.2.

ADVISORY: EVG-813.2 Parallel Electric Vehicle Charging Stations. The sidewalk adjacent to accessible parallel electric vehicle charging station spaces should be free of signs, street furniture, and other obstructions to permit deployment of a van side-lift or ramp or the vehicle occupant to transfer to a wheelchair or scooter. Accessible parallel electrical vehicle charging stations located at the end of the block face are usable by vans that have rear lifts and cars that have scooter platforms.

EVG-813.2.1 Parallel Electric Vehicle Charging Stations at Wide Sidewalks
Where the width of the adjacent sidewalk or available right-of-way exceeds 4.3 m (14.0 ft), an access aisle 1.5 m (5.0 ft) wide minimum shall be provided at street level the full length of the electric vehicle charging station, shall connect to a pedestrian access route and shall not encroach on the vehicular travel lane. The access aisle shall comply with EVG-812.3.1, EVG-812.3.2 and EVG-812.3.

EXCEPTION: Alterations. In alterations where the street or sidewalk adjacent to the electric vehicle charging station space is not altered, an access aisle shall not be required**,** provided the Electric Vehicle Charging Stations space is located at the end of the block face.

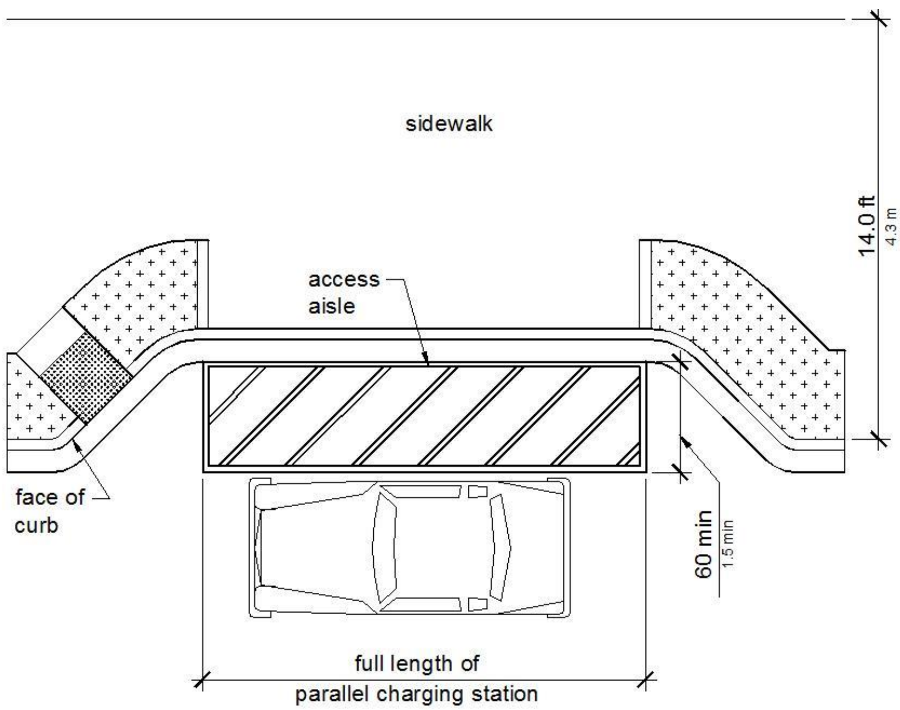

Figure 1 EVG-813.2.1 Parallel Electric Vehicle Charging Stations at Wide Sidewalks

ADVISORY: EVG-813.2.1 Wide Sidewalks. Vehicles may be positioned at the curb or at the parking lane boundary and use the space required by EVG-813.2.1 on either the driver or passenger side of the vehicle to serve as the access aisle.

EVG-813.2.2 Parallel Electric Vehicle Charging Stations at Narrow Sidewalks

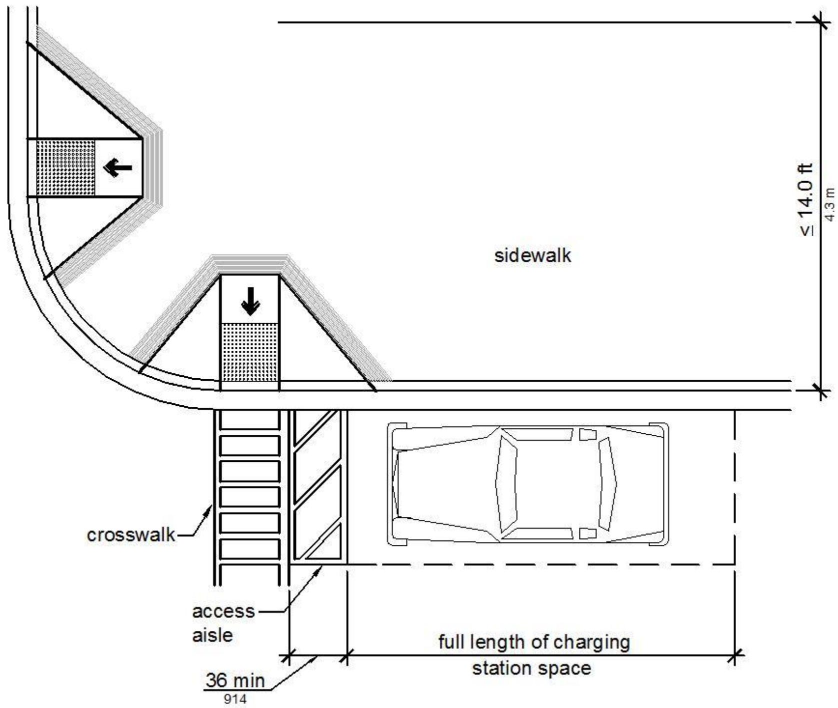

Figure EVG-813.2.2 Parallel Electric Vehicle Charging Stations at Narrow Sidewalks

An access aisle with a direct connection to the adjacent sidewalk is not required where the width of the adjacent sidewalk or the available right-of-way is less than or equal to 14.0 feet (4.3 m). When an access aisle is not provided, the Electric Vehicle Charging Stations spaces shall be located at the end of the block face to the maximum extent feasible.

> **ADVISORY:** EVG-813.2.2 Narrow Sidewalks. At parallel electric vehicle charging stations vehicle lifts or ramps can be deployed on an 8.0 feet (2.4 m) wide sidewalk if there are no obstructions.

EVG-813.3 Perpendicular or Angled Electric Vehicle Charging Stations
Where perpendicular or angled electric vehicle charging stations are provided, an access aisle 8.0 feet (2.4 m) wide minimum shall be provided at street level the full length of the electric vehicle charging station space and shall connect to a pedestrian access route. The access aisle shall comply with EVG-812.3 and shall be marked so as to discourage parking in the access aisle. Two electric vehicles charging stations or one electric vehicle charging stations and one accessible parking space shall be permitted to share a common access aisle.

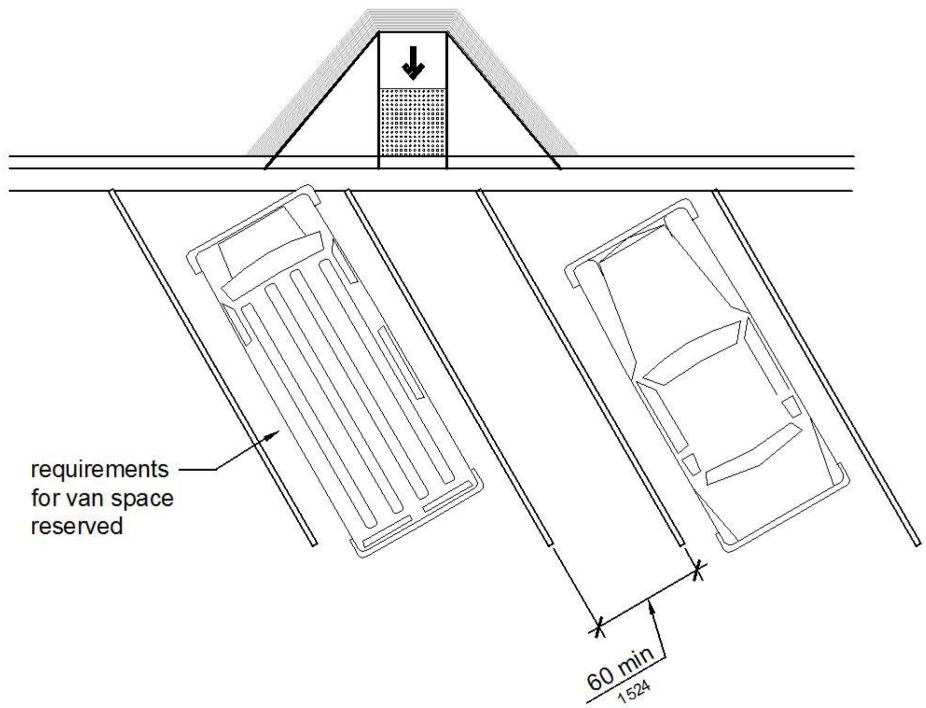

Figure EVG-813.3 Perpendicular or Angled Electric Vehicle Charging Stations

ADVISORY: EVG-813.3 Perpendicular or Angled Electric Vehicle Charging Stations Spaces. Perpendicular and angled parking spaces permit the deployment of a van side-lift or ramp.

EVG-813.4 Curb Ramps or Blended Transitions

Curb ramps or blended transitions shall connect the access aisle to the pedestrian access route. Curb ramps shall not be located within the access aisle.

ADVISORY: EVG-813.4 Curb Ramps or Blended Transitions. At parallel electric vehicle charging stations spaces, curb ramps and blended transitions should be located so that a van side-lift or ramp can be deployed to the sidewalk and the vehicle occupant can transfer to a wheelchair or scooter. Electric vehicle charging station spaces at the end of the block face can be served by curb ramps or blended transitions at the pedestrian street crossing.

EVG-813.5 Marking

On-street electric vehicle charging station spaces may be marked with Electric Vehicle Charging Only Lettering in compliance with EVG-812.2.2 Electric Vehicle Charging Only Lettering.

EVG-814 Electric Vehicle Charging Station Equipment

EVG-814.1 Electric Vehicle Charging Station Equipment

Equipment pedestals and pay stations that serve electric vehicle charging stations shall comply with EVG-814.1.

EVG-814.1.1 Location
Equipment pedestals and pay stations shall comply with EVG-814.1.1.

EVG-814.1.1.1 Parallel Locations
At parallel electric vehicle charging station spaces, equipment pedestals and pay stations shall be on the immediately adjacent sidewalk or ground surface and located 36 inches maximum from the head end or foot end of the projected length of the space.

EVG-814.1.1.2 Perpendicular or Angled Locations
At perpendicular or angled Electric Vehicle Charging Station spaces, equipment pedestals and pay stations shall be located on the immediately adjacent sidewalk or ground surface at the head end within the projected width of the electric vehicle charging station space.

EXCEPTION: For alterations at existing facilities when an accessible route or general circulation path is not provided adjacent to the head end of the space or access aisle, the equipment pedestal and pay station may be located within the projected width of the access aisle 36 inches maximum from the head end of the space.

ADVISORY: EVG-814.1.1 Location. Locating equipment pedestals and pay stations at the head or foot of the electric vehicle charging station permits deployment of a van side-lift or ramp or the vehicle occupant to transfer to a wheelchair or scooter.

EVG-814.1.2 Charging Station Equipment Operable Parts
Operable parts and charging cord stowage locations shall comply with 11B-309 Operable Parts.

EVG-814.2 Displays and Information
Displays and information shall be visible from a point located 3.3 feet (1.0 m) maximum above the center of the clear floor or ground space in front of the equipment pedestal and pay station.

EVG-814.3. Charging Station Equipment Clear Floor Space
Clear floor space at electric vehicle charging stations shall comply with 11B-305 Clear Floor Space and shall be centered on the display and information side of the electric vehicle charging station equipment.

Related 2013 California Building Code
Chapter 11B Accessibility Regulations

2013 CBC Path of Travel Provisions for Alterations

11B-202.4 Path of Travel Requirements in Alterations, Additions and Structural Repairs

When alterations or additions are made to existing buildings or facilities, an accessible path of travel to the specific area of alteration or addition shall be provided. The primary accessible path of travel shall include:

1. A primary entrance to the building or facility,
2. Toilet and bathing facilities serving the area,
3. Drinking fountains serving the area,
4. Public telephones serving the area, and
5. Signs.

EXCEPTIONS:

1. Residential dwelling units shall comply with 11B-233.3.4.2.

2. If the following elements of a path of travel have been constructed or altered in compliance with the accessibility requirements of the 2010 California Building Code, it shall not be required to retrofit such elements to reflect the incremental changes in this code solely because of an alteration to an area served by those elements of the path of travel:

   1. A primary entrance to the building or facility,

   2. Toilet and bathing facilities serving the area,

   3. Drinking fountains serving the area,

   4. Public telephones serving the area, and

   5. Signs.

3. Additions or alterations to meet accessibility requirements consisting of one or more of the following items shall be limited to the actual scope of work of the project and shall not be required to comply with 11B-202.4:

   1. Altering one building entrance.

   2. Altering one existing toilet facility.

3. Altering existing elevators.

4. Altering existing steps.

5. Altering existing handrails.

4. Alterations solely for the purpose of barrier removal undertaken pursuant to the requirements of the Americans with Disabilities Act (Public Law 101-336, 28 C.F.R., Section 36.304) or the accessibility requirements of this code as those requirements or regulations now exist or are hereafter amended consisting of one or more of the following items shall be limited to the actual scope of work of the project and shall not be required to comply with 11B-202.4:

1. Installing ramps.

2. Making curb cuts in sidewalks and entrance.

3. Repositioning shelves.

4. Rearranging tables, chairs, vending machines, display racks, and other furniture.

5. Repositioning telephones.

6. Adding raised markings on elevator control buttons.

7. Installing flashing alarm lights.

8. Widening doors.

9. Installing offset hinges to widen doorways.

10. Eliminating a turnstile or providing an alternative accessible route.

11. Installing accessible door hardware.

12. Installing grab bars in toilet stalls.

13. Rearranging toilet partitions to increase maneuvering space.

14. Insulating lavatory pipes under sinks to prevent burns.

15. Installing a raised toilet seat.

16. Installing a full-length bathroom mirror.

17. Repositioning the paper towel dispenser in a bathroom.

18. Creating designated accessible parking spaces.

19. Removing high-pile, low-density carpeting.

5. Alterations of existing parking lots by resurfacing and/or restriping shall be limited to the actual scope of work of the project and shall not be required to comply with 11B-202.4.

6. The addition or replacement of signs and/or identification devices shall be limited to the actual scope of work of the project and shall not be required to comply with 11B-202.4.

7. Projects consisting only of heating, ventilation, air conditioning, reroofing, electrical work not involving placement of switches and receptacles, cosmetic work that does not affect items regulated by this code, such as painting, equipment not considered to be a part of the architecture of the building or area, such as computer terminals and office equipment shall not be required to comply with 11B-202.4. unless they affect the usability of the building or facility.

8. When the adjusted construction cost is less than or equal to the current valuation threshold, as defined in Chapter 2, Section 202, the cost of compliance with 11B-202.4 shall be limited to 20 percent of the adjusted construction cost of alterations, structural repairs or additions. When the cost of full compliance with 11B-202.4 would exceed 20 percent, compliance shall be provided to the greatest extent possible without exceeding 20 percent.

When the adjusted construction cost exceeds the current valuation threshold, as defined in Chapter 2, Section 202, and the enforcing agency determines the cost of compliance with 11B-202.4 is an unreasonable hardship, as defined in Chapter 2, Section 202, full compliance with 11B-202.4 shall not be required. Compliance shall be provided by equivalent facilitation or to the greatest extent possible without creating an unreasonable hardship; but in no case shall the cost of compliance be less than 20 percent of the adjusted construction cost of alterations, structural repairs or additions. The details of the finding of unreasonable hardship shall be recorded and entered into the files of the enforcing agency and shall be subject to Chapter 1, Section 1.9.1.5, Special Conditions for Persons with Disabilities Requiring Appeals Action Ratification.

For the purposes of this exception, the adjusted construction cost of alterations, structural repairs or additions shall not include the cost of alterations to path of travel elements required to comply with 11B-202.4.

In choosing which accessible elements to provide, priority should be given to those elements that will provide the greatest access in the following order:

1. An accessible entrance;

2. An accessible route to the altered area;

3. At least one accessible restroom for each sex;

4. Accessible telephones;

5. Accessible drinking fountains; and

6. When possible, additional accessible elements such as parking, storage and alarms.

If an area has been altered without providing an accessible path of travel to that area, and subsequent alterations of that area or a different area on the same path of travel are undertaken within three years of the original alteration, the total cost of alterations to the areas on that path of travel during the preceding three-year period shall be considered in determining whether the cost of making that path of travel accessible is disproportionate.

9. Certain types of privately funded, multistory buildings and facilities were formerly exempt from accessibility requirements above and below the first floor under this code, but as of, April 1, 1994, are no longer exempt due to more restrictive provisions in the federal Americans with Disabilities Act. In alteration projects involving buildings and facilities previously approved and built without elevators, areas above and below the ground floor are subject to the 20-percent disproportionality provisions described in Exception 8, above, even if the value of the project exceeds the valuation threshold in Exception 8. The types of buildings and facilities are:

    1. Office buildings and passenger vehicle service stations of three stories or more and 3,000 or more square feet (279 m^2) per floor.

    2. Offices of physicians and surgeons.

    3. Shopping centers.

    4. Other buildings and facilities three stories or more and 3,000 or more square feet (279 m^2) per floor if a reasonable portion of services sought and used by the public is available on the accessible level.

    For the general privately funded multistory building exception applicable to new construction and alterations, see Division 11B-206.2.3, Exception 1.

The elevator exception set forth in this section does not obviate or limit in any way the obligation to comply with the other accessibility requirements in this code. For example, floors above or below the accessible ground floor must meet the requirements of this section except for elevator service. If toilet or bathing facilities are provided on a level not served by an elevator, then toilet or bathing facilities must be provided on the accessible ground floor.

2013 CBC reference from EVG-814.1.2 Electric Vehicle Charging Stations Pedestals and Pay Stations

11B-309 Operable Parts

11B-309.1 General
Operable parts shall comply with 11B-309.

11B-309.2 Clear Floor Space
A clear floor or ground space complying with 11B-305 shall be provided.

11B-309.3 Height
Operable parts shall be placed within one or more of the reach ranges specified in 11B-308.

11B-309.4 Operation
Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum.

> **EXCEPTION:** Gas pump nozzles shall not be required to provide operable parts that have an activating force of 5 pounds (22.2 N) maximum.

Reference from 11B-309 Operable Parts to 11B-305 Clear Floor or Ground Space

11B-305 Clear Floor or Ground Space

11B-305.1 General
Clear floor or ground space shall comply with 11B-305.

11B-305.2 Floor or Ground Surfaces
Floor or ground surfaces of a clear floor or ground space shall comply with 11B-302. Changes in level are not permitted.

> **EXCEPTION:** Slopes not steeper than 1:48 shall be permitted.

11B-305.3 Size
The clear floor or ground space shall be 30 inches (762 mm) minimum by 48 inches (1219 mm) minimum.

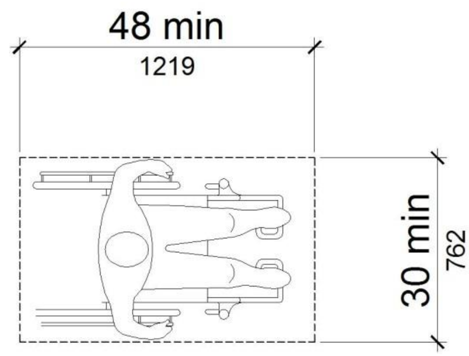

Figure 11B-305.3
Clear Floor or Ground Space

11B-305.4 Knee and Toe Clearance
Unless otherwise specified, clear floor or ground space shall be permitted to include knee and toe clearance complying with 11B-306.

11B-305.5 Position
Unless otherwise specified, clear floor or ground space shall be positioned for either forward or parallel approach to an element.

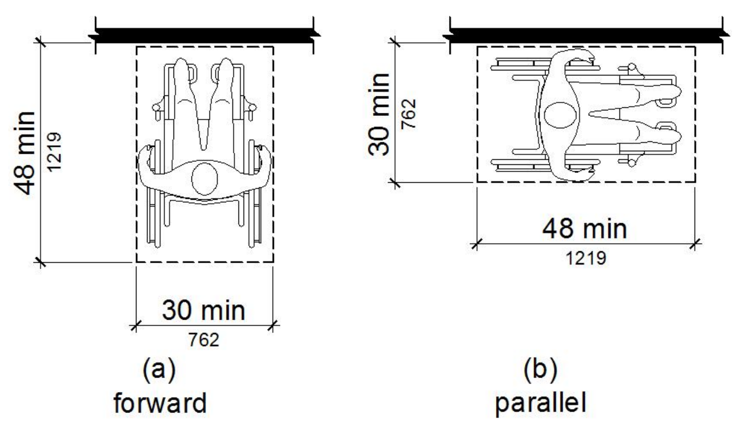

Figure 11B-305.5
Position of Clear Floor or Ground Space

11B-305.6 Approach
One full unobstructed side of the clear floor or ground space shall adjoin an accessible route or adjoin another clear floor or ground space.

Reference from 11B-305 Clear Floor or Ground Space to 11B-302 Floor or Ground Surfaces

11B-302 Floor or Ground Surfaces

11B-302.1 General
Floor and ground surfaces shall be stable, firm, and slip resistant and shall comply with 11B-302.

EXCEPTIONS: 1. Within . . .

11B-302.3 Openings
Openings in floor or ground surfaces shall not allow passage of a sphere more than ½ inch (12.7 mm) diameter except as allowed in 11B-407.4.3, 11B-409.4.3, 11B-410.4, 11B-810.5.3 and 11B-810.10. Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel.

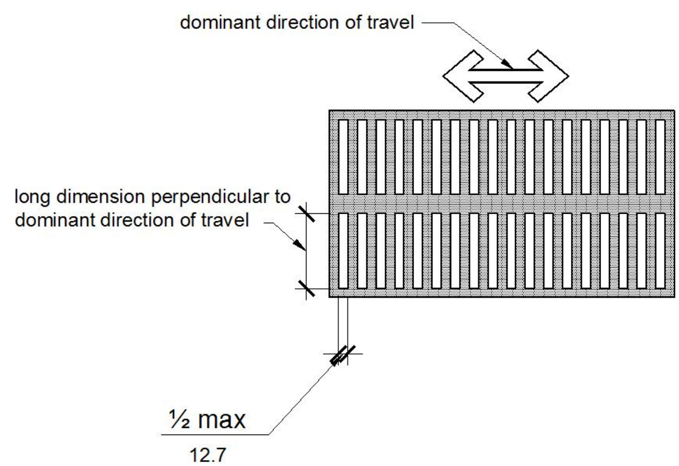

Figure 11B-302.3
Elongated Openings in Floor or Ground Surfaces

Reference from 11B-707 Automatic Teller Machine, and Fare Machines and Point-of-Sale Devices

11B-707.1 General.
Automatic teller machines and fare machines shall comply with 11B-707.

APPENDIX F
Task 8 Plan to Accelerate PEV Adoption in Fleets

Upstate Plan to Accelerate PEV Adoption in Fleets

Upstate Plug-in Electric Vehicle
Readiness Project
Task 8 Deliverable

Prepared by the Upstate Plug-in Electric Vehicle study team:
Siskiyou County Economic Development Council
Schatz Energy Research Center
GHD

Prepared for the California Energy Commission
ARV-12-007

September 2014

LEGAL NOTICE

Table of Contents

Table of Contents 3

Table of Abbreviations and Definitions 4

Introduction 6

Approach 6

Public and Private Vehicle Fleets in the Region 6

Resources for Fleet Managers 7

General Information Sources to Support PEV Adoption in Fleets 8
Listings and Information for Currently Available PEVs 8
Fleet Cost and Environmental Footprint Calculators 8
EV Charging Station Maps/Locators 8
PEV Incentives (rebates, tax credits, grants) 9
Resources for Developing Green Fleet Policies 10

Development of PEV FleET Tool 10

Outreach to Fleet Managers 12

Important Criteria for Fleet Evaluations 12

Evaluation of PEV Opportunities in Local Fleets 13

Lessons Learned 13

Plan to Accelerate PEV Adoption in Fleets 14

Appendix A – Data Input Form for PEV FleET 16

Appendix B – City of Mount Shasta Fleet Evaluation 17

Appendix C – City of Redding Fleet Evaluation 30

Table of Abbreviations and Definitions

Abbrev.	Full Name	Definition
AFLEET	Alternative Fuel Life-Cycle Environmental and Economic Transportation Tool	A spreadsheet tool developed by Argonne National Laboratory for estimating petroleum use, greenhouse gas emissions, air pollutant emissions, and cost of ownership of light-duty and heavy-duty vehicles.
BEV	Battery Electric Vehicle	A vehicle that only runs on electricity. The Nissan Leaf and Tesla Model S are popular examples. Often referred to as an "electric vehicle" or EV.
CO_2	Carbon dioxide	A compound that is a gas at room temperature and ambient pressure.
CVRP	Clean Vehicle Rebate Project	California state rebate program for zero emission vehicles.
DGS	California Department of General Services	Business manager for the State of California. Handles vehicle fleet operations, including master purchase contracts for fleet vehicles.
EV	Electric Vehicle	A vehicle that uses electricity for motive power and can be charged from an external source, such as a PEV or a PHEV.
EVSE	Electric Vehicle Supply Equipment	A charging station where PEVs can recharge their batteries.
FleET	Fleet Evaluation Tool	The PEV FleET is a spreadsheet tool for evaluating the cost effectiveness PEVs in fleet applications.
GHG	Greenhouse gas	Gases such as carbon dioxide and methane that when collected in the earth's atmosphere they trap heat and cause a warming effect.
GPS	Global positioning system	Space-based satellite navigation system that provides location and time information.
GREET	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Fleet Footprint Calculator	A life-cycle assessment model developed by Argonne National Laboratory for evaluating the energy and emission impacts of advanced vehicle technologies and alternative transportation fuels.
HVIP	Hybrid and Zero Emission Truck and Bus Voucher Incentive Project	California state incentive program that offers vouchers for hybrid and zero emission trucks and buses.

ICE	Internal combustion engine	An engine where the internal combustion of a fuel is converted to mechanical power.
kWh	Kilowatt-hour	A unit of energy.
PEV	Plug-in Electric Vehicle	Any vehicle that can be charged from an external source. Includes both BEVs and PHEVs.
PEVCC	Plug-in Electric Vehicle Coordinating Council	A group of local stakeholders who provided input on the *Upstate Plug-in Electric Vehicle Readiness Project* with the goal of promoting and accelerating the deployment of PEVs in the region.
PHEV	Plug-in Hybrid Electric Vehicle	A vehicle with a hybrid gasoline/electric motor that can also be charged from an external source. These vehicles enable some amount of electric-only driving with a gasoline backup. The Chevy Volt is a popular example.
USDOE	United States Department of Energy	Federal agency who's mission it is to "ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions."

Introduction

The Upstate Plug-in Electric Vehicle Readiness Project aims to prepare three of California's northernmost counties for the introduction of plug-in electric vehicles (PEVs). Three neighboring counties compose the Upstate Region: Siskiyou, Shasta and Tehama. The Upstate region is one of ten regions that were awarded PEV readiness grants under the California Energy Commission's Alternative and Renewable Fuels and Vehicle Technology Program. The scope of the project includes development of an infrastructure deployment plan, an assessment of greenhouse gas impacts, a plan to mitigate on-peak charging impacts, a plan to streamline the permitting of electric vehicle charging equipment, a plan to accelerate PEV adoption in fleets, and an education and outreach effort.

The goal of Task 8 of the Upstate Plug-in Electric Vehicle Readiness Project is to accelerate the adoption of PEVs in fleet applications. This document describes the efforts conducted to accomplish this task and lays out a plan to accelerate the adoption of PEVs in fleet applications.

Approach

The approach taken for this task involved the following set of project activities:

1. Identify vehicle fleets in the region
2. Compile resources for fleet managers
3. Develop fleet evaluation methodology
4. Reach out to fleet managers
5. Engage with fleet managers and obtain necessary fleet data
6. Pre-screen potential fleet vehicles
7. Evaluate fleet opportunities
8. Prepare plan to accelerate PEV adoption in fleets

Public and Private Vehicle Fleets in the Region

<u>Local Government</u>
Siskiyou County
Shasta County
Tehama County
Anderson
Corning
Dorris
Dunsmuir
Etna
Fort Jones
Montague
Mount Shasta

Red Bluff
Redding
Shasta Lake
Tulelake
Weed
Yreka

State Agencies
Federal Agencies

<u>Upstate Tribes</u>
Karuk Tribe
Pit River Tribe
Quartz Valley Indian Reservation
Redding Rancheria

<u>Schools / Colleges</u>
College of the Siskiyous
Institute of Technology
Lake College
National University
Shasta Bible College
Shasta College
Simpson College

<u>Private Fleets</u>
Delivery services (Federal Express, United Parcel Service)
Building contractors (general, electrical, HVAC, plumbing, security systems)
Professional services (engineering, land surveyors, home health care)
Rental car companies (Avis, Budget, Dollar, Enterprise, Hertz)
Retail delivery/distribution (florists, bakeries, catering, auto parts)
Retail repair services (appliance repair, office equipment repair)
Taxicabs (ABC Cab Company)
Telecommunications (Charter Communications, Sisqtel)

Resources for Fleet Managers

Below is a listing of resources and tools that offer important information to fleet operators who are considering adopting PEVs for their fleets. Information provided includes: general information sources, listings of available PEVs, cost and environmental footprint calculators, EV charging station maps/locators, information on incentives (i.e., tax credits and rebates), and resources for developing green fleet policies.

General Information Sources to Support PEV Adoption in Fleets

- Plug-in Electric Vehicle Handbook for Fleet Managers, USDOE/Clean Cities
- Alternative Fuels Data Center, USDOE (http://www.afdc.energy.gov/)
- Plug-In Electric Vehicle Resource Center, California Air Resources Board (http://www.driveclean.ca.gov/pev)
- California Governor's Office of Planning and Research, Zero-Emission Vehicles web page (http://www.opr.ca.gov/s_zero-emissionvehicles.php)
- Institute for Local Government Greening Agency Fleets Resource Center (http://www.ca-ilg.org/greening-agency-fleets-resource-center)

Listings and Information for Currently Available PEVs

- Clean Cities 2014 Buyer's Guide (http://www.afdc.energy.gov/uploads/publication/60448.pdf)
- Clean Cities Guide to Alternative Fuel and Advanced Medium- and Heavy-Duty Vehicles (http://www.afdc.energy.gov/uploads/publication/medium_heavy_duty_guide.pdf)
- Light-Duty Alternative Fuel Vehicle Search (http://www.afdc.energy.gov/vehicles/search/light/)
- Heavy-Duty Alternative Fuel Vehicle and Engine Search (http://www.afdc.energy.gov/vehicles/search/heavy)
- Find and Compare Cars (http://fueleconomy.gov/feg/findacar.shtml)
- DriveClean Buying Guide for Clean and Efficient Vehicles, California Air Resources Board (http://www.driveclean.ca.gov/)
- California Air Resources Board Clean Vehicle Rebate Project (https://energycenter.org/clean-vehicle-rebate-project)
- Plug-in Cars (http://www.plugincars.com/cars)

Fleet Cost and Environmental Footprint Calculators

- Vehicle Cost Calculator (http://www.afdc.energy.gov/calc/)
- Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Fleet Footprint Calculator (http://greet.es.anl.gov/carbon_footprint_calculator)
- Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool (https://greet.es.anl.gov/afleet)
- Petroleum Reduction Planning Tool (http://www.afdc.energy.gov/prep/)

EV Charging Station Maps/Locators

- Alternative Fueling Station Locator, USDOE (http://www.afdc.energy.gov/locator/stations/)
- Car Stations (http://carstations.com/)
- PlugShare (http://www.plugshare.com/)
- ChargePoint (https://na.chargepoint.com/charge_point) – lists only ChargePoint stations

PEV Incentives (rebates, tax credits, grants)

Federal Tax Credits for PEVs
Federal tax credits of up to $7500 per vehicle, depending on battery capacity, have been available for the last few years for eligible PEVs (see Internal Revenue Service Form 8936). The credit must be used in the year it is claimed and cannot be carried over to subsequent tax years. The credits will be phased out as sales increase. Specifically, credits will be phased out as each manufacture reaches 200,000 in eligible PEV sales. Through 2012 the largest cumulative PEV sales in the US is for the Chevrolet Volt, totaling about 31,000 vehicles in 2011-2012. For further information see http://www.fueleconomy.gov/feg/taxcenter.shtml.

State PEV Rebates
The Clean Vehicle Rebate Project (CVRP) offers vehicle rebates ranging from $1500 to $2500, depending on the all-electric range of the PEV. Funding for this program is expected to last through 2015, though rebate levels may drop with time. Over the last two years nearly 17,000 rebates have been awarded totaling about $39 million. For more information see http://energycenter.org/clean-vehicle-rebate-project.

Another state program, the Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP), offers vouchers ranging from about $8,000 to $45,000 per eligible vehicle. These vouchers are geared toward fleet vehicle operators and amounts vary depending on the type of truck (hybrid versus zero emission) and the gross weight of the vehicle (heavier vehicles getting larger vouchers). Recent funding levels have been $18 to $19 million annually, and funds are expected to continue through 2015 or 2016. For more information see http://www.californiahvip.org/default.aspx.

State Grants for Electric Vehicle Charging Stations
The California Energy Commission, under their Alternative and Renewable Fuel and Vehicle Technology Program, is offering grants to support the installation of electric vehicle charging stations. Each year an investment plan is adopted, and over the last three years approximately $7 million per year (out of $90 to $100 million total) has been allocated for this purpose. Note that this program funded the Upstate Plug-In Electric Vehicle Project. Funding for this program is expected to continue through 2016. For more information see http://www.energy.ca.gov/drive/index.html.

Department of General Services Master Vehicle Contracts
The California Department of General Services (DGS) maintains master contracts for vehicles that local agencies can use to purchase fuel efficient and alternative fuel vehicles at lower prices than may be available otherwise. DGS awards master vehicle contracts to individual dealerships for specific models of vehicles within a general class of vehicles, such as hybrid sedans. Local agencies can order vehicles directly from selected dealerships under the DGS master vehicle contracts. The DGS website contains all the information necessary for local agencies to find vehicles and dealerships that are included

in the contracts. Information about using the DGS website to purchase vehicles can be found at the link below.
http://www.ca-ilg.org/sites/main/files/file-attachments/resources__Using_DGS_Master_Vehicle_Contracts_FINAL_0.pdf

Resources for Developing Green Fleet Policies

- Model ordinance for local governments regarding the adoption of zero emission vehicles and the greening of municipal fleets, California Governor's Office of Planning and Research (http://opr.ca.gov/docs/Fleet_model_resolution.docx)
- Example green fleet policies (http://www.garfieldcleanenergy.org/trans-fleets-policies.html)
- Green fleet case studies for CA local government fleets (http://www.ca-ilg.org/post/greening-agency-fleets-community-stories-and-snapshots)
- Evaluating green fleet options for CA local government (http://www.ca-ilg.org/post/information-help-evaluate-green-fleet-options)
- Greening Fleets – A roadmap to lower costs and cleaner corporate fleets (http://business.edf.org/files/2014/03/greening-fleets.pdf)

Development of PEV FleET Tool

A fleet vehicle assessment requires identification of vehicles that might be suitable for replacement with a PEV. For those vehicles that are deemed potentially suitable, an economic analysis can be performed to evaluate the cost-effectiveness of switching to a PEV. In addition, the greenhouse gas (GHG) emission impacts can also be assessed. PEV adoption will typically result in reduced GHG emissions and can thereby help a municipality or other organization meet its GHG reduction goals.

Fleet electrification will also require the installation of electric vehicle charging equipment, also known as electric vehicle supply equipment (EVSE). The capabilities and capacities of various EVSE units should be researched and considered. Level 2 chargers will typically be suitable for charging vehicles overnight, where as Level 3 fast chargers can be used for quick charging (i.e., 20 minutes), though at a much greater cost. Also, some EVSE units can charge multiple vehicles at one time. Based on the number of electric vehicles and their charging needs, an assessment of required EVSE must be made.

To conduct a PEV fleet vehicle assessment a set of information must be compiled to characterize the existing fleet vehicles as well as the potential PEV replacements. Information required for the existing, conventional fleet vehicles is listed below. Appendix A includes a form for collecting the necessary input data for the PEV FleET model.

- Average and maximum miles traveled per day
- Average annual mileage

- Percent city driving
- Annual maintenance costs
- Characteristics of the likely conventional replacement vehicle (purchase cost, fuel economy)
- Cost of fuel

For potential PEV replacement vehicles, the following information is necessary:
- PEV characteristics (range in miles per full charge, efficiency in miles per kWh)
- PEV purchase cost and expected PEV maintenance costs
- PEV incentives (applicable rebates, tax credits, etc.)
- Estimated installed cost of electric vehicle charging equipment
- Cost of electricity (including time of use aspects and demand charges)

To facilitate the evaluation of PEV adoptions for fleet applications the Plug-In Electric Vehicle Fleet Evaluation Tool (PEV FleET) was developed. An Excel spreadsheet-based tool, PEV FleET is intended to be used by fleet operators or others who desire to perform fleet evaluations. Users are prompted to input necessary data and then choose the vehicles they want to evaluate. Outputs from the tool include:
- Incremental initial cost
- Simple payback
- Discounted payback
- Internal rate of return
- Net present value (over a 10 year life-cycle)
- Avoided downstream tons of CO_2 per year

This tool can be used to calculate the costs and benefits in a vehicle fleet when replacing conventional internal combustion engine (ICE) vehicles with plug-in electric vehicles (PEVs). PEVs can include both battery all-electric vehicles (BEVs) and/or plug-in hybrid electric vehicles (PHEVs). Note that the PEV_FleET model assumes vehicles are being replaced at the end of their useful lives. Therefore, comparisons are between a new conventional ICE replacement vehicle and a new PEV. Costs and specifications (like fuel economy) are based on the new vehicles. Annual mileage figures, however, should typically be based on the usage charateristics of the old vehicle being replaced.

Features of the PEV FleET model are:
- Includes compiled information on currently available PEVs, including cost, range, fuel economy, tax credits and California state rebates
- Includes compiled information on a sampling of available EVSE, including cost, input power, and associated annual fees
- Includes compiled information on typical EVSE installation costs
- Includes compiled information on utility electric rates for commercial customers, including Pacific Gas and Electric, Redding Electric and Pacific Power and Light
- Allows individual and aggregate PEV assessment for fleet applications

- Allows evaluation of individual vehicles or a fleet of vehicles
- Allows inclusion or exclusion of the cost of electric vehicle charging infrastructure
- Allows use of State-negotiated fleet vehicle rates where applicable

Outreach to Fleet Managers

Outreach to fleet managers included communications with local municipalities. Two municipalities, the Cities of Mount Shasta and Redding, expressed interest in participating in fleet evaluations. The project team worked with city staff from these two jurisdictions to conduct an evaluation of their fleets and assess opportunities for PEV deployment (see below). Information about PEVs and access to the PEV FleET tool was also available to other local municipalities upon request.

Important Criteria for Fleet Evaluations

The PEV market is in its early stages of development. Currently there are only about 25 light-duty PEVs available, and they are primarily passenger sedans, coupes, and hatchbacks. There is one small sport utility battery electric vehicle, the Toyota RAV4. There is also one manufacturer[1] who is offering a PHEV range-extender in a full-size truck, van, or sport utility vehicle format. These vehicles are supposed to be available in the 2014/2015 timeframe.

Because of this limited menu of offerings and because battery all-electric vehicles have limited range, it is important to make sure that available PEVs can meet the requirements of the application being considered. In addition, the initial cost of PEVs is often greater then comparable conventional counterparts, but they can pay for themselves over time because they operating costs are substantially lower. Key pre-screening criteria that should be considered before conducting a full economic analysis include:

- The required vehicle range (miles driven per trip) is compatible with PEV characteristics. Battery all-electric vehicles typically have a 60 to 100 mile range on a full charge. Plug-in hybrid electric vehicles typically have a 10 to 40 mile all-electric range, but can be driven longer distances (e.g., > 300 miles) using the gasoline-powered drive train.
- PEVs can meet the needs of the application. Currently PEVs are primarily available as light duty passenger vehicles. Passenger and cargo capacities should be evaluated to make sure they are appropriate. Hatchback models with fold-down rear seats can offer added utility and cargo hauling opportunities.
- The vehicle being considered is to be replaced in the next couple of years.

[1] Via Motors, http://www.viamotors.com/

- The vehicle being considered has relatively high annual miles driven. Annual miles driven has a big effect on economic payback. In general, more miles driven results in a quicker payback.

Evaluation of PEV Opportunities in Local Fleets

The PEV FleET was used to evaluate opportunities for PEV adoption in two municipal fleets in the cities of Mount Shasta and Redding. In both cases, the project team worked with city staff to identify vehicle applications that were most likely to be suitable for PEV adoption. City staff provided required input data for the model. PEV adoption opportunities were first evaluated for specific vehicles on a one-for-one replacement basis without the inclusion of EVSE costs. Numerous PEVs were evaluated for each application and simple paybacks were evaluated. A combined fleet analysis was then performed where multiple PEV adoptions were considered along with the purchase and installation of EVSE infrastructure. Finally, a sensitivity analysis was conducted to assess the impact to the model results caused by changes in various input parameters.

In both cases model results showed there were multiple cost-effective opportunities for adoption of PEVs. Appendices B and C include summary results of the example fleet evaluations for the cities of Mount Shasta and Redding.

Lessons Learned

The following are some key lessons learned while working to promote the adoption of PEVs in Upstate region municipal vehicle fleets.

- There is a mixed level of interest from fleet managers. Some may be very interested in PEV opportunities, while others may have little to no interest.
- Fleet managers have limited time available to assess fleet opportunities for PEVs. They must see value in the effort, such as the potential to reduce fleet operating costs. They may be averse to taking risks with new technologies that are not fully proven and that may not meet their needs.
- While we attempted to develop a fairly user friendly spreadsheet tool for evaluating PEVs in a vehicle fleet, the likelihood that a fleet operator will have the time and resources required to utilize the PEV FleET tool is probably rather low. It is more likely they would need the assistance of an outside analyst to help them utilize the tool.
- There are limited options in terms of PEV range and size, and very limited PEV options for heavy-duty vehicles like trucks and vans. These limitations limit adoption opportunities.
- There is a need for light duty plug-in electric trucks and vans.
- Fleets that have already adopted fuel-efficient vehicles may find it more difficult to identify cost-effective opportunities for PEVs.

- Fleet operators may have a desire to consider all alternative fuel vehicle fleet options, not just PEVs.
- Some municipal fleet vehicles have low annual miles driven – this lengthens payback times for PEVs and can make it hard to meet cost effectiveness criteria.
- The higher initial cost of PEVs and the high cost of EVSE can be barriers.
- Parking enforcement can be a good niche application for a PEV, though there are limited offerings with regard to plug-in electric parking enforcement vehicles.
- It is important to pre-screen fleet vehicles to make sure that available PEVs can meet the requirements of the application being considered. There is no point spending time and resources evaluating PEVs for an unsuitable application.
- In order to conduct a reliable evaluation it is important to have access to accurate vehicle travel data, such as maximum trip length, average trip length, annual mileage, and annual maintenance costs. This information may not always be readily available.
- For PHEVs, it is important to be able to estimate how many miles will be driven in all-electric mode for a given application. This can be difficult to accurately estimate and may significantly impact the economic analysis. The possibility of collecting travel data for fleet vehicles using cell phone data, GPS data, or other tracking devices can be very valuable in enabling an accurate fleet assessment.
- There is minimal information available on the likely maintenance costs associated with PEVs. One source[2] estimates that PEV maintenance costs will be only half as much as their conventional ICE vehicle counterparts. This annual maintenance cost savings can have a very significant impact on the cost effectiveness of PEV adoption. More reliable information is needed on this topic.
- Electricity demand charges can have a negative impact on the cost effective adoption of PEVs into fleets, especially where demand charges are high. This issue should be discussed with the local electric utility and strategies should be explored for mitigating excessive demand charges. One option may be to place the EVSE on a separate, non-demand metered electric account.

Plan to Accelerate PEV Adoption in Fleets

The Siskiyou County Economic Development Council has administered the Upstate Plug-in Electric Vehicle Readiness Project, and many other governmental and non-governmental entities in the region have participated in the project, either through participation on the Upstate PEVCC or by attending project meetings. Below is a list of actions that these entities can take to help promote PEV adoption in fleets in the Upstate region:

- Make presentations to elected officials and city staff
- Provide the "Upstate Plan to Accelerate PEV Adoption in Fleets" to fleet operators

[2] http://www.baclimate.org/images/stories/actionareas/ev/bacc_ev_fleet_business_case.pdf

- Share the wealth of information and resources that have been assembled as a part of the Upstate Plug-in Electric Vehicle Readiness Project
- Make the PEV FleET tool available to fleet operators
- Offer guidance and assistance to fleet operators in evaluating green fleet options
- Encourage municipalities to adopt green fleet policies
- Encourage municipalities to include green fleet activities in their climate action plans
- Encourage local businesses to adopt green fleet policies
- Publicize and promote local green fleet activities
- Document and share successful local case studies where PEVs have been introduced into local vehicle fleets

Appendix A – Data Input Form for PEV FleET

Plug-in Electric Vehicle Fleet Evaluation
Input information for PEV FleET tool

Name of Organization	
Contact Person (name)	
Contact Person (phone#)	
Contact Person (email)	
Cost of gasoline	
Electric utility and rate types	

ID#	Vehicle department (admin, IT, engineering, etc.)	Vehicle to be replaced (make/model)	Annual mileage	Ave. miles/trip	Max. miles/trip	% city driving	Annual maintenance costs	Likley conventional replacement vehicle (make/model)	Likley conventional replacement vehicle cost	Likely charging period (overnight, daytime, both)
1										
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Appendix B – City of Mount Shasta Fleet Evaluation

MEMORANDUM

To: Rod Bryan, City of Mt. Shasta
From: Jim Zoellick, Schatz Energy Research Center
Re: Evaluation of plug-in electric vehicle adoptions for the City fleet
Date: May 28, 2014

Executive Summary

We assessed opportunities for the deployment of plug-in electric vehicles (PEVs) into the City's fleet for a select group of vehicles. We found that a handful of alternatives could payback within the anticipated lifetime of the replacement vehicle. Key findings include:

- The City is considering purchase of a Ford Explorer SUV for the police department. Of the vehicles evaluated this application appears to be the best fit for a PEV. An all-electric Toyota RAV4 EV could payback in less than 3 years, and other smaller hatchback or sedan options could payback even faster, or perhaps could be cheaper from the outset. Adding charging infrastructure could extend payback periods by about 3 to 4 years.
- If one of the Dodge Ram 1500 trucks could be replaced with an SUV or hatchback sedan, paybacks could be very quick (e.g., 0 to 4 years). However, the key question to be answered is whether or not one of these vehicles would be appropriate for the application. Adding charging infrastructure could extend the payback period by about 2 years.
- The majority of vehicles that the City was interested in evaluating were Class 2 and Class 3 light-duty 4WD trucks (Ford F-250, Dodge Ram 1500 and 2500). There is only one comparable plug-in hybrid electric truck expected to be available in the coming year and it is rather expensive. It is possible that this truck could payback in about 10 years.
- The combined replacement of multiple vehicles along with the purchase of charging equipment could payback in about 5 years and could offer substantial dollar savings and CO_2 emission reductions over a 10-year period.

Introduction

The City of Mt. Shasta received a grant from the California Energy Commission to conduct an electric vehicle readiness study for Siskiyou, Shasta and Tehama Counties, referred to in the study as the Upstate Region. The Siskiyou Economic Development Council is administering the grant and technical work is being carried out by the Schatz Energy Research Center at Humboldt State University and GHD Engineering. The study is intended to prepare the region for the successful deployment of a large number of PEVs into the region. PEVs include both battery all-electric vehicles (BEVs) like the Nissan Leaf, as well as plug-in hybrid electric vehicles (PHEVs) like the Chevy Volt.

The Upstate PEV Readiness Study includes the following activities: planning for public charging infrastructure throughout the region, efforts to streamline permitting for charging infrastructure, efforts to accelerate PEV adoption in fleets, and education and outreach. This memo describes the approach we took and summarizes the results we obtained in our analysis of PEV adoption opportunities for the City of Mt. Shasta's vehicle fleet.

Approach

We worked with the City's fleet manager to identify a list of vehicles for evaluation. The criteria used to identify key opportunities included the following:

- **PEVs are appropriate for the application**. Currently PEVs are primarily available as light duty passenger vehicles. However, the City of Mt. Shasta has a substantial need for 4WD trucks. We did our best to identify PEVs that could be appropriate for the needed application.
- **The vehicle is anticipated to be replaced in the next couple of years.**
- **The vehicle has relatively high annual miles driven**. Annual miles driven has a big effect on economic payback. In general, more miles driven results in a quicker payback.
- **The required vehicle range (miles driven per trip) is compatible with PEV characteristics**. Battery all-electric vehicles typically have a 60 to 100 mile range on a full charge. Plug-in hybrid electric vehicles typically have a 10 to 40 mile all-electric range, but can be driven longer distances (e.g., > 300 miles) using the gasoline powered drive train.

Analysis

We developed a customized spreadsheet tool, the PEV Fleet Evaluation Tool (PEV FleET), to assess the economic viability of replacing a subset of the City's internal combustion engine (ICE) fleet vehicles with PEVs. In the analysis we included the cost of electric vehicle charging equipment (also known as electric vehicle supply equipment, or EVSE), State of California rebates under the Clean Vehicle Rebate Project, and California Department of General Services negotiated contract pricing where applicable. We also estimated the avoided downstream CO_2 emissions.

To help the City evaluate the economic costs and benefits associated with PEV adoption, we calculated the incremental initial cost (including EVSE, if desired), the simple payback time in years, and the net present value at 10 years. We found that a handful of alternatives can pay for themselves within a few years. Note that the PEV FleET spreadsheet tool is being provided to City staff to allow them to conduct further analyses as they see fit.

Results

The City elected to consider the replacement of ten vehicles in their fleet. These vehicles serve two different departments/purposes: public works and police. A list of the existing fleet vehicles and their characteristics as provided by the City of Mt. Shasta is included in Attachment A. Tables 1, 3, and 4 examine the cost effectiveness of replacing a group of vehicles and installing charging equipment. Table 5 presents the results of a sensitivity analysis where economic model assumptions were varied and the impact on estimated paybacks was assessed.

Police Department

One of the existing Police Department vehicles is a Ford Crown Victoria. This vehicle is driven approximately 5,800 miles per year, 90% of that in the city. The maximum trip length is 100 miles and the average trip length is about 8 miles. The conventional replacement for this vehicle is slated to be a Ford Explorer SUV. It is likely that this vehicle could effectively be replaced with a small SUV, hatchback or sedan. The majority of the miles driven in this vehicle are for short distance, around town trips, which would be very suitable for either a BEV or PHEV. The Toyota RAV4 battery electric vehicle, rated at a 100 mile all electric range, could potentially achieve the maximum required trip length of 100 miles, though this might be cutting it a bit too close. Perhaps a different vehicle could be used for these longer trips. Alternatively, a PHEV could be chosen that could achieve the required maximum distance in hybrid mode and could cover most of the around town trips in all electric mode.

We examined a number of PEV options to replace this Police Department vehicle, including both plug-in (PHEV) and full-electric (BEV) vehicles. The results in Table 1 show that most PEVs have a lower initial cost than the Ford Explorer. Only the Toyota RAV4 EV costs more initially, and it has a payback period of less than three years. All PEVs result in substantial cost savings over the 10-year analysis period. In addition, all PEVs result in an estimated reduction in CO_2 emissions of 2.8 to 2.9 tons per year. The Toyota RAV4 EV, being a small SUV, is the closest vehicle in size and style to the proposed Ford Explorer replacement vehicle. Table 2 compares the seating capacity, passenger volume, and cargo volume of the PEVs versus the Ford Explorer and Ford Crown Victoria. Also shown is the approximate driving range, in both electric and gasoline modes, for each of the vehicles. Pictures of the PEVs evaluated are included in Attachment B.

Table 1 : Police Department Vehicle PD9

ICE Replacement: Ford Explorer ($40,000)

PEV Replacement	***Incremental initial cost****	***Payback (yrs)***	***Net Present Value*****	***CO_2 emissions reduction (tons/yr)***
BEV/Nissan Leaf (73 mi range)***	($13,700)	0	$35,500	2.9
BEV/ Ford Focus (76 mi range)***	($6,102)	0	$28,000	2.9
BEV/ Honda Fit EV (82 mi range)***	($5,875)	0	$28,000	2.9
PHEV/Toyota Prius 1.8L	($13,550)	0	$25,200	2.8
PHEV/Ford C-MAX ENERGI	($8,550)	0	$19,900	2.8
PHEV/Ford Fusion Energi	($5,102)	0	$16,500	2.8
PHEV/Chevrolet Volt	($4,158)	0	$15,300	2.8
PHEV/Honda Accord Plug-in Hybrid	($1,720)	0	$13,300	2.8
BEV/Toyota RAV 4 EV (100 mi range)	$6,531	2.6	$14,600	2.9

One-for-one replacement assumes no EVSE costs, 90% city driving, an 8-mile average trip distance, and 5,800 miles of driving per year. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs). **Net present value is determined over a 10-year life. ICE replacement cost provided by City of Mt. Shasta. ***Not capable of achieving a 100 mile trip without recharging during the trip.

Table 2: Vehicle Size and Range Comparison

Powertrain	*Make*	*Model*	*Style*	*Doors*	*Seating capacity*	*Passenger vol (ft3)*	*Trunk vol (ft3)**	*Hatchback cargo vol w/ back seats down (ft3)*	*All-electric range (mi)*	*Total range (mi)*
PHEV	Honda	Accord Plug-in Hybrid	Sedan	4-dr	5	103	9	N/A	13	570
PHEV	Ford	Fusion Energi	Sedan	4-dr	5	103	12	N/A	20	622
PHEV	Ford	C-MAX ENERGI	Hatchback	4-dr	5	100	19	43	21	623
BEV	Ford	Focus	Hatchback	4-dr	5	91	15	34	76	76
PHEV	Chevrolet	Volt	Hatchback	4-dr	4	90	11	18	35	380
BEV	Honda	Fit EV	Hatchback	4-dr	5	89	12	49	82	82
BEV	Nissan	Leaf	Hatchback	4-dr	5	92	24	30	73	73
PHEV	Toyota	Prius 1.8L	Hatchback	4-dr	5	94	16	22	11	541
BEV	Toyota	RAV 4 EV	SUV	4-dr	5	108	36	73	100	100
ICE	Ford	Explorer	SUV	4-dr	6	106	21	81	N/A	353
ICE	Ford	Crown Victoria	Sedan	4-dr	7	152	21	N/A	N/A	342

* Trunk volume for a hatchback applies to the space behind the rear seats.

Public Works Department

Nine vehicles were identified for possible replacement in the Public Works Department. All of the existing vehicles are 4WD trucks, with the exception of one 4WD Jeep. All of these vehicles are due to be replaced with new, full-size, super-duty 4WD trucks with 3/4-ton to 1.5-ton payload capacities. Currently there is only one PHEV that has comparable features. This vehicle is sold by Via Motors (see http://www.viamotors.com/); a specification sheet for the vehicle can be found in Attachment C. It is a plug-in hybrid electric truck, or extended-range truck as described by Via Motors. It features a 40-mile all-electric range and an extended range of 400 miles in gasoline hybrid-electric mode. It is a 4WD model with an 1,800 pound payload capacity. Via Motors manufactures the hybrid-electric power train and integrates it into a standard truck chassis. The power train is designed to work in GM Silverado, Ford F-Series and Dodge Ram series trucks, and will initially be offered on the GM Silverado platform. The Via extended-range electric truck also features a power export inverter than can provide up to 10-kW of electrical power at 110/220 VAC. Via Motors is currently accepting pre-order reservations in the amount of $1,000. The truck is expected to sell for $79,000 in volume.

We examined the cost-effectiveness of this vehicle compared to the conventional replacement vehicles being considered, including the Dodge Ram 1500 and 2500 series and the Ford F-250 series trucks. In all cases the payback for the Via Motors electric truck is rather long, on the order of 9 to 10 years. In addition to the Via Motors electric truck, we examined the possibility of swapping out one of the full-size trucks for a smaller PEV, such as the Toyota RAV4 sport utility vehicle or the Ford C-MAX Energi hatchback sedan. It is unclear if these vehicles would be appropriate for the application. They are both front-wheel drive vehicles, and are not available in four-wheel drive. They are also substantially smaller in size and hauling capacity. However, it may be possible to replace one of the full-size trucks with a PEV and limit its use to specific, appropriate tasks. The Toyota RAV4 EV pays back in about 4 years and the Ford C-MAX Energi is cheaper from the start. Both vehicles offer substantial dollar savings over time, as well as significant reductions in greenhouse gas emissions. Table 3 presents results for the assessment of possible PEV adoptions in the Public Works Department fleet.

Table 3 : Public Works Department

Conventional vehicle	***PEV replacement***	***Incremental initial cost****	***Simple payback (yrs)***	***Net present value*****	***Avoided CO_2 (tons/yr)***
PW4 Dodge Ram 2500	Via Motors eREV truck	$36,500	9.6	($4,100)	9.0
PW14 Dodge Ram 1500	Toyota RAV4 EV	$11,531	4.0	$13,200	3.8
PW11 Dodge Ram 1500	Ford C-MAX Energi	($3,550)	0	$27,600	6.0

One-for-one replacement assumes no EVSE costs. Conventional vehicle characteristics are as shown in Appendix A. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs). **Net present value is determined over a 10-year life.

Combined Fleet Analysis

The one-for-one vehicle replacement results presented above are expanded to a fleet analysis in Table 4. In the fleet scenario, four vehicles are replaced at once along with the installation of electric vehicle charging equipment. The estimated payback time is 5.4 years. It was assumed that one charger would be installed for each vehicle. However, it is possible that one charger could potentially serve more than one vehicle. Also, there may be California Energy Commission grants available to help cover the cost of EVSE, and these grants can substantially improve fleet payback times. It is also important to note that EVSE installation costs are very particular to each installation and can vary significantly from one installation to the next. Therefore, it is recommended that cost estimates be developed for the installation of electric vehicle charging infrastructure before moving forward with any purchase of a PEV.

Table 4: Combined Fleet Scenario

Conventional vehicle	PW4 Dodge Ram 2500	PD9 Ford Explorer	PW14 Dodge Ram 1500	PW11 Dodge Ram 1500
PEV Replacement	Via Motors eREV truck	Toyota RAV4 EV	Toyota RAV4 EV	Ford C-MAX Energi
Number of EVSE ports: Clipper Creek CS40	4			
Incremental initial cost*	$65,257			
Simple payback	5.4 years			
Net present value (over 10 years)	$37,100			
Avoided CO_2 emissions	21.7 tons per year			

Conventional vehicle characteristics are as shown in Appendix A. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP, as well as installed cost estimates for EVSE. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs).

Sensitivity Analysis

The baseline assumptions used in this analysis are shown in Table 5. To assess the impact of variations in these parameters we conducted a sensitivity analysis for the combined fleet scenario. As shown in Table 6, we found that the economic results do not vary dramatically given reasonable variations in the input parameters. In most cases the payback period increases by no more than about one year. The most sensitive parameter appears to be the assumption of annual maintenance cost savings associated with PEVs. The literature indicates that PEVs may benefit from significantly lower annual maintenance costs. For battery all-electric vehicles there are no oil changes, fewer moving parts, and regenerative breaking reduces wear on brakes. Plug-in hybrid electric vehicles can also benefit from lower wear on the engine and breaks. This analysis assumed a 50% reduction in annual maintenance costs for BEVs[3] and a 10% reduction for

[3] ICEVs to EVs in Commercial and Governmental Fleets: A Business Case, Bay Area Climate Collaborative, August 23, 2010

PHEVs. If these maintenance cost savings were not realized, the payback period for the fleet scenario would increase by less then 3 years to 8.2 years in total. Also note that a 10% increase in PEV purchase cost also has a rather significant impact, increasing the fleet payback period by almost 2 years.

Table 5: Baseline Assumptions

Parameter	Value
CVRP rebate (Y/N)	Yes
Conventional vehicle purchase cost	Provided by City of Mt. Shasta Fleet Manager
PEV purchase cost	MSRP
State negotiated purchase cost	From CA Department of General Services (where applicable)
EVSE equipment costs	From mfg./distributor
EVSE installation costs	Per EVSE contractor/distributor
Annual mileage	Provided by fleet manager, specific to each vehicle
Peak demand charges	$0.00
Annual BEV maintenance cost	Half the cost of ICE maintenance
Annual PHEV maintenance cost	90% the cost of ICE maintenance
Gasoline cost	$3.89/gal (provided by fleet manager)
Fuel economy	Per EPA ratings (where available), else mfg. rating
Percent miles driven in city	85% to 100% (provided by fleet manager)
Average miles per trip	5 to 16 miles (provided by fleet manager)
Annual conventional ICE vehicle maintenance cost	$2,400 to $5,500 per year (provided by fleet manager)
Electric rate schedule	Pacific Power A-32 General Service > 20 kW
Electricity cost	Per Pacific Power rate schedule

Table 6: Sensitivity Analysis

Change in input parameter	Incremental initial cost	Simple payback (yrs)	Net present value
Baseline	$65,257	5.4	$37,100
Only 2 EVSE instead of 4 EVSE	$60,460	5.0	$41,900
No CVRP rebate	$74,257	6.2	$28,100
No state negotiated purchase price	$66,795	5.6	$35,500
PEV purchase cost +10%	$86,258	7.2	$16,100
EVSE installed cost +100%	$79,502	6.6	$22,800
No annual maintenance cost savings	$65,257	8.2	$2,700
Gasoline cost +20% ($4.67/gal)	$65,257	4.7	$53,400
Gasoline cost -20% ($3.11/gal)	$65,257	6.5	$20,700
Annual mileage +20%	$65,257	4.8	$50,600
Annual mileage -20%	$65,257	6.3	$23,500
ICE fuel economy +10%	$65,257	5.9	$29,300
ICE fuel economy -10%	$65,257	5.0	$46,500
Electric rate schedule A25	$65,257	5.6	$33,400
Electric rate schedule A36	$65,257	5.3	$40,300
Electric rate schedule AT48	$65,257	5.2	$41,800
Worst case demand charge on A32 rate	$65,257	5.9	$29,100
Worst case demand charge on A36 rate	$65,257	6.3	$22,700
Worst case demand charge on AT48 rate	$65,257	6.1	$26,200

Attachment A – Fleet Vehicles Considered for Replacement

Plug-in Electric Vehicle Fleet Evaluation

Input information for PEV FleET tool

Name of Organization	City of Mt.Shasta
Contact Person (name)	Rod Bryan
Contact Person (phone#)	530-859-7526
Contact Person (email)	rbryan@mtshastaca.gov
Cost of gasoline	$3.89 per gal.
Electric utility and rate type	Pacific Power-rate unknown

ID#	***Vehicle department (admin, IT, engineering, etc.)***	***Vehicle to be replaced (make/model)***	***Annual mileage***	***Ave. miles/trip****	***Max. miles/trip****	***% city driving****	***Annual maintenance costs***	***Likley conventional replacement vehicle (make/model)***	***Likley conventional replacement vehicle cost***	***Likely charging period (overnight, daytime, both)***
PW1	PW	1999 Jeep Cherokee 4WD	7000	10	100	90	$3,200	2015 Dodge Ram 1500	$35,000	O-N
PW2	PW	2008 Ford F250 4WD	10,000	8	100	90	$5,200	2015 F250	$42,500	O-N
PW3	PW	2002 Dodge Ram 1500 4WD	10,250	8	100	90	$5,000	2015 Ram 2500	$40,000	O-N
PW4	PW	2003 DodgeRam 2500 4WD	11,500	16	100	85	$5,500	2015 Ram 2500	$40,000	O-N
PW7	PW	2004 Ford F250 4WD	7,800	8	5	100	$3,500	2015 F250	$42,500	O-N
PW9	PW	2003 Ford F250 4WD	3,700	5	100	95	$2,400	2015 F250	$42,500	O-N
PW10	PW	2001 Dodge Ram 2500 4WD	7,000	5	5	100	$3,200	2015 Ram 2500	$40,000	O-N
PW11	PW	2002 Dodge Ram 1500 4WD	10,000	10	100	85	$4,800	2015 Ram 1500	$35,000	O-N
PW14	PW	2002 Dodge Dakota 4WD	5,800	5	5	95	$3,000	2015 Ram 1500	$35,000	O-N
PD9	PD	2004 Ford Crown Vic	5,800	8	100	90	$3,000	2015 Ford Explorer	$40,000	O-N

*Note that average miles/trip, maximum miles/trip and % city driving were all used to determine the percent all-electric miles driven for a PHEV. Percent city driving was assumed to be equivalent to the expected percent all-electric miles. Then the minimum of the PHEV all-electric range divided by the average miles per trip or the expected percent all-electric miles was used as a proxy for the actual percent all-electric miles driven. For battery all-electric vehicles, the percent all electric miles driven was always assumed to be 100%. If the maximum trip length was greater than the BEV range, then it is assumed that the vehicle was charged during the trip or that an alternate vehicle was used for trips that exceeded the BEVs range.

Attachment B – PEVs Evaluated

Chevy Volt
Plug-in Hybrid

Toyota Prius
Plug-in Hybrid

Ford Focus EV
Full Electric

Nissan Leaf
Full Electric

Honda Fit EV
Full Electric

Honda Accord
Plug-in Hybrid

Toyota RAV4
Full Electric

Ford Fusion
Plug-in Hybrid

Ford C-Max
Plug-in Hybrid

Attachment C – Via Motors Extended Range Electric Truck

Reduces fuel costs by up to 80% with near-zero emissions operation

Plugs In Anywhere

Plug it into a standard outlet or charge in half the time with a 240 volt outlet or charging station. Driving in all-electric mode costs as little as 60 cents per equivalent gallon or about 5 cents a mile. In addition, VTRUX qualifies for a $7,500 federal tax credit and thousands of dollars in additional clean fuel credits in several states.

Unlimited Range

Say good-bye to range anxiety, this an electric vehicle with unlimited range. VIA's new eREV trucks drive up to 40 miles on batteries then continue up to 400 miles or more on longer trips. It generates its own electricity using a fuel-efficient onboard generator or "range extender."

Power Export

The VTRUX power export option provides 10 kW at 50 amps of onboard mobile power. This provides mobile emergency power to keep facilities on-line, run tools to power a job site, or power your home during an outage.

Power Port

Convenient power port for charging and power xPort outlets; Includes j1772 charge connector and optional 120 V and 240 V power xPort.

Charging Options

Use a standard charging station, or charge conveniently at home using a standard 110 or 220 volt outlet.

Integrated iPad® Display

Innovative iPad integration makes hybrid controls, GPS, dispatch information easy to use.

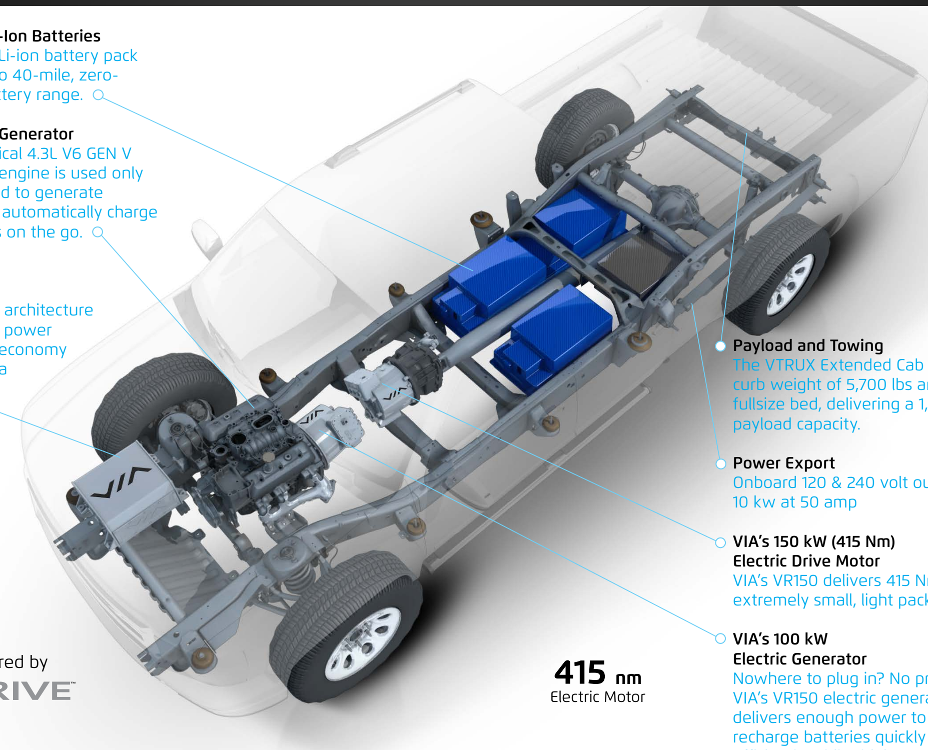
4WD 2WD options	1/2 ton Chassis with 7,500 GVW	up to 415 Nm Torque	up to 40 miles of EV range	Unlimited extended (hybrid) range	up to 100 mpg average gas fuel economy (unloaded)	4.3L V6 EcoTec3 gas electric-generator	100 kW electric generator

Drive anywhere without range anxiety

Advanced Li-Ion Batteries
The 23 kWh Li-ion battery pack delivers up to 40-mile, zero-emission battery range.

Gas/Electric Generator
The economical 4.3L V6 GEN V combustion engine is used only when needed to generate electricity to automatically charge the batteries on the go.

Controller
The 300 volt architecture provides the power density and economy required for a wide variety of trucks.



Payload and Towing
The VTRUX Extended Cab has a curb weight of 5,700 lbs and a fullsize bed, delivering a 1,400 lb payload capacity.

Power Export
Onboard 120 & 240 volt outlets 10 kw at 50 amp

VIA's 150 kW (415 Nm) Electric Drive Motor
VIA's VR150 delivers 415 Nm in an extremely small, light package.

VIA's 100 kW Electric Generator
Nowhere to plug in? No problem. VIA's VR150 electric generator delivers enough power to recharge batteries quickly and efficiently while driving.

Powered by VDRIVE

415 nm
Electric Motor

It's the cleanest, most economical work vehicle on the planet.

First models available in a crew cab body style followed by double cab standard box models.

Efficiency

	National Average			
Miles Driven per Year	12,775	14,600	18,250	36,500
Miles Driven per Day	40	60	70	100
Gas Fuel Economy	Battery Only	120 mpg	84 mpg	30 mpg

All Electric Range	Up to 40 miles
Extended Range	Up to 400 miles
Drive	4WD
Traction Motor Torque	415 Nm peak, 210 Nm continuous
Generator Power	150 kW Peak, 100 kW Continuous
Power Export Inverter	Up to 10 kW (50 Amps)
Solar Panel Option	600 watt and 800 watt options

Power Export Voltage	110 & 240 VAC 60 Hz
Charge Input	120 or 240 V
Lithium Ion Batteries	~23 kWh
Battery Voltage	300 Volt
Chassis	1/2 Ton
Gross Combined Weight Rating	7,500 lbs
Payload Capacity	1,400 lbs

VIA Motors. A Better Way to Go.

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Appendix C – City of Redding Fleet Evaluation

MEMORANDUM

To: Jim Schmitz, Fleet Manager, City of Redding
From: Jim Zoellick, Schatz Energy Research Center
Re: Evaluation of plug-in electric vehicle adoptions for the City fleet
Date: September 24, 2014

Executive Summary

We assessed opportunities for the deployment of plug-in electric vehicles (PEVs) into the City's fleet for a select group of vehicles. We found that a number of alternatives could payback within the anticipated lifetime of the replacement vehicle. Key findings include:

- Eleven vehicle replacements across three different departments (Police, Parks, and Electric) were evaluated and a substantial number of opportunities were identified where PEVs could potentially replace conventional gasoline powered vehicles in a cost-effective manner.
- All of the vehicle replacements evaluated involve vehicles that travel 50 miles or more per average trip, and most travel greater than 100 miles per average trip. This means that PHEVs rather than BEVs may be best suited in most applications. However, BEVs may work in certain cases where longer trips can be scheduled for other vehicles.
- Numerous PEV options show promise for the Police Department fleet, with most payback periods totaling four years or less, and substantial net savings accruing over a ten-year life cycle. Available PEV size ranges (passenger capacity, passenger volume, and storage volume) are similar to conventional vehicles.
- One vehicle was evaluated for the Parks Department. Because of it's low annual mileage and the low cost of the conventional vehicle used for comparison, the payback periods are rather long; however, an increase of only a few thousand dollars in the conventional vehicle purchase price would result in a number of cost effective PEV options.
- The vehicles evaluated in the Electric Department also have rather low annual mileages and low conventional vehicle replacement costs, making it more challenging to find favorable PEV replacements. Nonetheless, there are a few promising opportunities where PEVs could replace vehicles in the Electric Department fleet. One of the Electric Department vehicles averages only 50 miles per trip and could be a good candidate for a BEV.
- A combined fleet scenario examined the replacement of five conventional vehicles with five PEVs, including an estimated cost for installing five Level 2 charging stations. This scenario results in a payback of six years and a net present savings over ten years of $11,000, while also avoiding an estimated 11 tons of carbon dioxide emissions each year.
- A sensitivity analysis shows that reasonable variations in various parameters, such as cost of fuel, annual mileage, and conventional vehicle fuel economy, will generally have

modest impacts on the economic results. However, modest changes in the initial cost of PEVs or conventional vehicles can have a rather significant impact on the overall economic results.

- Before PEV charging stations are installed, the impact of electricity demand charges should be discussed with a Redding Electric Utility representative, including strategies for addressing potential electric bill impacts.

Introduction

The City of Mt. Shasta received a grant from the California Energy Commission to conduct an electric vehicle readiness study for Siskiyou, Shasta and Tehama Counties, referred to in the study as the Upstate Region. The Siskiyou Economic Development Council is administering the grant and technical work is being carried out by the Schatz Energy Research Center at Humboldt State University and GHD Engineering. The study is intended to prepare the region for the successful deployment of a large number of PEVs into the region. PEVs include both battery all-electric vehicles (BEVs) like the Nissan Leaf, as well as plug-in hybrid electric vehicles (PHEVs) like the Chevy Volt.

The Upstate PEV Readiness Study includes the following activities: planning for public charging infrastructure throughout the region, efforts to streamline permitting for charging infrastructure, efforts to accelerate PEV adoption in fleets, and education and outreach. This memo describes the approach we took and summarizes the results we obtained in our analysis of PEV adoption opportunities for the City of Reddings's vehicle fleet.

Approach

We worked with the City's fleet manager to identify a list of vehicles for evaluation. The criteria used to identify key opportunities included the following:

- **PEVs are appropriate for the application**. Currently PEVs are primarily available as light duty passenger vehicles. The vehicle applications considered in this evaluation were all for light duty passenger vehicles.
- **The vehicle is anticipated to be replaced in the next couple of years.**
- **Where possible, the vehicle has relatively high annual miles driven**. Annual miles driven has a big effect on economic payback. In general, more miles driven results in a quicker payback. Annual miles driven ranged from a low of 5,000 miles to a high of 17,000 miles.
- **The required vehicle range (miles driven per trip) is compatible with PEV characteristics**. Battery all-electric vehicles typically have a 60 to 100 mile range on a full charge. Plug-in hybrid electric vehicles typically have a 10 to 40 mile all-electric range, but can be driven much longer distances (e.g., > 300 miles) using the gasoline powered drive train. Most of the vehicle applications considered had a maximum range requirement of 200 miles or more. While these applications will likely require a PHEV in order to attain the required range, it may be possible to place one or two BEVs in these applications if the long trips are infrequent and could be served instead by another vehicle in the fleet.

Analysis

We developed a customized spreadsheet tool, the PEV Fleet Evaluation Tool (PEV FleET), to assess the economic viability of replacing a subset of the City's internal combustion engine (ICE) fleet vehicles with PEVs. In the analysis we included the cost of electric vehicle charging equipment (also known as electric vehicle supply equipment, or EVSE), State of California rebates under the Clean Vehicle Rebate Project, and California Department of General Services negotiated contract pricing where applicable. We also estimated the avoided downstream CO_2 emissions.

To help the City evaluate the economic costs and benefits associated with PEV adoption, we calculated the incremental initial cost (including EVSE, if desired), the simple payback time in years, and the net present value at 10 years. We found that a number of alternatives can pay for themselves within a few years. Note that the PEV FleET spreadsheet tool is being provided to City staff to allow them to conduct further analyses as they see fit.

Results

The City elected to consider the replacement of eleven vehicles in their fleet serving three different departments: Police, Parks, and Electric Utility. A list of the existing fleet vehicles and their characteristics, as provided by the City of Redding, is included in Attachment A. A photographic list of the PEVs evaluated and a description of their characteristics are provided in Attachments B and C, respectively. Tables 1, 2, 4, 5, and 6 examine the cost effectiveness of replacing individual vehicles. Table 7 examines the cost effectiveness of replacing a group of vehicles and installing charging equipment. Table 9 presents the results of a sensitivity analysis where economic model assumptions were varied and the impact on estimated payback times was assessed.

Police Department

A total of six Police Department vehicles were considered for replacement. Annual mileage for these vehicles ranged from 9,000 to 17,000 miles. Average trip mileage was stated to range from 50 to 150 miles, with a maximum trip length of 100 to 200 miles. City driving comprises 85% of the miles driven for these vehicles. While the expected replacement cost for the conventional vehicles was estimated to be \$20,000 to \$25,000, the current manufacture's suggested retail price (MSRP) for these vehicles ranges from \$27,000 to \$30,000 for the entry level models. The current MSRPs were used in this analysis.

Because of the relatively high trip mileage associated with these vehicles (up to 150 miles per average trip and up to 200 miles for the maximum trip length), the appropriate PEV replacement vehicle is likely a PHEV that would offer all electric capabilities for short around town trips, as well as extended range for longer trips. However, it may be possible to deploy one or more battery all-electric vehicles (BEVs) in the fleet, though vehicle scheduling adjustments would need to be made because of their limited range. Gasoline-powered vehicles would need to be scheduled for all long trips, and BEVs would be reserved for shorter trips only.

With this in mind, we examined both PHEVs and BEVs for the Police Department fleet. Tables 1 and 2 show the results. As Table 1 illustrates for one of the Police Department vehicles, there are numerous PEV options that could prove to be economical. Most payback periods shown are four years or less, and in these cases net present savings over a ten-year life range from about $5,000 to $20,000. Table 2 examines the Chevy Volt PHEV replacement for the other five Police Department vehicles. In all cases the payback period and net savings are favorable. The conventional replacements for these Police Department vehicles were specified as a Chevrolet Impala, Buick Regal, or Acura sedan. One important consideration for PEV replacement vehicles can be their size, including passenger capacity, passenger volume, and storage volume. Table 3 compares these parameters for the PEVs and the conventional vehicles, and shows that the PEVs compare favorably. Pictures of the PEVs evaluated are included in Attachment B. Note that the Chevy Volt has been used as a police cruiser in a couple of jurisdictions, including the New York City Police Department and the Washtenaw County Sheriff's Office in Michigan.

Table 1 : Assessment of PEV replacement for Police Department Vehicle D0007

ICE Replacement: Chevrolet Impala ($28,000)
17,000 mi/yr, 100-150 mi/trip, 200 mi max., 85% city driving

PEV Replacement	*Incremental initial cost**	*Payback (yrs)*	*Net Present Value***	*CO_2 emissions reduction (tons/yr)*
PHEV/Toyota Prius 1.8L	($2,893)	(2.0)	$15,200	3.3
PHEV/Ford C-MAX ENERGI	($155)	(0.1)	$11,100	3.1
PHEV/Chevrolet Volt	$3,390	2.9	$6,600	3.3
PHEV/Ford Fusion Energi	$5,200	4.0	$5,800	3.1
PHEV/Honda Accord Plug-in Hybrid	$10,280	7.6	$1,300	3.1
BEV/Nissan Leaf (84 mile range)***	($1,490)	(0.7)	$20,500	5.9
BEV/Ford Focus (76 mile range)***	$1,178	0.5	$18,200	5.9
BEV/Toyota RAV 4 EV (103 mile range)***	$17,576	9.1	($1,100)	5.9

One-for-one replacement assumes no EVSE costs. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs). **Net present value is determined over a 10-year life. ***Not capable of achieving maximum trip length without recharging during trip.

Table 2 : Assessment of additional Police Department vehicle replacements with Chevy Volt

Vehicle to be replaced	*Incremental initial cost**	*Payback (yrs)*	*Net Present Value***	*CO_2 emissions reduction (tons/yr)*
D0013, 441 Police/Chevrolet Impala	$3,390	3.1	$6,000	2.9
D0016, 441 Police/Buick Regal	$1,390	1.0	$10,000	3.4
D0056, 441 Police/Buick Regal	$1,390	1.3	$7,600	2.8
D0064, 441 Police/Acura ILX	$4,390	5.5	$2,400	2.1
PS001, 441 Police/Buick Regal	$1,390	1.3	$7,700	2.8

One-for-one replacement assumes no EVSE costs. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs). **Net present value is determined over a 10-year life.

Table 3: Vehicle Size and Range Comparison

Powertrain	Make	Model	Style	Doors	Seating capacity	Passenger vol (ft3)	Trunk vol (ft3)*	Hatchback cargo vol w/ back seats down (ft3)	All-electric range (mi)	Total range (mi)
PHEV	Honda	Accord Plug-in Hybrid	Sedan	4-dr	5	103	9	N/A	13	570
PHEV	Ford	Fusion Energi	Sedan	4-dr	5	103	12	N/A	20	622
PHEV	Ford	C-MAX ENERGI	Hatchback	4-dr	5	100	19	43	21	623
BEV	Ford	Focus	Hatchback	4-dr	5	91	15	34	76	76
PHEV	Chevrolet	Volt	Hatchback	4-dr	4	90	11	18	35	380
BEV	Nissan	Leaf	Hatchback	4-dr	5	92	24	30	73	73
PHEV	Toyota	Prius 1.8L	Hatchback	4-dr	5	94	16	22	11	541
BEV	Toyota	RAV 4 EV	SUV	4-dr	5	108	36	73	100	100
ICE	Chevrolet	Impala	Sedan	4-dr	5	105	19	N/A	N/A	379-521
ICE	Buick	Regal	Sedan	4-dr	5	97	14	N/A	N/A	342-486

* Trunk volume for a hatchback applies to the space behind the rear seats.

Parks Department

Only one vehicle was analyzed for the Parks Department. The assessment was conducted for vehicle S0707, a Dodge Stratus. The Dodge Stratus is no longer being manufactured, so the Dodge Avenger was assumed to be the conventional replacement vehicle. The results for this assessment are shown in Table 4. The payback periods are substantially longer for this vehicle, and a net savings over ten years is only realized when the vehicle is replaced with a Chevy Spark. The reasons for the long paybacks and poor net savings in this application are due to the fact that this vehicle is only driven 5,000 miles per year, and the conventional replacement vehicle has a rather low purchase cost of only $21,000. If the conventional replacement vehicle cost was only a few thousand dollars more, the economic results would be much more favorable.

Table 4 : Assessment of PEV replacement for Parks Department Vehicle S0707

ICE Replacement: Dodge Avenger ($21,000) 5,000 mi/yr, 50-150 mi/trip, 150 mi max., 70% city driving				
PEV Replacement	***Incremental initial cost****	***Payback (yrs)***	***Net Present Value*****	***CO_2 emissions reduction (tons/yr)***
PHEV/Toyota Prius 1.8L	$4,107	8.8	($100)	1.1
PHEV/Ford C-MAX ENERGI	$6,845	14.7	($3,200)	1.1
PHEV/Chevrolet Volt	$10,390	never	($6,800)	1.3
PHEV/Ford Fusion Energi	$12,200	never	($8,600)	1.1
PHEV/Honda Accord Plug-in Hybrid	$17,280	never	($13,500)	1.1
BEV/Chevrolet Spark***	$3,320	4.8	$2,500	1.9
BEV/Nissan Leaf***	$5,510	8.7	($100)	1.9
BEV/Fiat 500e***	$8,300	12.3	($2,500)	1.9
BEV/Ford Focus***	$8,178	12.6	($2,600)	1.9
BEV/Toyota RAV 4 EV***	$24,576	never	($19,900)	1.9

One-for-one replacement assumes no EVSE costs. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs). **Net present value is determined over a 10-year life. ***Not capable of achieving maximum trip length without recharging during trip.

Electric Utility Department

Four vehicle replacements were assessed for the Electric Utility Department. Three of the vehicles are driven only 5,000 miles per year, and the cost of the conventional replacement vehicle for three of the four vehicles in the department is $23,000 or less. These factors make it tough for the PEV replacements to perform favorably in terms of economic payback. Nonetheless, there are some positive opportunities. Table 5 shows the economic assessment results for vehicle EE401. This vehicle has a higher conventional vehicle replacement cost ($27,000 for the Ford Taurus), and therefore shows some favorable opportunities for both PHEVs and BEVs. Because the average miles per trip for this vehicle is only 50 miles, a BEV could be a good fit in this application. In this case a different vehicle would likely need to be used for longer trips (e.g., the maximum stated trip length is 200 miles).

Table 5 : Assessment of PEV replacement for Electric Utility Department Vehicle EE401

ICE Replacement: Ford Taurus ($27,000) 5,000 mi/yr, 50 mi/trip, 200 mi max., 40% city driving				
PEV Replacement	***Incremental initial cost****	***Payback (yrs)***	***Net Present Value*****	***CO_2 emissions reduction (tons/yr)***
PHEV/Toyota Prius 1.8L	($1,893)	(4.5)	$5,500	1.1
PHEV/Ford C-MAX ENERGI	$845	2.2	$2,400	1.1
PHEV/Chevrolet Volt	$4,390	10.2	($700)	1.5
PHEV/Ford Fusion Energi	$6,200	14.7	($2,900)	1.1
PHEV/Honda Accord Plug-in Hybrid	$11,280	never	($7,800)	1.1
BEV/Chevrolet Spark***	($2,680)	(4.4)	$7,900	1.8
BEV/Nissan Leaf***	($490)	(0.9)	$5,200	1.8
BEV/Ford Focus***	$2,178	3.8	$2,700	1.8
BEV/Fiat 500e***	$2,300	3.8	$2,800	1.8
BEV/Toyota RAV 4 EV***	$18,576	never	($14,500)	1.8

One-for-one replacement assumes no EVSE costs. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs). **Net present value is determined over a 10-year life. ***Not capable of achieving maximum trip length without recharging during trip.

Vehicle EV402 in the Electric Utility Department is driven 12,000 miles per year. Because of this higher mileage, there is at least one PHEV replacement, the Toyota Prius, that exhibits a favorable payback (see Table 6).

Table 6 : Assessment of PEV replacement for Electric Utility Department Vehicle EV402

ICE Replacement: Toyota Camry ($23,000) 12,000 mi/yr, 200-300 mi/trip, 400 mi max., 40% city driving				
PEV Replacement	***Incremental initial cost****	***Payback (yrs)***	***Net Present Value*****	***CO_2 emissions reduction (tons/yr)***
PHEV/Toyota Prius 1.8L	$2,107	3.0	$3,800	1.4
PHEV/Ford C-MAX ENERGI	$4,845	8.8	($100)	1.1
PHEV/Chevrolet Volt	$8,390	never	($4,200)	1.2
PHEV/Ford Fusion Energi	$10,200	never	($5,500)	1.1

One-for-one replacement assumes no EVSE costs. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs). **Net present value is determined over a 10-year life.

Combined Fleet Analysis
The individual vehicle evaluations presented above do not include the cost of installing electric vehicle charging equipment. These one-for-one vehicle replacements are expanded to a fleet analysis in Table 7. In the fleet scenario, five vehicles are replaced at once along with the installation of electric vehicle charging equipment. The estimated payback time is six years. It was assumed that one charger would be installed for each vehicle. However, it is possible that one charger could potentially serve more than one vehicle. Also, there may be California Energy Commission grants available to help cover the cost of EVSE, and these grants can substantially improve fleet payback times. It is also important to note that EVSE installation costs are very particular to each installation and can vary significantly from one installation to the next. Therefore, it is recommended that cost estimates be developed for the installation of electric vehicle charging infrastructure before moving forward with any purchase of a PEV.

Table 7: Combined Fleet Scenario

Conventional vehicles	D0016 (Police, Buick Regal); PS001 (Police, Buick Regal); S0707 (Parks, Dodge Avenger); EE401 (Electric, Ford Taurus); EV402 (Electric, Toyota Camry)
PEV Replacements	PHEV/Chevrolet Volt; PHEV/Ford Fusion Energi; BEV/Chevrolet Spark; BEV/Nissan Leaf; PHEV/Toyota Prius 1.8L
Number of EVSE ports: Clipper Creek CS40	5
Incremental initial cost*	$26,171
Simple payback	6.0 years
Net present value (over 10 years)	$11,000
Avoided CO2 emissions	11.0 tons per year

Conventional vehicle characteristics are as shown in Appendix A. *Incremental initial cost is based on the CA Department of General Services where applicable, or on the MSRP, as well as installed cost estimates for EVSE. Cost includes CVRP rebate ($1,500 for PHEVs; $2,500 for BEVs).

Sensitivity Analysis
The baseline assumptions used in this analysis are shown in Table 8. To assess the impact of variations in these parameters we conducted a sensitivity analysis for the combined fleet scenario. Table 9 shows the change in incremental initial cost, simple payback, and net present value given reasonable variations in the input parameters. In most cases the payback period varies by no more than about 30%. The most sensitive parameter appears to be the initial cost of the vehicles and/or the electric vehicle charging equipment.

It should also be pointed out that the worst case scenario for Redding Electric Utility demand charges has a very significant negative impact on the economic results. However, this absolute worst case is very unlikely to occur. The worst case scenario assumes all vehicles are charging simultaneously from the same electric service (same meter) at a time that is coincident with the existing peak demand for that meter, and that this happens every month throughout the year. This would be an extremely unlikely event. For comparison purposes, if this worst case scenario occurred only one month out of the year, the resulting payback would be 6.2 years; if it occurred twice per year the resulting payback period would be 7.4 years. This is an issue that should be discussed with a Redding Electric Utility service representative before PEV charging equipment is installed, including strategies for addressing potential electric bill impacts.

Table 8: Baseline Assumptions

Parameter	***Value***
CVRP rebate (Y/N)	Yes
Conventional vehicle purchase cost	Provided by City of Redding Fleet Manager
PEV purchase cost	MSRP
State negotiated purchase cost	From CA Department of General Services (where applicable)
EVSE equipment costs	From mfg./distributor
EVSE installation costs	Per EVSE contractor/distributor
Annual mileage	Provided by Fleet Manager, specific to each vehicle
Peak demand charges	$0.00
Annual BEV maintenance cost	Half the cost of ICE maintenance
Annual PHEV maintenance cost	90% the cost of ICE maintenance
Gasoline cost	$3.75/gal (estimate based on Redding gasoline prices)
Fuel economy	Per EPA ratings (where available), else mfg. rating
Percent miles driven in city	40% to 85% (provided by Fleet Manager)
Average miles per trip	50 to 300 miles (provided by Fleet Manager)
Annual conventional ICE vehicle maintenance cost	$200 to $1,790 per year (provided by Fleet Manager)
Electric rate schedule	Redding Electric Utility E2 Small Commercial
Electricity cost	Per Redding Electric Utility rate schedule

Table 9: Sensitivity Analysis

Change in input parameter	*Incremental initial cost*	*Simple payback (yrs)*	*Net present value*
Baseline	$26,171	6.0	$11,000
Only 3 EVSE instead of 5 EVSE	$21,373	4.9	$15,800
No CVRP rebate	$35,671	8.2	$1,500
No state negotiated purchase price	$31,009	7.1	$6,200
PEV purchase cost +10%	$41,173	9.4	-$4,000
EVSE installed cost +100%	$42,817	9.8	-$5,600
No annual maintenance cost savings	$26,171	7.0	$5,800
Gasoline cost +20% ($4.50/gal)	$26,171	4.9	$19,000
Gasoline cost -20% ($3.00/gal)	$26,171	7.6	$3,000
Annual mileage +20%	$26,171	5.1	$17,400
Annual mileage -20%	$26,171	7.2	$4,600
ICE fuel economy +10%	$26,171	7.0	$5,700
ICE fuel economy -10%	$26,171	5.1	$17,500
Electric rate schedule REU E7/E8 Large Commercial	$26,171	5.4	$15,100
Worst case demand charge on REU E7/E8 Large Commercial rate	$26,171	never	-$51,600

Attachment A – Fleet Vehicles Considered for Replacement

Plug-in Electric Vehicle Fleet Evaluation
Input information for PEV FleET tool

Name of Organization	City of Redding
Contact Person (name)	Jim Schmitz
Contact Person (phone#)	530-224-6091
Contact Person (email)	jschmitz@ci.redding.ca.us
Cost of gasoline	
Electric utility and rate type	

	ID#	Vehicle department (admin, IT, engineering, etc.)	Vehicle to be replaced (make/model)	Annual mileage	Ave. miles/trip	Max. miles/trip	% city driving	Annual maintenance costs	Likley conventional replacement vehicle (make/model)	Likley conventional replacement vehicle cost*	Likely charging period (overnight, daytime, both)
1	D0007	441 Police	Chevrolet Impala (2013)	17,000	100-150	200	85	1300	Chevy Impala	$28,000	Both
2	D0013	441 Police	Chevrolet Impala (2013)	15,000	100-150	200	85	1790	Chevy Impala	$28,000	Both
3	D0016	441 Police	Buick Regal (2000)	12,000	100-150	200	85	1400	Buick Regal	$30,000	Both
4	D0056	441 Police	Buick Regal (2002)	9,000	50-100	150	85	1000	Buick Regal	$30,000	Both
5	D0064	441 Police	Acura (2007)	11,000	100-150	200	85	1400	Acura	$27,000	Both
6	PS001	441 Police	Buick Lacross (2006)	9,000	50-100	100-150	85	1,200	Buick / any of the above	$30,000	Both
7	S0707	610 Parks	Dodge Stratus (2005)	5,000	50-100	150	70	250	Any of the above or Stratus**	$21,000	Both
8	EE401	852 Electric	Ford Tauras (2014)	5,000	50	200	40	200	New car 10 years away	$27,000	Both
9	EV002	853 Electric	Honda civic (2002)	5,000	200-300	400	40	400	Honda Civic	$21,000	Both
10	EV003	853 Electric	Honda civic (2004)	5,000	200-300	400	40	350	Honda Civic	$21,000	Both
11	EV402	853 Electric	Toyota Camry (2008)	12,000	200-300	400	40	1300	Toyota Camry	$23,000	Both

* The likely conventional cost provided by the Fleet Manager was $20,000 to $25,000 per likely conventional replacement vehicle. The cost numbers shown and used in the analysis were based on current MSRP's vehicles listed.

** The Dodge Avenger was used as the assumed conventional replacement vehicle for this application.

Additional notes: Average miles per trip for a 50-100 mile range were assumed to be 75 miles, for a 100-150 mile range they were assumed to be 100 miles, and for a 200-300 mile range they were assumed to be 200 miles. The PHEV all-electric range was divided by the average miles per trip to determine the percent all-electric miles driven for a PHEV. For battery all-electric vehicles, the percent all electric miles driven was always assumed to be 100%. If the maximum trip length was greater than the BEV range, then it is assumed that the vehicle was charged during the trip. Alternatively, a different vehicle could be used for trips that exceed the BEVs range.

Attachment B – Pictures of PEVs Evaluated

Chevy Volt
Plug-in Hybrid

Toyota Prius
Plug-in Hybrid

Ford Focus EV
Full Electric

Nissan Leaf
Full Electric

Chevy Spark
Full Electric

Fiat 500e
Full Electric

Attachment C – Characteristics of PEVs Evaluated

Vehicle Type	PHEV/ BEV	Make	Model	Year	Full Electric Charge Range (mi)	Electric Fuel economy (mi/kWh) - city	Electric Fuel economy (mi/kWh) - hwy	Purchase cost ($)	Purchase cost (state rate) ($)	Gasoline Fuel economy (PHEV only) - city	Gasoline Fuel economy (PHEV only) - hwy	On-board charger rating (kW)	CVRP rebate ($)	Federal tax credit ($)
Sedan/Wagon	PHEV	Chevrolet	Volt	2015	38	3.03	2.78	34345	32890	35	40	3.3	1500	7500
Sedan/Wagon	PHEV	Ford	C-MAX ENERGI	2014	19	3.23	2.7	31635	29345	44	41	3.3	1500	4007
Sedan/Wagon	PHEV	Ford	Fusion Energi	2015	19	3.23	2.7	34700	34700	44	41	3.3	1500	4007
Sedan/Wagon	PHEV	Honda	Accord Plug-in Hybrid	2014	13	3.7	3.125	39780	39780	47	46	6.6	1500	3626
Sedan/Wagon	PHEV	Toyota	Prius 1.8L	2015	11	3.85	3.03	29990	26607	51	49	3.3	1500	2500
Coupe	BEV	Chevrolet	Spark	2015	82	3.8	3.23	26820	26820			3.3	2500	7500
Coupe	BEV	Fiat	500e	2015	87	3.62	3.2	31800	31800			6.6	2500	7500
Sedan/Wagon	BEV	Ford	Focus	2014	76	3.23	2.94	35170	31678			6.6	2500	7500
Sedan/Wagon	BEV	Nissan	Leaf	2015	84	3.125	2.7	29010	29010			6.6	2500	7500
Sport Utility Vehicle	BEV	Toyota	RAV 4 EV	2014	103	2.33	2.17	49800	48076			10	2500	7500

APPENDIX G
PEV Incentives

TASK 8: PEV INCENTIVES MEMO

Introduction:

The purpose of this memo is to outline potential options for incentivizing greater adoption of plug-in electric vehicles (PEVs) in the Upstate California region. Incentives can be a powerful motivator for encouraging a change in consumer and commercial business behavior towards adoption of alternative transportation options like PEVs. Incentives can take many forms including economic subsidies, convenience, and distinguished status through community leadership. More specifically, these incentives include (but are not limited to):

Economic: Reduction of PEV transportation costs

- Federal, State, and City programs to reduce PEV and charging equipment (EVSE) purchase cost through tax credits and rebates[1]
- Municipalities providing free or reduced public charging costs
- Utilities reducing private charging costs through special PEV charging rates to residential and commercial customers

Convenience:

- Municipalities constructing public infrastructure to foster charging away from home (the Upstate PEV Readiness Plan addresses this incentive)
- Providing educational materials to consumers and fleet evaluations to commercial businesses to aid in understanding adoption advantages
- Streamlining EVSE installation through reduced fees and wait times for permitting and inspections through local municipalities
- Utilities providing customer assistance and resources for purchasing, installing, or upgrading EVSE
- Municipalities providing free or advantageous parking
- Private businesses adding or allowing EVSE infrastructure installation on premises to attract tourists

Status and Community Leadership:

- Local municipalities supporting a Plug-in Electric Vehicle Coordinating Council with in-kind staff time

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[1] The California PEV Collaborative provides a dynamic web search tool that indexes existing programs available from the Federal Government, the State of California, and municipalities. The web search tool can be found at: http://driveclean.ca.gov/pev/Incentives.php

- Local municipalities incorporating PEV promotion policies and language into community planning efforts
- Local municipalities publically recognizing outstanding efforts of local businesses that have started to transition their fleets to PEVs
- Local community-oriented Foundations supporting public venues through PEV infrastructure installation at local libraries, schools, and theaters.
- Private businesses adding or allowing EVSE infrastructure installation on premises to demonstrate a commitment to improving local environmental air quality

Incentives for Plug-in Electric Vehicle Users or Consumers

CALIFORNIA PLUG-IN ELECTRIC VEHICLE COLLABORATIVE

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PROGRAM NAME & SPONSOR	INCENTIVE	SELECTION CRITERIA/PROGRAM DESCRIPTION	TIMING & TYPE OF SOLICITATION	WEBSITE
VEHICLES				
National Programs				
Qualified Plug-In Electric Drive Motor Vehicle Tax Credit - Internal Revenue Service	Tax credits range from $2,500 to $7,500	For qualified electric drive vehicles acquired after 12/31/09. The credit is phased out for each manufacturer in the 2nd quarter following the calendar quarter in which a minimum of 200,000 qualified PEVs have been sold in the U.S.	For eligible vehicles acquired after 12/31/09	www.irs.gov/businesses/article/0,,id=214841,00.html
Plug-In Electric Drive Conversion Kit Tax Credit - Internal Revenue Service	Tax credit up to $4,000	10% tax credit toward the cost of converting a vehicle to a qualified plug-in electric drive motor vehicle.	For eligible vehicles placed in service after 2/17/09	www.irs.gov/newsroom/article/0,,id=206871,00.html
Low-speed or Two- or Three-Wheel Plug-In Electric Vehicle Tax Credit - Internal Revenue Service	Tax credit is 10% of the cost of the vehicle, up to a maximum credit of $2,500	For qualified low-speed or two- or three-wheel PEVs.	For eligible vehicles acquired between 2/17/2009 and 1/1/2012	www.irs.gov/newsroom/article/0,,id=207051,00.html
Employee Corporate Incentives - varies by company/organization	Incentives range from $1,000 to $5,000	Some private companies and other organizations are helping employees to purchase hybrid or alternative fuel vehicles. Some include California hotels, Bank of America, Google, Integrated Archive Systems, Cliff Bar & Co., Timberland, Patagonia, and many more.	Open	www.hybridcars.com/corporate-incentives.html
California Programs				
Clean Vehicle Rebate Project - California Air Resources Board	$2,500 for zero emission vehicles (ZEVs); $1,500 for plug-in hybrid electric vehicles (PHEVs); $900 for neighborhood electric vehicles (NEVs) and zero emission motorcycles (ZEMs)	Rebate for California consumers to purchase qualifying zero emission and near-zero emission vehicles.	While funds last	www.energycenter.org/cvrp
Los Angeles/Riverside Area Programs				
City of Corona Alternative Fuel Vehicle Rebate Program	$2,000 toward the purchase of a new qualified alternative fuel vehicle or $1,000 for a qualified used vehicle	Qualified vehicles include compressed natural gas, EV or a non-diesel hybrid and meet emission standards set by the California Air Resources Board. Rebates are only available to licensed drivers living in the City of Corona. NEVs do not qualify. Vehicles must meet the Super Low Emission Vehicle (SULEV) standard for passenger and light-duty trucks, and the Ultra Low Emission Vehicle (ULEV) standard for medium duty non-diesel hybrids	While funds last	http://www.discovercorona.com/City-Departments/Public-Works/Public-Services-and-Information/Alternative-Fuel-Vehicle-Rebate-Program.aspx
City of Riverside Employee Vehicle Purchase Incentives	Up to $2,000 for new vehicles and up to $1,000 for used vehicles	City of Riverside employees are eligible to receive a rebate toward the purchase of qualified natural gas or hybrid electric advanced technology partial zero emission vehicle (ATPZEV).	While funds last	www.riversideca.gov/air/alternativefuel.asp
Rebate for City of Riverside Residents	$2,000 toward the purchase of a new qualified vehicle with original manufacturer's alternative fuel equipment	For vehicles fueled exclusively with natural gas, hybrid, PHEV or EV and meeting both of the following criteria: 1) Combined estimated new EPA MPG rating of 34 MPG or greater as published at www.fueleconomy.gov; and 2) Smog score of 9 or greater as published at www.driveclean.ca.gov. Vehicles with conversions do not qualify.	Open	www.riversideca.gov/air/alternativefuel.asp
San Joaquin Valley Programs				

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PROGRAM NAME & SPONSOR	INCENTIVE	SELECTION CRITERIA/PROGRAM DESCRIPTION	TIMING & TYPE OF SOLICITATION	WEBSITE
San Joaquin Valley Light/Medium Duty Vehicle Emission Reduction Incentive	Rebate of $1,000 - $3,000 per vehicle depending on the emission certification level and vehicle size	Vehicles must be powered by alternative fuel, electric, or hybrid electric engines/motors.	Open	www.valleyair.org/transportation/removeII/LMD.htm
FUELING AND CHARGING EQUIPMENT				
Bay Area Programs				
Bay Area Residential Charging Incentive Program - BAAQMD	Incentives to reduce the purchase and installation cost of home charging equipment	$700 rebate for residents that purchase a Level 2 charging equipment from Coulomb Technologies in the BAAQMD area .	Open though 12/31/12 while funding is available.	www.baaqmd.gov/EVReady
ChargePoint America	Free Coulomb charging equipment and installation costs up to $1,200 in the San Jose/San Francisco Bay Area	For qualifying residents and businesses in the San Jose/San Francisco Bay Area that purchase or lease a Chevy Volt, Ford Transit Connect, Ford Focus BEV, or Smart Fortwo electric drive vehicle.	While funds last	www.chargepointamerica.com/search-zip-code.php
EV Project	Free residential charging equipment and installation up to $1,200. Free DC Fast Charger Ports and installation up to $14,000 for Nissan Leafs.	For residents living within the BAAQMD territory who purchase or lease the Nissan Leaf.	While funds last	www.theevproject.com/index.php
Los Angeles Area Programs				
Charge Up LA!	$2,000 toward Level 2 charging equipment and a separate time-of-use meter at their home	To cover “out-of-pocket” charger and installation expenses, after other discounts and incentives are deducted, for the first 1,000 customers that submit a completed application. Also available to apartment and condominium residents with permission from property owner and/or homeowner association.	While funds last for first 1,000 customers	www.ladwp.com/ladwp/cms/ladwp002056.jsp
ChargePoint America	Free Coulomb charging equipment and installation costs up to $1,200 in Los Angeles region	For qualifying residents and businesses in the Los Angeles region that purchase or lease a Chevy Volt, Ford Transit Connect, Ford Focus battery electric vehicle (BEV), or Smart Fortwo electric drive vehicle.	While funds last	www.chargepointamerica.com/search-zip-code.php
EV Project	Free residential charging equipment, free DC Fast Charger Ports (valued at about $780), and installation subsidy	For residents living within the greater Los Angeles region. Both the Nissan Leaf and the Chevy Volt qualify.	While funds last	www.theevproject.com/index.php
Sacramento Area Programs				
ChargePoint America	Free Coulomb charging equipment and installation costs up to $1,200 in the Sacramento area	For qualifying residents and businesses in the Sacramento area that purchase or lease a Chevy Volt, Ford Transit Connect, Ford Focus BEV, or Smart Fortwo electric drive vehicle.	While funds last	www.chargepointamerica.com/search-zip-code.php
San Diego Area Programs				
EV Project	Free residential charging equipment, free DC Fast Charger Ports (valued at about $780), and installation subsidy.	For residents living in the greater San Diego region. Both the Nissan Leaf and the Chevy Volt qualify.	While funds last	www.theevproject.com/index.php
SPECIAL DECALS AND PERMITTING				

CALIFORNIA PLUG-IN ELECTRIC VEHICLE COLLABORATIVE

Incentives for Plug-in Electric Vehicle Users or Consumers

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PROGRAM NAME & SPONSOR	INCENTIVE	SELECTION CRITERIA/PROGRAM DESCRIPTION	TIMING & TYPE OF SOLICITATION	WEBSITE
California Programs				
Green Clean Air Decals	Access to HOV lanes for single occupancy vehicles through 1/1/15	Eligible vehicle types include purchased or leased cars meeting California's enhanced advanced technology partial zero emission (ATPZEV) requirements.	Program began 1/1/12; Limited to first 40,000 eligible vehicles. Access to HOV lanes ends 1/1/2015	www.arb.ca.gov/msprog/carpool/carpool.htm
White Clean Air Decals	Access to HOV lanes for single occupancy vehicles through 1/1/15	Eligible vehicles must be a federal inherently low emission vehicle (ILEV) which includes certified zero emission vehicles (100% battery electric and hydrogen fuel cell) and CNG vehicles certified to the Air Resources Board's Super Ultra Low Emission Vehicle standard.	Available to an unlimited number of qualifying vehicles; Program ends 1/1/2015	www.arb.ca.gov/msprog/carpool/carpool.htm
UTILITY RATE DISCOUNTS				
Los Angeles Area Programs				
LA DWP	Discount of 2.5 cents per kWh for EVs charged during off-peak hours	The discount is available for a maximum of 500 kWh/month limited to the base-period rate (off-peak hours).	Open	www.ladwp.com/ladwp/cms/ladwp002056.jsp
Pacific Gas and Electric	Discount rate for electricity used to charge qualifying vehicles including BEVs, PEVs, and natural gas vehicles	For PG&E customers charging BEVs, PEVs, and NGVs via a home fueling appliance during off-peak hours. NEVs do not qualify.	Open	www.pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_E-9.pdf
SCE	Discount rate available for EV charging	Discount of 7.825 cents per kWh for electricity used to charge PHEVs, BEVs, electric golf carts and NEVs during off-peak hours.	Open	www.sce.com/CustomerService/rates/residential/electric-vehicles.htm
Sacramento Area Programs				
SMUD	Discount rate for residential customers that own or lease PEVs and install a time-of-use (TOU) meter at the charging location	Discount of 2.43 cents per kWh off the winter off-peak residential rate, and 2.71 cents per kWh off the summer off-peak residential rate. The monthly service charge is waived for the PEV charging rate. Proof of vehicle registration is required.	Open; Non-competitive	https://www.smud.org/en/residential/environment/plug-in-electric-vehicles/PEV-rates.htm
San Diego Area Programs				

CALIFORNIA PLUG-IN ELECTRIC VEHICLE COLLABORATIVE

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PROGRAM NAME & SPONSOR	INCENTIVE	SELECTION CRITERIA/PROGRAM DESCRIPTION	TIMING & TYPE OF SOLICITATION	WEBSITE
SDG&E	Three time-of-use (TOU) discount rates available for EV charging	Available to residents in single family dwelling flats and apartments. Super off peak rate is .145/kWh	Open; Non-competitive	http://sdge.com/clean-energy/electric-vehicles/electric-vehicles
PARKING				
Los Angeles Area Programs				
City of Hermosa Beach - Free Metered Parking	Free metered parking at silver pole meters	For all-electric and natural gas vehicles with identifying stickers.	Open	http://www.hermosabch.org/modules/showdocument.aspx?documentid=815
City of Santa Monica - Free Metered Parking	Free metered parking	For vehicles that have been issued green or white carpool lane decals by the State of California.	Open	www.smgov.net/Departments/OSE/Categories/Transportation/Automobiles.aspx
LAX Free EV Parking	Free parking at charging stations located in the lower/arrivals level of parking structures 1 and 6	For EVs only, up to a maximum of 30 days per visit at designated parking structures.	Open	http://www.lawa.org/parking/
Sacramento Area Programs				
City of Sacramento - Free EV Parking	Free parking in designated city parking facilities	For EVs only.	Open	www.cityofsacramento.org/transportation/parking/offstreetother.html
San Jose Area Programs				
City of San Jose - Free Metered Parking	Free metered parking	For vehicles that have been issued green or white carpool lane decals by the State of California or NEVs that have been issued a NEV tag by the City of San Jose.	Open	www.sjdowntownparking.com/pdf/CleanAirVehicleParkingPermitApp2011.pdf
INSURANCE DISCOUNTS				
California Programs				
Farmers Insurance Discounts	10% discount on all major coverage	Gas-electric hybrids, electric vehicles, and dedicated compressed natural gas, ethanol, methanol or propane vehicles qualify.	Open	www.farmers.com/california_insurance_discounts.html

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PROGRAM NAME & SPONSOR	INCENTIVE	SELECTION CRITERIA/PROGRAM DESCRIPTION	TIMING & TYPE OF SOLICITATION	WEBSITE
AAA Insurance Discount for Hybrid and Alternative Fuel Vehicles	5% discount on auto insurance policies	Factory-built hybrid and electric vehicles, as well as automobiles that use ethanol (E85), natural gas or propane.	Open	http://www.csaa.com/insurance/vehicle-insurance/hybrid-owners-save-on-aaa-auto-insurance

APPENDIX H
Task 9 PEV Outreach & Education

Education and Outreach Plan
California Upstate Region PEV Readiness Project

Introduction

The area encompassed in this project includes Siskiyou, Shasta and Tehama counties. The Siskiyou County Economic Development Council (SCEDC) and its project partners will informally include other counties in the Upstate Region, such as Glenn and Colusa counties, in the education and outreach activities as much as possible. The Upstate Region is very different from other areas in the state and requires a unique education and outreach approach that takes into account the important characteristics of the area and the region's culture.

These counties are predominantly rural and are home to many natural and wilderness areas. As such they are important tourist destinations for outdoor recreational opportunities. Interstate 5 bisects these five counties making it an important transportation route connecting Oregon with central California. Winter storms in areas in some of these counties can be unpredictable and severe requiring different transportation assurances than in other areas in the state.

There has been little Plug-in Electric Vehicle (PEV) education and outreach effort in this region up to this point. Many people have incomplete or inaccurate information about PEVs and their benefits. A large segment of the population is unaware that PEVs are currently on the market and that they perform as well as, or sometimes even better, than conventional gasoline vehicles. In addition, few people realize the important link that the Upstate Region serves as a critical transportation link in the West Coast Green Highway, which runs from British Columbia, Canada to Baja, Mexico. Without electric charging infrastructure in the Upstate Region, PEV drivers cannot make the border to border journey.

In order to gain support for the deployment of PEVs and charging infrastructure in the Upstate Region, SCEDC will develop and implement an education and outreach campaign tailored to this largely rural area and its unique qualities. This campaign will raise awareness and understanding of the growing PEV market, dispel the myths about the technology, allay fears of range anxiety and cast the Upstate's adoption of PEVs as a critical part of a larger movement that can bring economic and environmental benefits to the area.

Education and Outreach Plan Focus

The goal of this plan is to provide the roadmap for reaching out to the diverse stakeholders in the Upstate Region to educate them on PEV options and benefits. SCEDC will develop easily accessible education and outreach resources that provide trusted, unbiased information focused on PEV

- Availability
- Characteristics

- Vehicle range
- Charging requirements
- Electric Vehicle Supply Equipment (EVSE) options
- Environmental benefits
- Fuel cost savings
- Proper match of vehicle to lifestyle/application
- Requirements for EVSE installations
- Utility rate options
- Available incentives

This plan identifies targeted audiences, key messages and the specific actions that SCEDC and its project partners will undertake on a near-term, mid-term and long-term basis. The plan emphasizes maximizing resources by using existing information and work already developed at the state level as well as in other regions throughout the country. The step-wise approach and targeted information laid out in this plan will help drive customer support and demand for PEVs in the Upstate Region.

Audience

The education and outreach efforts will target regional and local decision-makers, local government staff, business leaders, utility and energy professionals, public and private fleet vehicle operators, emergency first responders and the general public. There are sub-groups of the general public which will require separate focused messaging. To maximize resources the education and outreach efforts will focus on community leaders, such as county boards of supervisors and other elected or appointed officials. Many of the communities within the Upstate Region are actively involved with their local governments and communities. The education and outreach efforts will tap into that involvement to reach the general public as well as several of the established community groups such as the Rotary, Elks and Kiwanis organizations.

Key Messages

The key messages will focus on PEV benefits to community health, air quality, greenhouse gas reduction and economic development. SCEDC will use and adapt the key messages developed by the California Plug-in Electric Vehicle Collaborative and the West Coast Green Highway Initiative. SCEDC will modify these messages so that they are relevant to the Upstate Region and emphasize specific messages with different community groups depending on the group's focus and interest. For example, the education and outreach presentations or other materials will focus on economic development opportunities when SCEDC is targeting economic development groups.

SCEDC will tailor the following PEV Collaborative messages to the Upstate Region.

- Drive a PEV Now: With several models available today and dozens coming in the next two years, major automakers are committed to PEVs as an essential part of their current and future model lineup.

- Experience the Most Technologically Advanced Fuel Efficient Cars Today: PEV drivers get high performance, smooth acceleration, great torque and quiet comfort from their PEVs, plus the latest in high tech convenience.
- Save Green by Being Green: With lower fuel costs (electricity vs. gasoline) and higher efficiency, PEVs cost less to operate over their lifetimes than comparable gasoline vehicles.
- Clean the Air, Improve Public Health, Reduce Your Carbon Footprint: Clean California electricity enables PEVs to significantly reduce greenhouse gas emissions and cut down on air pollution. California electricity generation continues to get cleaner every day.
- Support Energy Independence. PEVs Use Electricity Generated from Domestic Sources: Gasoline production relies heavily on imported oil, while electricity is generated more locally. PEV drivers help reduce our dependence on imported oil by spending their hard-earned dollars on fuel that is produced mainly in the state.

SCEDC will tailor the following West Coast Green Highway talking points to emphasize the important link that the Upstate Region serves in connecting the northern and southern portions of the West Coast Green Highway.

- The West Coast Green Highway is an initiative to promote the use of cleaner fuels. By increasing the market demand for high-efficiency, zero- and low-carbon-emitting vehicles, this initiative aims to reduce the transportation sector's impact upon the environment and dependency on foreign oil.

- The West Coast Green Highway is the 1,350 miles of Interstate 5 (I-5) stretching from the U.S. border with Canada, through Washington, Oregon, and California, to the U.S. border with Mexico.

- Designated a "Corridor of the Future" by the U.S. Department of Transportation, I-5 could soon become the nation's cleanest, greenest, and smartest highway.

- The West Coast Green Highway reduces carbon emissions, creates jobs and advances energy independence.

- The West Coast Green Highway initiative strengthens the economy with environmentally sustainable transportation options. By encouraging a shift from petroleum-based fuels to alternative fuels with low or no carbon emissions, the initiative helps meet national and state-wide greenhouse gas reduction goals and creates green-technology jobs.

- Making the shift to electric transportation will:

    - Lower the cost to fuel a vehicle – on average, it costs about 3 times less to drive an electric vehicle compared to a similar vehicle that runs on gasoline.
    - Help displace oil as the nation's dominant fuel source.
    - Help insulate the nation from future oil shocks and economic meltdowns.
    - Boost national security through energy independence.
    - Drive economic growth with the emergence of an industry comprised of new vehicle and infrastructure technology.

- Reduce environmental effects from the transportation sector's greenhouse gas emissions.

SCEDC will adapt the following key messages that have been derived from various sources.

- Electric cars are very reliable.
- They do not require oil changes or tune ups.
- They have fewer moving parts than a gasoline-powered car, which makes them easier and cheaper to maintain. New technology has ensured that PEVs have increased efficiency while maintaining a powerful engine.
- Because California's electricity is generated mostly in-state, from a wide variety of sources, PEVs provide Californians with *personal energy independence*, by reducing their reliance on volatile world markets.
- Millions of transportation fuel dollars will go toward electricity generated mostly in-state rather than gasoline from foreign oil.
- Gasoline production relies heavily on imported oil, while electricity is generated more locally.
- PEV drivers help reduce our dependence on imported oil by spending their hard-earned dollars on fuel that is produced mainly in the state of California.

The following are examples of Upstate Region-focused messages.

- The Upstate Region has some of the lowest power rates in the state and thus the greatest opportunity to provide the most cost savings and dollars back into the consumer's pocket.
- The California Upstate Region is a critical part of the West Coast Green Highway, connecting the Pacific Northwest portion of the highway with the rest of California and enabling PEV drivers to drive the entire distance from British Columbia to Baja, Mexico.

Approach

Education and outreach strategies will include the development of web-based material, a promotional brochure and informative presentations at local events. SCEDC is routinely involved in local and regional outreach efforts, most recently through the development of a regional food system plan, regional agri-tourism initiative and regional industry collaboration activities. SCEDC will take advantage of existing outreach efforts when possible to reach the diverse community groups in the area.

Challenges and Opportunities

There are several education and outreach challenges in the Upstate Region.

- Limited understanding of PEVs and their benefits.
- Distrust and resistance to PEV technology.
- Range anxiety, particularly where there are long distances between home and work or other destinations.
- Concerns about PEV performance in winter storms or inclement weather.

- Limited information at the point of sale.
- Unfamiliarity with charging stations.
- Limited understanding and/or embracing the concepts of how PEVs can benefit the environment or help climate change by reducing greenhouse gas emissions.

Along with these challenges, however, there are also opportunities to highlight economic development benefits, which are a priority in this area, and the important transportation link the region serves in the West Coast Green Highway. There is an opportunity as well to continue to build relationships with Oregon and Washington by ensuring seamless a travel experience among the states and strengthening the tri-state partnership. This will lay the groundwork for future collaboration.

SCEDC will use the following education and outreach activities. The activities are broken down into three timeframes: Near-term (within a year), mid-term (one to two years) and long term (more than two years).

Near-term approach (less than a year)

1. Develop outreach materials for multiple targeted audiences.
    - Presentations – A PEV 101 PowerPoint and oral presentation that covers the basics of what PEVs are and how they can benefit the Upstate Region.
    - Radio Ads - Short radio spots describing the planning process and notifying people of ways that they can engage and provide input.
    - Print Material – Flyers and/or brochures for distribution at community meetings and events.
    - Web-Based – SCEDC will develop and host a website with information about the project, ways to engage and basic information about PEVs. The website will link to other sites that provide additional information, such as fuel cost calculators, so that people can calculate what their individual cost savings would be. The information will be routinely updated.
2. Develop lists and contact information for targeted audiences and identify potential local PEV champions and enthusiasts. Targeted audience lists will include
    - Local Government and Community Leadership Groups such as city councils, county boards and business development councils.
    - Community Service Groups such as Elks, Rotary and Kiwanis organizations.
    - Public Fleets
    - Private Fleets
    - Emergency Responders
    - Local Media Outlets
    - Local PEV owners and enthusiasts
3. Identify existing community forums, events or meetings where PEV 101 presentations can be given.
4. Hold a PEV 101 workshop for key audiences: regional and local decision-makers, local government staff, building and permitting officials, business leaders, utility and energy professionals, public and private fleet vehicle operators, emergency first responders and the general public.

Mid-term (one to two years)

1. Continue offering PEV 101 presentations at local community forums and events.

2. Participate in the annual BC to Baja PEV Road Rally in the summers of 2014 and 2015 (if continued).
3. Hold events throughout the Upstate Region as part of the National Plug-in Day in the summers of 2014 and 2015.
4. Hold PEV test drive events. Other areas have found that getting people in PEVs is an effective way to introduce people to PEVs as well as build confidence and enthusiasm about PEVs and their benefits.
5. *Revenge of the Electric Car* screenings – Ashville, North Carolina has found that using the screening of the movie the *Revenge of the Electric Car* has been an effective way to energize and launch PEV events. The screenings could be paired with the BC to Baja Road Rally, National Plug-in Day events or PEV test drive events.
6. Host PEV booths at local community fairs and other events. SCEDC will identify public events to host booths and showcase PEVs. This list will be posted on the website and will help people and auto-dealers identify events that fit with their priorities and schedules.

Long-term (more than two years)

1. Continue to identify and participate in national and regional PEV events such as the BC to Baja Road Rally and National Plug-in Day events.
2. Outreach to high schools and technical and community colleges to include PEV training and curriculum in courses. Other areas have found this to be very effective in getting young people excited about PEVs. There are several models that could be adapted to the Upstate Region, such as the Electric Vehicle Challenge, which is an education program that engages high school students in advanced electric drive technology through real-world, hands-on experience. Students participate in a yearlong educational program and learn about engineering, environmental science and electronics. Students then work as a team and use their skills to design, construct and operate a street-legal, full-size plug-in electric vehicle. Currently the program operates in Virginia, North Carolina, Florida, West Virginia and Iowa, but they are interested in expanding their reach to a national level.
3. Continue to identify and participate in new outreach opportunities.

Performance Assessment

As a new technology, the landscape and information about PEVs is rapidly changing. SCEDC will conduct periodic assessments and adaptively manage the education and outreach efforts to make sure that the latest and most accurate information is being conveyed. The periodic assessment will also identify new outlets for outreach and ways to link with other state-wide, regional or national education and outreach efforts.

SISKIYOU COUNTY
ECONOMIC DEVELOPMENT
www.siskiyoucounty.org

Plug-in Electric Vehicles

What are Plug-in Electric Vehicles (PEV)?

A PEV is a Plug-in Electric Vehicle that runs at least partially on battery power and is recharged from the electricity grid.

Pure Battery Electric Vehicles (BEVs) run on electricity stored on batteries and have an electric motor rather than a gasoline engine.

Plug-in Hybrid Electric Vehicles (PHEVs) combine two propulsion modes in one vehicle - an electric motor (that is battery-powered and can be plugged in and recharged) and a gasoline engine (that can be refueled with gasoline).

What are the Benefits of PEVs?

> Improving air quality and lowering greenhouse gas (GHG) emissions, resulting in better health and productivity.

> Creating new clean energy jobs.

> Enhancing energy security and national security by lowering dependence on foreign oil imports.

> Providing fuel cost savings that can help stimulate the local economy.

> Leveraging California's culture of leadership in technology and innovation.

> On average, in California it costs approximately$1.50 per gallon to run a PEV.

California Leadership Embraces the Charge

In 2012, Governor Jerry Brown strengthened the State's commitment to zero emission vehicles (ZEV) and infrastructure in order to protect the environment, stimulate economic growth and improve air quality. With an Executive Order, he established aggressive PEV vehicle and infrastructure targets that call for 1.5 million ZEVs and easy access to infrastructure for all of California by 2025. (http://gov.ca.gov/news.php?id=17463)

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Plug-in Electric Vehicles

Electric Vehicle Infrastructure in Northern California

The Upstate Region of California includes three county jurisdictions: Siskiyou, Shasta, and Tehama. The Upstate Region is preparing for the rollout of PEVs and to be a key participant in the expansion of th West Coast Electric Highway. Planning and coordination for electric vehicle infrastructure in the Upstate Region will help to link communities along the Interstate 5 corridor and provide connectivity between the population centers in the Upstate Region.

The Siskiyou County Economic Development Council is leading a project to coordinate efforts throughout the Upstate Region in support of the successful introduction of plug-in electric vehicles and the strategic development of charging infrastructure to support PEVs. This will be facilitated through the creation of a regional Plug-in Electric Vehicle Coordinating Council (PEVCC), development of an infrastructure deployment plan, streamlining of the permitting and installation process for electric vehicle supply equipment (EVSE), efforts to accelerate PEV adoption in vehicle fleets, and development of an education and outreach program to promote PEV adoption throughout the region.

What is the West Coast Electric Highway?

The West Coast Electric Highway connects electric vehicle drivers with fast charging between EV-friendly communities along Interstate 5 and other major roadways. The initiative compliments The EV Project, www.evproject.com, a $230 million US Department of Energy project to deploy electric vehicle charging infrastructure in six states including Washington, Oregon, and California. Located at strategic points along Interstate 5, the stations provide a backbone for EV charging along the I-5 corridor connecting cities with robust EV charging from Vancouver, British Columbia, to Baja, Mexico.

Want more information on PEVs?

Siskiyou County Economic Development - http://www.siskiyoucounty.org/PEV
West Coast Electric Highway - http://www.westcoastgreenhighway.com/
PEV Collaborative - http://www.pevcollaborative.org/
Drive Clean PEV Resource Center - http://www.driveclean.ca.gov/
U.S. Department of Energy - http://www1.eere.energy.gov/vehiclesandfuels/
California Energy Commission - http://www.energy.ca.gov/drive/technology/plugin_electric.html

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Acronyms

Alternative Fuel Vehicle (AFV)

Plug-in Electric Vehicle (PEV)

Alternative and Renewable Fuels and Vehicle Technology Program (ARFVTP)

American Society for Testing and Materials (ASTM)

Commission Agreement Manager (CAM)

California Code of Regulations (CCR)

California Environmental Quality Act (CEQA)

Greenhouse gas (GHG)

United States Environmental Protection Agency (U.S. EPA)

Electric Vehicle Support Equipment (EVSE)

Level 1 (L1)

Level 2 (L2)

Level 3 (L3)

Alternating Current (AC)

Volt (V)

Ampere (A)