CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

North Coast Plug-in Electric Vehicle Readiness Plan Implementation

Prepared for: California Energy Commission
Prepared by: Redwood Coast Energy Authority
Schatz Energy Research Center
Local Government Commission

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Project Partners:

- California Department of Transportation (Caltrans) District 1
- Charge Across Town
- City of Arcata
- City of Eureka
- City of Fortuna
- City of Rio Dell
- California Division of the State Architect (DSA)
- Humboldt County
- Local Government Commission
- OurEvolution Energy & Engineering
- Pacific Gas and Electric
- Pacific Power
- Siskiyou Economic Development Council
- Trinity Public Utilities District
- Trinity County Department of Transportation
- and the many potential EVCS site host businesses and organizations

PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about $100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-14-603 to fund grant projects that support new and existing planning efforts for plug-in electric vehicles and fuel-cell electric vehicles. In response to PON-14-603, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards January 16, 2015 and the agreement was executed as ARV-14-046 on May 8, 2015.

ABSTRACT

The North Coast Plug-in Electric Vehicle Readiness Plan Implementation Project carried out core elements of the North Coast Plug-in Electric Vehicle Readiness Plan in Humboldt, Del Norte, and Trinity Counties. Key tasks included engagement with jurisdictions on electric vehicle charging station permitting, codes, and standards, the development of an electric vehicle charging station selection guide and development of resources for contractors, siting the next phase of a regional electric vehicle charging station network, the installation of trailblazing signage to existing electric vehicle charging station, and Plug-in Electric Vehicle awareness campaigns.

The project team successfully executed these key tasks. Engagement with jurisdictions resulted in productive discussion and sharing of best practices. A suite of resources was developed to address electric vehicle charging station selection, planning, zoning, permitting, and installation. Engineering designs, drawings and cost estimates were developed to the 10 percent level for 26 site host locations for electric vehicle charging station. Electric vehicle charging station trailblazing signage was installed across the County, directing Plug-in Electric Vehicle drivers to regional electric vehicle charging station. Finally, the benefits of Plug-in Electric Vehicles were communicated to a wide audience, with a diversity of outreach methods employed.

Keywords: Plug-in electric vehicles, Plug-in Electric Vehicle Readiness Plan, electric vehicle charging station, permitting, codes, standards, fleet vehicles, Ride-and-Drives, outreach, education, electric vehicle infrastructure, planning, rural, hard-to-reach

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EXECUTIVE SUMMARY

The goal of the North Coast Plug-in Electric Vehicle Readiness Plan Implementation project was to support and promote the continued growth of plug-in electric vehicle adoption in Del Norte, Humboldt and Trinity Counties. This was facilitated by implementing key tasks called for in the North Coast Plug-in Electric Vehicle Readiness Plan.

- Engage with regional municipalities in a coordinated effort to streamline processes for the permitting and inspection of residential, commercial, and public electric vehicle charging stations. Through one-on-one meetings, a workshop, and the development and distribution of relevant electric vehicle charging station resources, regional municipalities were provided with information and support regarding updating and streamlining zoning and permitting processes. Engagement resulted in productive discussions about challenges faced by building and planning staff in rural communities, as well as best practices for facilitating electric vehicle charging station installation.
- Develop streamlined electric vehicle charging station installation processes and conduct detailed regional siting assessments and engagement with potential site hosts. A comprehensive electric vehicle charging station selection Guide was developed and distributed to assist contractors and electric vehicle charging station owners streamline the electric vehicle charging station installation process. In addition, regional siting assessments were conducted at locations in alignment with the North Coast Plug-in Electric Vehicle Readiness Plan. The project team solicited feedback from willing site hosts on site design through concept drawings. 10 percent engineering designs and cost estimates for 26 locations were completed and distributed.
- Promote plug-in electric vehicle adoption through profile raising campaigns and installation of trailblazing signage for existing electric vehicle charging stations. Plug-in electric vehicle education and outreach was conducted through a variety of engagement methods, including Ride-and-Drive events, plug-in electric vehicle car shows, presentations and social media. Engagement activities resulted in an estimated 8,000+ impressions. Specific outreach targeting fleet managers was also conducted, in the form of two comprehensive fleet analyses. In addition, 24 electric vehicle charging station trailblazing signs were installed throughout the County both help plug-in electric vehicle drivers locate stations and increase awareness of the network by conventional vehicle drivers.

Chapter 1: Introduction

1.1 Problem Statement

In July 2014, the North Coast Plug-in Electric Vehicle Coordinating Council's North Coast Plug-in Electric Vehicle Readiness Plan was completed, developed by Redwood Coast Energy Authority (RCEA) in partnership with Schatz Energy Research Center (SERC) and other regional stakeholders. The plan called for a variety of implementation measures to encourage uptake of Plug-in Electric Vehicles (PEV) including streamlining permitting and inspection processes for Electric Vehicle Charging Station (EVCS), siting and installing EVCS, and conducting public outreach and education campaigns. The primary barrier preventing the implementation of these measures was financial. While RCEA received funding to install nine EVCS in the region, there were no resources available to plan the next round of installations or to enact the other critical implementation measures identified in the readiness plan. To continue the acceleration of the local PEV market, it is critical that these support activities be addressed as soon as possible.

1.2 Goals and Objectives

Goals of the Agreement:

The goal of this Agreement was to implement the North Coast PEV Readiness Plan in the counties of Humboldt, Del Norte, and Trinity by conducting detailed siting assessments for new EVCS; by engaging regional municipalities in streamlining permitting and inspection processes and adopting PEV friendly codes; and by conducting outreach and publicity campaigns (including the installation of directional signage) to encourage adoption of PEVs.

Objectives of the Agreement:

The objectives of this Agreement are listed in Table 1 along with quantitative and measurable outcomes against which the success of the proposed project can be measured.

Table 1: Project Objectives and Measurable Outcomes

Objective	Measurable Outcome
Engage with regional municipalities in a coordinated effort to streamline processes for the permitting and inspection of residential, commercial, and public EVCS	Encourage all eleven regional government entities to adopt streamlined processes Successfully see at least four jurisdictions adopt new processes for permitting EVCS
Develop streamlined EVCS installation processes and conduct detailed regional siting assessments and engagement with potential site hosts	Develop standardize specifications for charging station equipment and engage with at least three local contractors to encourage best practices Produce at least 30 and as many as 40 detailed EVCS designs and cost estimates in locations consistent with the Readiness Plan and with willing site hosts
Promote PEV adoption through profile raising campaigns and installation of trailblazing signage for existing EVCS	Conduct at least 5 ride and drive events to promote the latest PEVs on the market Table at 6 or more public events Publish at least 6 newsletter editions Achieve at least 4 media spots highlighting regional PEV activities Make at least 6 presentations to community organizations and/or fleet operators Install trailblazing signage guiding PEV drivers to at least 10 existing and soon to be installed EVCS

Source: Redwood Coast Energy Authority

1.3 Project Team

Redwood Coast Energy Authority

The RCEA was formed in 2003 to develop and implement sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient, and renewable resources available in the region. RCEA is a local government Joint Powers Authority, representing the County of Humboldt, all incorporated cities in Humboldt County, and the Humboldt Bay Municipal Water District. In addition to projects related to energy and energy efficiency, RCEA has acted as the lead agency for three Alternative and Renewable Fuel and Vehicle Technology Program grants.

Schatz Energy Research Center

The SERC at Humboldt State University was founded in 1989 with a mission to promote the use of clean and renewable energy resources. Over the years SERC has been involved in extensive research, planning, design, and analysis activities for the development and implementation of sustainable energy systems. SERC conducts research, analysis, policy and planning studies; designs, builds, operates, and demonstrates clean and renewable energy technologies; develops curriculum and provides training; and educates key decision makes and the general public about the advantages of clean and renewable energy technologies. This work has included promotion of sustainable transportation options, including hydrogen fuel cell vehicles and plug-in electric vehicles.

SERC has participated in the development of data collection and analysis programs for a wide variety of energy and transportation systems, including playing a lead role in the development of PEVI, the agent-based PEV Infrastructure model used to site charging stations throughout the North Coast region.

Local Government Commission

The Local Government Commission is a nonprofit organization fostering innovation in environmental sustainability, economic prosperity and social equity. The Local Government Commission is helping to transform communities through inspiration, practical assistance and a network of visionary local elected officials and other community leaders.

The Local Government Commission is currently leading "CivicSpark," a statewide Governor's Initiative focused on supporting local-government energy and climate action programs. This program is being implemented in partnership with the State of California through the Governor's Office of Planning and Research along with a network of regional organizations including the Redwood Coast Energy Authority as the North Coast regional coordinator.

CivicSpark provides high-quality, technical support to local and regional local governments, helping California communities pursue clean energy, reduce greenhouse gas emissions, safeguard against climate change impacts, and implement sustainable community strategies. To do this, 48 CivicSpark AmeriCorps members work with nine regional partners to provide capacity-building support to local governments through research, planning and implementation activities, while simultaneously supporting volunteer engagement.

1.4 Background

The North Coast PEV Readiness Plan, completed in July of 2014, contained a suite of actions necessary to support the successful introduction of PEVs and the strategic development of charging infrastructure in the region. The plan was funded by the California Energy Commission and included these key components:

- Creation of a Plug-in Electric Vehicle Coordinating Council
- Development of an infrastructure deployment plan
- Assessment of local permitting and installation requirements for electric vehicle supply equipment and development of a plan to support streamlining those processes
- Development of a plan to accelerate PEV adoption in vehicle fleets
- Development of an education and outreach program to promote PEV adoption in the community

In addition to the PEV Readiness Plan, RCEA received funding from the CEC through ARV-13-029 to install 10 EVCS across nine locations in Humboldt County. This installation represented the first phase of the charging network called for in the PEV Readiness Plan, which identified a total of 41 charging sites as the minimum number required to accommodate an anticipated penetration of 3,000 PEVs.

To plan for the next phase of EVCS deployment in the region, and to implement core elements of the North Coast PEV Readiness Plan, RCEA responded to the CEC's solicitation PON-14-603. In June of 2014, RCEA was awarded funding through ARV-14-046. The following Chapter outlines the activities and results from this project.

Chapter 2: Project Activities and Results

2.1 Engagement with Jurisdictions

The goal of this task was to engage with regional Authority Holding Jurisdictions to encourage the adoption of streamlined EVCS permitting and inspection processes, and to provide education on the potential to adopt local building codes that promote PEV adoption. This was accomplished through the development and distribution of relevant PEV resources, one-on-one meetings, and a workshop for building and planning staff.

2.1.1 Resources Developed

2.1.1.1 EVCS Zoning and Permitting Resource Binder

To ensure planning and building staff from Authority Holding Jurisdictions in the region had easy access to resources for EVCS permitting and inspection, Jerome Carman from SERC developed a comprehensive EVCS resource binder. This binder was designed to assist Authority Holding Jurisdictions in preparing for EVCS, including planning and zoning, relevant codes and standards, and streamlining permitting processes. Specifically, the binder contained the following resources:

- Planning and Zoning
  - Text from Assembly Bill 1236 requiring jurisdictions to streamline their EVCS permitting process
  - North Coast and Upstate Planning documents with information relevant to EVs
  - The Governor’s Office of Planning and Research EVCS Zoning Example
  - The City of Chelan EVCS Zoning Code
- Codes and Standards
  - Relevant industry codes and standards from the Society of Automotive Engineers, CHAdeMO. National Fire Protection Association, National Electric Code, Nationally Recognized Testing Laboratories, and Underwriters Laboratory.
  - Relevant sections from the 2016 California Building Code
  - Relevant Caltrans Policy Directives
  - Relevant California Vehicle Code
    - Including guidance on compliance with new EVCS accessibility standards
  - The Governor’s Office of Planning and Research’s PEV Parking Code Template
  - Relevant Health and Safety Code
  - Example 10 percent engineering drawings of EVCS sites
  - EVCS signage specifications
- Permitting
  - Electric Load Calculation Worksheets
  - Permit Templates for Residential Installations
  - Residential and Commercial Installation Checklists

- National Electrical Contractors Association Inspection Checklist
- The Governor's Office of Planning and Research's General EVCS Permitting Checklist

Full text of the binder is included as Appendix A.

While useful as a stand-alone resource, the binder was designed to complement a meeting or workshop. It aggregates materials building or planning staff may find useful as they prepare their jurisdiction for EVCS. RCEA and SERC met with jurisdictions throughout the project region to provide them with these resources.

2.1.1.2 Accessible EVCS Fact Sheet

Contained within the aforementioned EVCS Resource Binder was an "Accessible EVCS Fact Sheet". This fact sheet was developed by RCEA and SERC to assist municipalities and contractors with designing EVCS sites for Americans with Disabilities Act compliance. Prior to the 2016 edition of the California Building Code, there were no requirements explicitly written for EVCS. However, requirements were codified in the 2016 edition of the Building Code, and the project team identified a need for a fact sheet aggregating and clarifying these new requirements.

The fact sheet outlines the new accessibility requirements, provides diagrams of compliant site configurations, and includes links to additional resources. The project team worked with Dennis Corelis at the Division of the State Architect to verify the accuracy of the document. The full fact sheet is included as Appendix B.

Beyond its inclusion in the resource binder for planning and building staff, the Accessible EVCS fact sheet was useful in outreach to potential site hosts. The dedication of sufficient parking and location along an accessible route were important considerations when selecting potential site hosts. A clear understanding of accessibility requirements in the Building Code helped the project team identify potential sites and assisted in the development of site drawings. The fact sheet also helped potential site hosts understand the new requirements and clarify why the project team proposed particular locations and designs for EVCS on the site host's property.

2.1.1.3 Jurisdiction-Specific Permitting Guides

Background

Team member Pierce Schwalb met with staff from the City of Eureka and the City of Arcata Building Departments to discuss their permitting processes for EVCS. After learning about the current permitting processes, Mr. Schwalb provided staff with example streamlined processes used by other jurisdictions. Staff expressed hesitation about adopting alternative processes due to unfamiliarity with the mechanics of EVCS, particularly how they might affect the electrical grid in oversubscribed areas. It was determined that a guide document clarifying the current process would be a good first step before considering any updates. Development of similar EVCS permitting process summary guides were pursued for additional jurisdictions in Humboldt County.

Guide Development

To assist contractors and homeowners pursuing the installation of a residential EVCS, the project team created residential EVCS permitting guides for distribution by planning and building departments. The purpose of these guides was to clarify the EVCS permitting process used by a particular jurisdiction. A secondary benefit of the development of these guides was an opportunity for planning and building officials to review their municipalities' current process.

By working with the project team to get the process down on paper, it became an opportunity to discuss examples of more streamlined permitting processes used by other jurisdictions.

Once approved, the guides were delivered to the jurisdiction's planning and/or building offices where they would be made available to the public. EVCS Permitting Guides were completed for Humboldt County and the City of Eureka. While draft guides were developed for the remaining jurisdictions, either a lack of staffing or interest prevented their ultimate approval. The EVCS Permitting Guides for Humboldt County and the City of Eureka are included as Appendix C.

2.1.2 Meetings and Workshops

Coordination with planning and building staff in rural Del Norte and Trinity Counties proved to be challenging. Del Norte County typically has only one planner on staff, but that position remained vacant for the duration of this project. Trinity County's planner position was also vacant, though outreach to other County staff was completed successfully.

Due to the vacant planner position in Trinity County, Jerome Carman from SERC met with Rick Tippet, the County's Transportation Planner. Mr. Carman presented the materials contained in the resource binder and provided guidance on best practices for EVCS planning, zoning, codes, standards, and permitting. Potential locations for EVCS in the County were also discussed. Mr. Tippet expressed support for the installation of EVCS in the County and offered to host an EVCS at the Trinity County Department of Transportation. He also noted that building staff had previously attended a training on EVCS in Redding, California.

In addition to meeting with the Transportation Planner, Mr. Carman met with staff from the Trinity County Building Department. During this meeting, the County's current permitting process for EVCS was reviewed and discussed. They currently require 10 percent site designs and one-line diagrams before a permit will be issued. Due to funding and staffing concerns, it was determined that Trinity County will not be able to streamline their EVCS permitting process in the near future. A resources binder was left with the Department to assist them with future evaluations of their permitting process.

Due to the remoteness of Del Norte and Trinity Counties, and a lack of planning staff, it was determined that EVCS workshops were not feasible for those areas. However, many Authority Holding Jurisdictions in Humboldt County do have planning staff, and RCEA's central location in the County made it an ideal location to host a workshop. On February 16, 2017, SERC and RCEA hosted a workshop for planning and building staff at RCEA's office in Eureka.

The project team recruited planning and building staff through emails, phone calls, and physical distribution of an event flyer. Conversations with smaller Authority Holding Jurisdictions in Humboldt County, like the cities of Blue Lake and Trinidad, revealed that all planning work is contracted through local planning firms. Therefore, outreach was also targeted to local planning firms that service Authority Holding Jurisdictions in Humboldt County.

Staff members from the cities of Eureka, Arcata and Fortuna attended the workshop, along with representatives from the private firms of GHD and Greenway Partners. Mr. Carman delivered a presentation on EVCS planning, zoning, codes, standards, and permitting. The full presentation is included as Appendix D. In particular, sections of the presentation on new EVCS accessibility requirements and streamlining recommendations generated productive discussion. It was evident from these discussions that some smaller cities are feeling squeezed by the new EVCS accessibility requirements, due to the higher number of required parking spaces, and the requirements to streamline permitting processes, due to lack of staff and low familiarity with the mechanics of EVCS.

In addition to the presentation and discussion, the workshop included a site visit to an operating EVCS. This presented an opportunity for planning and building staff to become more familiar with the form and operation of an EVCS, as well as explore important site planning considerations. The particular EVCS visited by the group was not in compliance with the latest version of the California Building Code, which enabled a discussion on how a new installation would need to be different to achieve compliance.

2.1.3 Results

Feedback from participants in the workshop and meetings was positive, and the project team received follow up requests for additional information. While no attendees expressed any immediate plans to streamline their EVCS permitting and inspection processes, they were provided with all the resources they would need to initiate the process. Resource binders were also delivered to the Authority Holding Jurisdictions' unable to attend the workshop.

In addition, the development of EVCS Permitting Guides provided another opportunity for Authority Holding Jurisdictions to examine their own permitting processes. These guides are currently available to contractors and the general public at the Planning and Building Department offices for Humboldt County and the City of Eureka. These guides are included as Appendix C.

2.2 EVCS Installation Process

The goal of this task was to produce a streamlined set of EVCS criteria to assist potential EVCS owners/operators in choosing what equipment to install and to assist contractors with adopting best practices and understanding regional permitting requirements. This was accomplished through the development and distribution of a comprehensive EVCS selection guide and distribution of materials developed through tasks 2.1 and 2.6.

2.2.1 EVCS Selection Guide

RCEA in partnership with SERC, developed a comprehensive selection guide of available EVCS models. The purpose of this guide was to assist contractors, municipalities, and site hosts in general assess the available EVCS options and select a model most suited to their needs.

2.2.1.1 Guide Structure

The guide provides an objective comparison of EVCS models based on standardized criteria. To begin, the guide poses these questions to help users assess their needs:

- What type of charging do you want to provide?
- Do you want a networked charger or a stand-alone charger?
- Do you wish to charge for access to an EVC? What costs are you willing to incur?

To help users answer the first question, the guide provides a thorough discussion of different charging types, including charging levels, standards, and operational considerations. This is followed by a comparison of networked versus stand-alone EVCS, with a breakdown of additional features offered by networked EVCS and additional cost/reliability considerations. To help answer the final question, the guide provides information on potential costs incurred by a site host, like network fees and meter fees, and information on price structures for electric vehicle (EV) drivers, such as per kWh fees and time-based fees.

However, the essence of the guide is a series of tables giving users side-by-side comparisons of EVCS specifications. Users can compare hardware specifications, software features, payment systems, and certifications from 17 different EVCS manufacturers. Specifications are provided for the following categories:

- Hardware – Electrical
  - Number of Charging Ports/Type, Input Power, Output Power, Cross Vendor Software Compatibility, and Operating Conditions
- Hardware – Mechanical
  - Mounting, Cable Management , Number of Charging Ports/Type, Theft Deterrence, Power Rating input(s), and Operating conditions
- Management Software
  - Remote Management, Cross Vendor Hardware Compatibility, Network Protocol, Demand response capability, and Data Reporting
- Payment System
  - Open Access, Customer Payment, Price Setting Option, and Owner Payment
- Certifications
  - Listings, Accessibility Features, First Entry to Electric Vehicle Supply Equipment Market, and Installation Rating

The Full EVCS Selection Guide is included as Appendix E.

2.2.1.2 Guide Development

The project team had the opportunity to leverage additional funding for the development of the guide through collaboration with the Upstate PEV Readiness Project. The lead agency for this project, the Siskiyou Economic Development Council, has partnered with RCEA and SERC on a number of alternative fuels projects in the region. Siskiyou Economic Development Council's goals for their Readiness Project also included the development of a resource to assist regional entities with EVCS selection, and thus were an obvious partner in the development of the EVCS Selection Guide.

Development of the guide began with collecting EVCS specifications. While some EVCS specifications were available on manufacturer's websites, much of the needed information was not made publicly available. To obtain EVCS specifications not listed on manufacturer's websites, the project team developed a form cover letter and distributed it to manufacturers. Response from manufacturers was mixed; some responded immediately with the requested information, some required multiple follow up emails and phone calls, and a few never responded despite the project team's best efforts.

2.2.2 Engagement

Once completed, the EVCS Selection Guide was distributed locally to contractors and municipalities, and nationally to the Department of Energy and the National Renewable Energy Laboratory. In addition to wholesale distribution, the guide has been useful as follow-up material to consultation services provided by RCEA. As a regional PEV resource, RCEA is often consulted by contractors and municipalities with questions about EVCS. Soon after the guide was completed, The City of Arcata and Danco Builders both contacted RCEA for assistance in evaluating EVCS and were provided the EVCS Selection Guide as a follow-up resource.

In addition to the EVCS Selection Guide, a suite of resources was compiled and distributed to local contractors. These materials were designed to equip contractors with all the resources needed to make informed decisions and provide sound advice to clients about EVCS. These resources included the following documents:

- "Contractor's Checklist for Residential EVCS Installation," adapted from the Governor's Office of Planning and Research's "Plug-in Electric Vehicle Infrastructure Permitting Checklist." This document provides contractors with a six-phase technical checklist for installing EVCS at residential locations.
- "Humboldt County EVCS Permitting Guide," a copy of the most generic version of the permitting guides described in section 2.2.1.

These resources were distributed to local contractors and to the Humboldt Builders' Exchange for distribution to its members. The Humboldt Builders' Exchange is a local non-profit consortium of over 300 contractors that provides education and support services for its member businesses.

2.3 EVCS Siting

RCEA contracted with SERC to provide technical support and services for implementing the North Coast Plug-In Electric Vehicle Readiness Plan (Plan). This task focused on micro siting potential site host locations of EV chargers in order to support the accelerated adoption of electric vehicles in the planning region of Del Norte, Humboldt, and Trinity counties. The primary goals were to:

- Visit site hosts previously mentioned in the Plan,
- Conduct outreach to new potential site hosts,
- Conduct site visits and site evaluations for new potential site hosts,
- Engage with all potential site hosts to inform them of their options and negotiate terms for future agreements between possible EVCS owners/administrators and site hosts
- Prepare and submit 30 – 40 engineering designs, drawings, and cost estimates for sites with the highest favorability and most willing site hosts.

Guided by macro siting recommendations from the Plan, SERC focused on obtaining geographic coverage over the planning region with the expectation that the private market will more likely focus on the higher population centers. 75 new potential site host locations were identified. Table 2 shows the breakdown of identified sites by county.

Table 2: Total Locations Scored

Potential Locations			
	AC	**DC**	**Total**
Del Norte	17	3	20
Humboldt	31	8	39
Trinity	15	1	16
Total	63	12	75

Note: All locations that were considered and scored for the development of 10 percent engineering designs and cost estimates. A total of 26 of these locations were chosen. Six of these were funded and will be developed by ChargePoint.
Source: SERC, 2017

Of the 75 identified sites, 36 (48 percent) are located in more rural areas of the planning region. Challenges with identifying favorable sites with a willingness to host charging stations in the more rural areas of the planning region hampered SERC's ability to meet the geographic coverage objective. The focus on geographic coverage also conflicted with the goal of micro siting 30 – 40 sites because of challenges in rural areas. SERC was able to successfully complete engineering designs, drawings, and cost estimates for 26 sites. Thirteen of these sites (50 percent) are located in smaller outlying population centers.

Macro siting recommendations from the Plan provide guidance on the number of ports needed for a 2 percent penetration of EVs into the on-road community fleet. A focus on geographic coverage made significant progress towards meeting the recommended geographic distribution of the Plan. However, there is indication that the planning region may already be approaching an overbuild of necessary early market infrastructure in the population centers. The total number of ports recommended by the Plan for the three-county region is 101 Alternating Current and 5 Direct Current. The total number of existing, known funded, and currently micro sited plugs is 97 Alternating Current and 19 Direct Current. Table 3 below provides a high-level summary of the macro siting results from the Plan.

Table 3: Summary or Recommended Alternating Current and Direct Current Chargers

					Micro sited for this Project								
County	**Recommended**		**Existing**		**Funded**				**Proposed**			**Remaining**	
	AC	**DC**	**AC**	**DC**	**ReCargo**		**ChargePoint**		**AC**		**DC**	**AC**	**DC**
					AC	**DC**	**AC**	**DC**	**Pub**	**Fleet**	**Pub**		
Del Norte	16	2	3	0	2	2	3	4	4	2	0	7	0
Humboldt	66	2	37	0	4	6	3	6	29	2	0	31	2
Trinity	19	1	1	0	0	0	0	0	7	0	1	12	0
Total	101	5	41	0	6	8	6	10	40	4	1	50	2

Note: High level summary of the number of Alternating Current and Direct Current plugs that are recommended by macro siting results from the Readiness Plan, are already existing, are funded but are not yet installed, or have been proposed under this project. Remaining indicates the number of plugs that remain to be installed to obtain the geographic distribution recommended by the macro siting results.

Source: SERC, 2017

However, the continued need for wider geographic coverage results in a shortfall of 50 Alternating Current plugs and 2 Direct Current plugs (total shortfall is so large because there are numerous areas that have substantially more plugs than macro siting results indicate are needed). This shortfall occurs primarily in the more rural areas of the planning region. This result is due to the following factors:

- The local communities, who are historically early adopters, are funding their own installations primarily in the population centers,
- The state-funded West Coast Electric Highway effort exceeds projected early market needs, and
- It is challenging to find locations in rural areas that have both favorable existing infrastructure and willing property owners.

New California Building Code requirements presented additional challenges to identifying potential locations with favorable existing infrastructure and willing site hosts. The main challenges were:

- The requirement to label EV charging spaces as "EV Charging Only". The majority of businesses in the planning region have limited parking. With few EVs currently on the road many business owners see this requirement as reducing their ability to attract customers.
- Americans with Disabilities Act requirements further impact existing parking space. All designs require at least one EV charging space to be van accessible which requires the space of two standard parking spaces.

Furthermore, existing parking lot and path of travel infrastructure is often not well designed to accommodate the addition of EV chargers. Curbs, bollards, and wheel stops can present pedestrian path of travel hazards between the EV charger and the vehicle. Americans with Disabilities Act path of travel can be particularly challenging when the EV charger is located on a different elevation than the vehicle, such as a sidewalk. We also learned it is extremely important to be mindful of the fact that the driver will need to safely navigate this path of travel while also pulling a long electrical cord.

The designs and drawings developed successfully highlight and address these challenges. Solutions to these challenges developed during the micro siting effort were communicated to numerous permitting and planning staff in the region. The drawings developed will also inform the site hosts and contractors who implement them.

2.4 Signage

RCEA, in coordination with Caltrans District 1 and Public Works Departments across multiple jurisdictions, planned and constructed a network of EVCS trailblazing signage. Signage routes now direct drivers to nine regional EVCS off of Highway 101 and State Route 255. By completing signage routes between the EVCS and the state right-of-way, Caltrans will install EVCS signage on highway exit signs.[1]

2.4.1 Sign Placement

The first step in the process of establishing a network of EVCS trailblazing signage was to select top priority EVCS in the region. EVCS were ranked based on the number of trailblazing signs that would be required to complete a route, the number of resulting highway signage installed by Caltrans, and the willingness of the jurisdiction to host the signs. The objective was to maximize the number of signs installed on the state right-of-way while minimizing the number of trailblazing signs installed by RCEA. EVCS with signage routes that resulted in a higher ratio of state right-of-way signs to city trailblazing signs were considered to have a higher return on investment. Figure 1 lists all of the regional EVCS and assigned priority level.

1 Signage Fact Sheet, available at http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/alternative_fuels_signage_fact_sheet-final.pdf

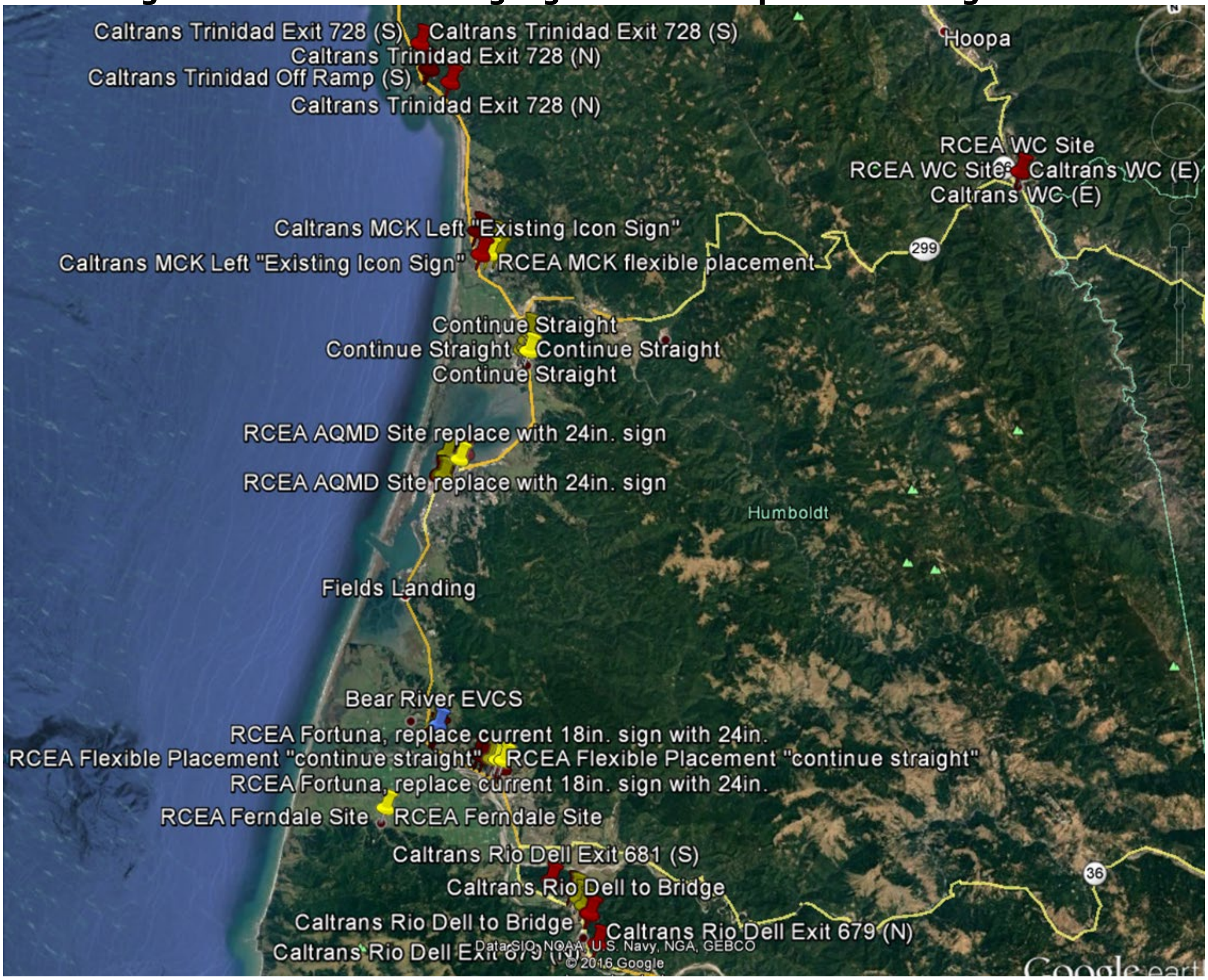
Figure 1: Priority List of Sign Placements for Trailblazing Routes

Priority List of Sign Placements						
Trailblazing Route	**# of Signs in Route**	**Caltrans Signs**	**Priority 1**	**Priority 2**	**Priority 3**	**Justification**
Rio Dell	2	4	X			Southern most indication of charging infrastructure, good ROI
Fortuna	2	2		X		Average ROI, likely low utilization
Ferndale	1	0			X	No ROI, likely low utilization
Eureka, Caltrans	2	2		X		Average ROI, frequently occupied, coordination potential with Caltrans
Eureka, C Street	1	2	X			Will likely beapproved, good ROI, first sign in Eureka
Eureka, GHD	2	2			X	Average ROI, City may not approve sign locations
Eureka, AQMD	1	2	X			Good ROI, could locate sign on AQMD property and bypass City
Eureka, St. Joes	3	2			X	Low ROI, only charging infrastructure indication on Myrtle
Arcata, F Street	1	3	X			Good ROI, Caltrans signs gets drivers reasonably close to ATC location
Arcata, ATC	2	1		X		Low ROI, drivers may be able to find without additional sign on 255
McKinleyville	2	2	X			Average ROI, potential for high utilization
Trinidad	1	4	X			Northern most indication of charging infrastructure, good ROI
Redway	2	4			X	High ROI, Not a typical pedestal EVCS, not ADA, no dedicated spaces
Bear River	2	3		X		Low ROI, may be able to coordinate signs with Bear River
Totals:	**24**	**33**	**8**	**8**	**8**	

Source: Redwood Coast Energy Authority

The project team identified six Priority 1 EVCS, four Priority 2 EVCS, and four Priority 3 EVCS. Likely trailblazing sign locations for Priority 1 and 2 EVCS were identified using “pins” on Google Earth. The resulting map was presented to Deb Meredith, the signage coordinator for Caltrans District 1, for feedback. A screenshot of the map is included as Figure 2.

Figure 2: Screenshot of Signage Plan Development on Google Earth



Source: Google Earth, adapted by the Redwood Coast Energy Authority

After incorporating Deb Meredith's feedback, possible trailblazing sign locations were presented to each jurisdiction for approval. Collaboration with representatives from each jurisdiction presented unique advantages and challenges. The following list summarizes RCEA's experiences with representatives from each jurisdiction, organized from South to North.

City of Rio Dell

Representative: Kyle Knopp, City Manager, City of Rio Dell

Summary: The proposed sign route originally submitted to Mr. Knopp included two sign installations. One sign would be located on Wildwood Ave., directly across from the EVCS. This sign would direct north-bound drivers to turn left. The other sign would either replace or reorient the current EV sign at the entrance to the parking lot. This sign would direct south-bound drivers to turn right.

Mr. Knopp requested additional signs be added at the intersections of Bellview Ave. and Davis St. with Wildwood Ave. This way an EV driver could be directed to the EVCS from every route into the city.

A total of four trailblazing signs were included in the final agreement.

City of Fortuna

Representative: Mike Johnson, General Services Superintendent, City of Fortuna

Summary: The proposed sign route submitted to Mr. Johnson included four sign installations. These signs would direct drivers from Highway 101 to Main Street, then right on 11th Street where the EVCS is located. Mr. Johnson approved all proposed locations.

A total of four trailblazing signs were included in the final agreement.

Humboldt County

Representative: Bob Bronkall, Deputy Director of Public Works, Humboldt County

Summary: The EVCS at the Bear River Casino in Loleta and the EVCS in the McKinleyville shopping center in McKinleyville are both within Humboldt County's jurisdiction. A signage route including one sign for the Loleta EVCS and four signs for the McKinleyville EVCS were submitted for Mr. Bronkall's review. He approved all suggested placements.

A total of five trailblazing signs were included in the final agreement.

City of Eureka

Representative: Scott Ellsmore, Engineering Technician, City of Eureka

Summary: The original signage plan submitted to Mr. Ellsmore included seven signs, directing EV drivers to three EVCS within the city. Mr. Ellsmore denied six of the proposed signs, citing sign blight and the fact that the city does not offer the same signage installation services to gas stations. The selected sign directs EV drivers to the EVCS located on C St.

In addition to discussing trailblazing sign placements, Mr. Ellsmore suggested a new approach to having the signs installed. RCEA had originally planned on soliciting bids from private contractors to perform installations across the County. Instead of this, Mr. Ellsmore suggested approaching Public Works Departments about installing the signs themselves and offering to reimburse them for time and materials. This was the approach RCEA ultimately ended up taking.

A total of one trailblazing sign was included in the final agreement.

City of Arcata

Representative: Netra Khatri, Assistant City Engineer, City of Arcata

Summary: The original signage plan submitted to Mr. Khatri included three signs, directing drivers to the EVCS at the Arcata Technology Center and the EVCS at the F Street public parking lot. The proposed sign route directed drivers from SR 255 to the EVCS. To provide direction for EV drivers entering the city from Hwy 101 on the Northern end of the City, Mr. Khatri requested adding an additional seven trailblazing signs.

A total of ten trailblazing signs were included in the final agreement.

City of Trinidad

Representative: Bryan Buckman, Director of Public Works, City of Trinidad

Summary: The original sign plan submitted to Mr. Buckman included two signs directing EV drivers to the EVCS on Patrick's Point Drive. These signs were to be located at the intersection of Patrick's Point Drive and Main Street, as well as directly across from the charging station. Mr. Buckman opted not to install either sign, citing sign blight.

No trailblazing signs were included in the final agreement.

2.4.2 Installation Process

To install the network of EV trailblazing signs across Humboldt County, RCEA originally intended to hire a single subcontractor. A Request for Proposals was developed, with the intention of identifying a local contractor to install all of the required signs. However, during a conversation with Scott Ellsmore, an engineer with the City of Eureka, an alternative approach was suggested.

Because a private contractor would have to purchase costly encroachment permits for projects in each jurisdiction's right-of-way and would be required to coordinate all work with each jurisdiction's Public Works Departments, Mr. Ellsmore suggested forgoing an agreement with a private contractor and instead requesting each jurisdiction perform the installation themselves. Each jurisdiction would be reimbursed for time and materials.

Per California Energy Commission requirements, an agreement was signed with each jurisdiction and they were added as minor subcontractors under agreement ARV-14-046. These agreements included the locations for trailblazing signs within the jurisdiction and the estimated budget to complete the work.

After finalizing the agreements with all jurisdictions, the necessary trailblazing signs were ordered. This included standard EV charging symbol signs (MUTCD D9-11b (alternate)), left, right, and straight arrows. Extras were ordered should any signs get damaged and need to be replaced. RCEA financial protocol requires obtaining three quotes for any purchases between $500 and $4,000. Therefore, quotes were requested from three local sign shops, with Statewide Traffic and Safety in Arcata, CA providing the lowest quote.

After signs arrived from Statwide Traffic and Safety, they were delivered to each jurisdiction for installation. A representative from each Public Works Department signed a receipt to confirm delivery. All signs were installed over the course of the next few months. Deb Meredith with Caltrans was kept up-to-date with the progress of installations, with the final sign being installed in April of 2017.

2.4.3 Results

Trailblazing signage was installed for nine EVCS in Humboldt County. A total of 24 trailblazing signs were installed, while the installation of 27 highway signs is planned by Caltrans. Coordination with local jurisdiction's Public Works Departments, as an alternative to using a private contractor, provided the project with significant cost savings. In addition, the Caltrans sign coordinator proved to be an invaluable resource for identifying the best locations for trailblazing signs. Table 4 includes a listing of the selected EVCS, number of trailblazing signs installed, and planned # of Caltrans sign installations. Pictures of all EVCS trailblazing signs are included as Appendix G.

Table 4: Selected EVCS and Number of Signs Installed

Station Location	Station Address	Jurisdiction	# of Signs (RCEA)	# of Signs (Caltrans)
Rio Dell Public Parking	203 Wildwood Ave, Rio Dell, CA 95562	City of Rio Dell	4	5
Fortuna Public Parking	638 11th St, Fortuna CA 95540	City of Fortuna	4	4
Bear River Hotel	11 Bear Paws Way, Loleta, CA 95551	Humboldt County	1	4
Fishermen's Market Square	4 C St, Eureka, CA 95501	City of Eureka	1	2
North Coast AQMD	707 L St, Eureka, CA 95501	City of Eureka	0	2
F Street Arcata Public Parking	685 F St Arcata, CA 95521	City of Arcata	8	4
Greenway Building	1459 8th St., Arcata CA 95521	City of Arcata	2	2
McKinleyville Shopping Center	1514 City Center Rd, McKinleyville, CA 95519	Humboldt County	4	2
Willow Creek China Flat Museum	38949 CA-299, Willow Creek, CA 95573	Humboldt County	0	2
Total:			24	27

Source: Redwood Coast Energy Authority

2.5 PEV Awareness

Even with the proliferation of commercial PEV models, educating people about the benefits of PEVs is still critical to supporting PEV adoption. In a survey conducted by the Air Resource Board in 2016, 77 percent of respondents, representing car-buying households in California, had yet to seriously consider a PEV.[2] Promoting awareness of PEVs was a central goal of ARV-14-046, and was successfully implemented through a variety of outreach activities. Table 5 provides a listing of outreach activities conducted as part of this project.

2 Kurani, K., Caperello, N., TyreeHageman, J. (2016). New car buyers' valuation of zero-emission vehicles: California. California Air Resources Board, available at www.arb.ca.gov/research/apr/past/12-332.pdf

Table 5: Outreach Activities

Outreach Activity	Number Conducted	Estimated Impressions
Presentations	7	400+
Ride and Drives	4	300+
Tabling at Community Events	24	2000+
PEV Car Shows	6	2000+
PEV Newsletters	6	852
Earned Media	18	2000+
Facebook Posts	28	819

Source: Redwood Coast Energy Authority

2.5.1 Awareness Campaigns

RCEA hosted and participated in community events throughout the County to promote PEVs. In addition, RCEA maintained a constant presence online through Facebook posts, earned media placements, and PEV newsletters.

2.5.1.1 Outreach Events

Presentations

The project team presented to local, regional, and state-wide groups to promote PEV awareness and encourage adoption. Presentations were given at the following events:

- Humboldt State University's Sustainable Futures Series, Arcata
- The Clean Cities Symposium, Eureka
- The Eureka Rotary Club's monthly meeting, Eureka
- The State-Wide Energy Efficiency Collaborative's Forum, Riverside
- The North Coast Climate Conference, Arcata
- The North State Super Region Annual Meeting, Redding
- Ribbon-cutting ceremony for the St. Joseph Hospital EVCS, Eureka

Ride-and-Drives

Ride-and-Drives were a central part of the overall campaign strategy, as these events are likely to increase PEV sales[3]. Aside from a lack of awareness, myths about the poor driving experience and low quality of PEVs pose a barrier to consumer interest. Ride-and-Drive events are an opportunity to dispel these myths and prove that PEVs can be more fun to drive and better appointed than their Internal Combustion Engine vehicle counterparts.

RCEA organized Ride-and-Drive events at three locations in Humboldt County – the Redwood Acres Racetrack, the Arcata Community Center, and the Humboldt Bay BMW dealership. Events varied in structure, with the first Ride-and-Drive organized as a stand-alone event at the Redwood Acres Fair Grounds. The second Ride-and-Drive was held at the Humboldt Bay

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3 Freyschlag, A. (2016). Drive Electric Northern Colorado – A community-wide approach to EV adoption, available at http://evroadmapconference.com/program/pre-sentations16/AnnieFreyschlag.pdf

BMW dealership, celebrating the launch of the BMW i3 PEV. The third Ride-and-Drive was again held at the Redwood Acres Racetrack, in conjunction with the Humboldt County Fair. The final Ride-and-Drive was held at the Arcata Community Center, and participants where shuttled over from the North County Fair half a mile away.

The structure of each event provided unique opportunities and challenges. For example, while a stand-alone event offers the greatest flexibility and autonomy, participation can be low compared to joining a larger event. Hosting an event at a dealership guarantees dealer participation but may be less enticing for attendees. For all events, RCEA partnered with area dealerships to provide an assortment of PEVs, and dealership staff were onsite to answer questions.

Before all Ride-and-Drive events, RCEA contacted local media outlets and provided them with marketing materials and information. Event details were posted on news websites and online event calendars. In addition, event details were posted on RCEA's website and Facebook page. A full listing of events, along with features in media, is included as Appendix H.

PEV Car Shows

In October of 2015, RCEA had originally planned to organize another Ride-and-Drive event. However, area dealerships opted not to participate, citing a variety of reasons. Instead, the event was converted into a PEV car show, with community members displaying their personal PEVs. Due to the success of this first event, five more of these PEV car shows were held over the course of the project. In many instances, PEV owners opened up their vehicles and invited attendees to sit inside, play with the controls, and evaluate the interior. As early adopters, they were eager to share their experiences owning a PEV and explain its benefits. Hearing this message from fellow community members was especially impactful, as event attendees often engaged with PEV owners longer than with dealership staff. One event in particular, the PEV car show at the 4th of July parade in Eureka, resulted in 1,450 impressions and had 6 different PEVs on display.

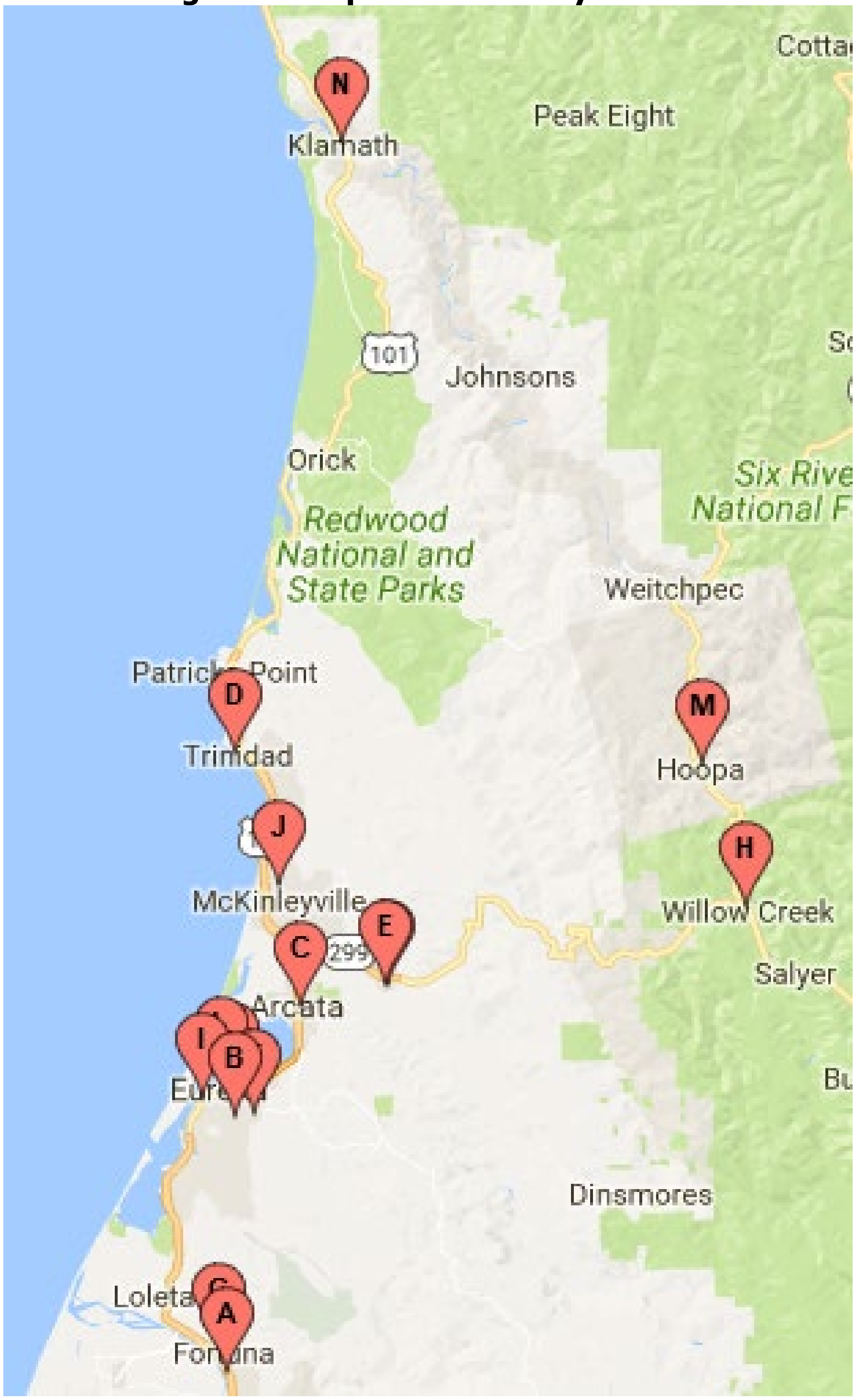
Tabling at Community Events

RCEA staff tabled at 24 community events over the course of the project. By participating in a wide range of community events, the project team was able to educate a diverse cross section of County residents about the benefits of PEVs. In particular, participation in events that did not have a sustainability focus, like Pony Express Days in McKinleyville, initiated beneficial conversations about PEVs with residents that had never been exposed to PEVs. PEV promotional material was displayed and the following materials were distributed:

- Clean Cities Vehicle Buyer's Guide
- Map of public electric vehicle charging stations
- The latest version of RCEA's PEV newsletter
- PG&E PEV collateral
- Information on CEC funded alternative fuels projects in the region
- RCEA promotional items, like pens and stickers

Events selected for this project were carefully chosen to reach the widest possible demographic. Participation in events like the Sustainable Living Expo in Arcata and the Party for the Planet at the Sequoia Park Zoo targeted environmentally conscious consumers, while participation in the Trinidad Fish Festival and Pony Express Days in McKinleyville reached a wider audience. Figure 3 and Table 6 provides the location and distribution of outreach events throughout the County.

Figure 3: Map of Community Events



Source: Batch Geo, adapted by the Redwood Coast Energy Authority

Table 6: Locations of Community Events

Letter	Event Location	# of Events
A	Eel River Brewing, Fortuna	1
B	Sequoia Park Zoo, Eureka	2
C	Arcata Community Center, Arcata	2
D	Trinidad School, Trinidad	1
E	Mad River Brewing, Blue Lake	2
F	Redwood Acres Fairgrounds, Eureka	3
G	Fortuna Chamber of Commerce, Fortuna	2
H	Bigfoot Museum, Willow Creek	2
I	Eureka Natural Foods, Eureka	2
J	Central Ave, McKinleyville	2
K	Humboldt County School District, Eureka	1
L	3rd Street, Eureka	2
M	Hoopa Valley, Hoopa	1
N	Klamath Community Center, Klamath	1

Source: Batch Geo, adapted by the Redwood Coast Energy Authority

2.5.1.2 Online Outreach

Earned Media

Over the course of the project, 18 earned media placements were achieved. The following organizations included content on project successes on their websites:

- Humboldt Visitors Bureau
- Lost Coast Outpost
- News Channel 3
- NGT News
- North Coast Journal
- North Coast News Channel 23
- The Times Standard

Write ups in media outlets promoted the current EVCS network and upcoming PEV events like car shows and ride-and-drives. Members of the project team were also consulted for articles discussing the current status of transportation in the region and opportunities for improvement through the incorporation of PEVs.

Facebook Posts

RCEA maintained an active social media presence over the course of the project. 28 posts relating to PEV promotion were included on the RCEA Facebook Page. These posts highlighted relevant PEV articles, events, and statistics. In addition, posts promoted the regional EVCS network and PEV efforts by RCEA's partners, like the North Coast Unified Air Quality Management District and Humboldt State University.

PEV Newsletters

RCEA developed six PEV newsletters for distribution to the general public. Newsletters were distributed using the email campaign management service MailChimp, posted on the RCEA website, and hard copies were handed out at PEV promotion events. Email versions of the newsletter were sent out to 852 subscribers, and email open rates were tracked using Mailchimp's campaign management software.

Article topics included:

- Currently available incentives for PEVs
- The status of PEV adoption locally, state-wide, and nationally
- How PEVs work, different types of PEVs available, and FAQs
- PEV owner testimonials
- Existing and planned EVCS
- Where to buy PEVs, with information from local dealerships
- Work done by the CEC to promote PEVs
- Links to additional resources

All six PEV newsletters distributed as part of this project are included as Appendix I.

2.5.2 Fleet Analyses

The project team performed two comprehensive fleet evaluations as part of this project. Analysis was conducted for municipal fleets operated by the City of Arcata and Humboldt County. These analyses determined the potential costs savings and potential emission reductions achievable by replacing end-of-life conventional vehicles with Battery Electric Vehicles or plug-in hybrid electric vehicles.

To conduct these fleet analyses, the project team utilized a comprehensive excel tool developed by SERC as part of the North Coast PEV Readiness Project. This tool, called PEV Fleet Evaluation Tool, takes data on fuel economy, average trip distance, annual mileage, percentage city driving, and MSRP of PEV and Internal Combustion Engine vehicles and calculates greenhouse gas emissions avoided and the payback on a PEV purchase. If the PEV replacement paid for itself within ten years of purchase, it was proposed to the municipality for consideration.

The PEV Fleet Evaluation Tool can be customized with different parameters to account for each municipality's unique circumstances. The following inputs can be customized:

- Applicable rebates, tax credits, and other incentives;
- Electric vehicle supply equipment, brand, model, and capabilities;
- Number of electric vehicle supply equipment units purchased;

- Electric vehicle supply equipment unit design, engineering, and installation costs;
- Gasoline price;
- Electric utility rate price structure;
- Percentage on/off peak charging;
- Plug-in hybrid electric vehicle and Battery Electric Vehicle maintenance costs factors (as function of conventional maintenance costs);
- Real discount rate (net of inflation)

The first step in the analysis process was finding interested fleet partners. A list of fleets in the region was compiled and the project team began making phone calls. Preference was given to local municipalities and fleets with a large number of light duty vehicles. The City of Arcata and Humboldt County expressed interest in analysis and were chosen to participate. The results from their analysis are included in the sections below.

2.5.2.1 The City of Arcata Fleet Analysis

The project team collaborated with Lori Reed from the City of Arcata to complete an analysis of the City's fleet. The City's fleet had received an analysis in 2013 as part of the North Coast PEV Readiness Project, but the composition of the fleet, and available PEV models, had changed substantially since this analysis.

Ms. Reed provided the project team with a full list of vehicles that were eligible for replacement. After discussion with Ms. Reed about the duty requirements of each vehicle, a total of ten vehicles were selected for analysis. These vehicles serve three different departments: Administration (5), Police (3) and Water (2).

2.5.2.2 City of Arcata Results

The City currently operates two GO-4 Internal Combustion Engine parking enforcement vehicles. These vehicles represent two of the three vehicles in the Police Department that were selected for analysis. Due to the highly-specialized nature of these aging vehicles, the City was incurring extremely high maintenance costs. The project team proposed replacing the GO-4s with all-electric parking enforcement vehicles. Battery Electric Vehicles like the Smart Car EV or Mitsubishi i-Miev would meet the unique duty requirements of parking enforcement and eliminate much of the city's current maintenance cost.

In addition to parking enforcement, the project team recommended replacing vehicles in the Administration Department. A few of the vehicles in the department had high range requirements (300+ miles) and thus required replacement by plug-in hybrid electric vehicles. Due to the relatively higher MSRPs of currently available plug-in hybrid electric vehicles, they did not offer paybacks within the useful life of the current Internal Combustion Engine vehicles. However, a few of the department's vehicles did not require such high maximum range, and the City was considering replacing them with a conventional hybrid Toyota Prius. Compared with a Toyota Prius, the Battery Electric Vehicle Nissan Leaf would pay back in 1.7 years, the Battery Electric Vehicle Mitsubishi i-MiEV in 4.4 years, and the Battery Electric Vehicle Chevy Spark EV in 7.3 years.

The Water Department's meter reader vehicle was deemed not to be a good fit for PEV replacement due to the need to carry a ladder. However, because the Department operated two Ford Rangers, the project team recommended replacing one of them with a Kia Soul EV. Even though this model provided a longer payback period (7.4 years) compared to other

Battery Electric Vehicle models, the cargo capacity requirements of the Water Department necessitated a vehicle with a larger trunk.

The results of the analysis were presented to Julie Neander, deputy director of Environmental Services for the City of Arcata. Along with the analysis report, a Clean Cities Buyer's guide and specifications on proposed PEV replacements were provided. After presenting all the material, Ms. Neander requested information on other jurisdiction's experiences with PEV parking enforcement vehicles. After conducting research, the project team connected Ms. Neander with representatives from cities currently operating PEVs as parking enforcement vehicles.

While not among the top recommendations in the analysis report, the City later decided to purchase two Chevrolet Volt EVs. These Volts replace two conventional vehicles in the Administration Department. RCEA has been working with the City to evaluate different charging options for their new plug-in hybrid electric vehicles.

The full fleet analysis report for the City of Arcata is included as Appendix J.

2.5.2.3 Humboldt County Fleet Analysis

The project team collaborated with Senior Automotive Technician Jo Wattle to complete an analysis of the County fleet, which is the largest in the region. The County submitted eighteen vehicles for evaluation. These vehicles included fifteen Ford Taurus's and three Toyota Prius's that were scheduled for replacement during the 2017-2018 fiscal year. While the County planned on replacing a number of other vehicles during this fiscal year, only vehicles in the medium and full-size sedan classes were considered for the analysis, due to lack of suitable plug-in electric counterparts for vehicles in larger classes.

An early challenge was the timing. The County agreed to collaborate with the project team on the fleet analysis during their process of soliciting bids for new vehicles for fiscal year 2017-2018. This meant that accurate information on the conventional replacements could not be provided immediately. The project team first began collaboration with the County in November 2016 but did receive accurate data on conventional replacement vehicles until February 2017.

Because of the lack of information on fiscal year 2017-2018 winning bids for replacement vehicles, the project team, in conjunction with Ms. Wattle, elected to use replacement vehicles from fiscal year 2016-2017 as proxies for 2017-2018 vehicles. The conventional replacement vehicles used in the analysis were the 2017 Dodge Charger as replacement for the Ford Taurus and the 2017 Ford Fusion Hybrid as replacement for the Toyota Prius.

2.5.2.4 Humboldt County Results

Results from the Humboldt County fleet analysis showed significant opportunities for savings through the replacement of conventional vehicles with PEVs. Should the County replace all eighteen vehicles with the cheapest suitable PEV, the 2017 Nissan Leaf, a net present value of $212,000 over the ten-year lifetime of the vehicles was calculated. This was due in large part to rebate and discount opportunities available on this particular model. The Nissan Leaf is eligible for a Clean Vehicle Rebate Project rebate of $2500 and an $8000 Nissan fleet discount, available if a fleet operator buys two or more vehicles at a time.

The Nissan Leaf was not the only PEV that paid for itself within the ten-year lifetime of the vehicle. Six other 2017-model PEVs – the Mitsubishi i-Miev, Ford Focus Electric, Volkswagen e-Golf, Kia Soul EV, Toyota Prius Prime, and Ford C-Max Energi - had payback times of less than ten years when replacing a Ford Taurus. When replacing a Toyota Prius, two PEVs – the Nissan Leaf and Mitsubishi i-Miev—had payback times of less than ten years.

The potential greenhouse gas emission reductions were also calculated. When compared to the Dodge Charger, all cost-effective Battery Electric Vehicles achieved emission reductions of 4.4 tons per vehicle per year, while the plug-in hybrid electric vehicle Toyota Prius Prime and Ford C-Max Energi achieved reductions of 3.4 and 2.7 tons per vehicle per year respectively. The two cost-effective replacements for the Toyota Prius achieved reductions of 2.1 tons per vehicle per year.

Team member Elliot Goodrich met with Ms. Wattle to present the analysis findings. Ms. Wattle was enthusiastic about the prospect of incorporating PEVs into the County fleet of 420+ vehicles. Ms. Wattle had just taken over as automotive technician in charge of purchasing and fleet management and was looking for ways to incorporate more cost-effective green vehicles into the fleet. Mr. Goodrich delivered the PEV Fleet Evaluation Tool to Ms. Wattle and provided training on use of the tool.

Ms. Wattle described several of the challenges she faced to incorporating PEVs. The principle barrier was that many municipal fleet operators are required to purchase the lowest cost option in a given class. In the County's case, fleet operators are only permitted to choose from a list of vehicle bids that are submitted by eligible dealers. If the dealers do not bid PEVs, they will not have the option of purchasing these models. She was allowed to account for fuel economy savings in considering bids, but not the savings from reduced maintenance costs. Changing these requirements could be an important mechanism for encouraging PEV adoption in government fleets.

The fleet analysis report developed for Humboldt County is included as Appendix K.

Chapter 3: Conclusions and Recommendations

3.1 Assessment of Project Success

The project was successful in implementing core elements of the North Coast PEV Readiness Plan and planning for the next phase of the regional EVCS charging network. The project team had productive engagements with Authority Holding Jurisdictions, contractors, potential site hosts and the general public. Comprehensive and appropriate PEV resources were developed and distributed. In addition, RCEA has secured follow-on funding (CEC-PON-16-601) to continue Zero Emission Vehicle outreach work and create an ombudsman position to provide regional Zero Emission Vehicle technical assistance. The efforts that have been initiated through this project to educate stakeholders, promote PEVs, and plan for additional charging infrastructure in the North Coast region have been very successful, and it is likely that these efforts will be sustained in the future.

The set of bulleted points that follow evaluate project success based on the set of five project metrics that were stated in Section 1.2 of this report.

- Encourage all eleven regional government entities to adopt streamlined processes. Productive engagement was achieved with nine jurisdictions: Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Humboldt County, Rio Dell, Trinidad, and Trinity County. Engagement was attempted with the two remaining jurisdictions of Del Norte County and Crescent City. However, due to vacant planning and building positions, these entities lacked the capacity to engage on EVCS planning. In addition, a suite of resources was developed and distributed to nine jurisdictions to assist in the evaluation and revision of current permitting processes.
- Successfully see at least four jurisdictions adopt new processes for permitting EVCS. As of April 2017, the project team is not aware of any new processes formally adopted for permitting EVCS. However, discussions with nine regional jurisdictions has helped raise awareness of the need to streamline processes to achieve state-level goals. The project team provided the necessary resources for jurisdictions to begin reviewing and revising their processes.
- Develop standardized specifications for charging station equipment and engage with at least three local contractors to encourage best practices. A comprehensive EVCS Selection Guide was developed to assist potential EVCS owner/operators and contractors identify the most suitable EVCS for their application. This resource has been distributed regionally to contractors and municipalities, as well as nationally to the Department of Energy and the National Renewable Energy Laboratory.
- Produce at least 30 and as many as 40 detailed EVCS designs and cost estimates in locations consistent with the Readiness Plan and with willing site hosts. Potential EVCS site hosts were identified based on recommendations from the North Coast PEV Readiness Plan. Completed 10 percent engineering design drawings and opinions of probable costs were distributed to participating site hosts. A total of 26 detailed site assessments were completed, including a mix of Direct Current and Alternating Current EVCS. Additional funding will be pursued to install EVCS at the locations assessed through this project.

- Conduct outreach activities as specified in the grant agreement to promote the latest PEVs on the market. The project team held four Ride-and-Drives, presented at seven events, tabled at 24 community events, organized six PEV car shows, distributed six PEV newsletters, earned 18 media placements, and made 28 posts on Facebook. These outreach activities resulted in an estimated 8,000+ impressions. In addition, two comprehensive fleet analyses were completed for the City of Arcata and Humboldt County. Participation in the fleet analysis process led the City to purchase two plug-in hybrid electric vehicle Chevrolet Volts.
- Install directional signage guiding PEV drivers to at least 10 existing and soon to be installed EVCS. The project team coordinated the installation of 24 trailblazing signs, which direct drivers to nine regional EVCS. These sign installations will result in the installation of an additional 27 signs by Caltrans along state right-of-ways. Sign placement for a tenth EVCS was stymied by two jurisdiction's unwillingness to host the required signs.

3.2 Conclusions and Lessons Learned

The PEV Readiness Plan Implementation Project was a success. The implementation of core elements of the PEV Readiness Plan resulted in a significant increase in regional awareness and capacity to accommodate a growing population of PEVs. While continued funding is required to support the full implementation of the PEV Readiness Plan, this project-initiated momentum that will continue into the future.

Below is a summary of a few lessons learned during the project.

- Jurisdictions were appreciative of assistance, but insufficiently staffed and funded to follow through on many recommendations. Building and planning staff expressed frustration at mandates like Assembly Bill 1236, which require jurisdictions to streamline EVCS permitting processes. A chief complaint was that resources necessary to implement requirements were not included in these mandates.
- Workshops are an effective venue for initiating discussion between jurisdictions. By getting staff from Authority Holding Jurisdictions, engineering firms, SERC, and RCEA all in the same room, productive discussions were initiated, and best practices were shared.
- Working with potential EVCS site hosts to determine an agreed-upon layout took more time than expected, averaging around 3 – 4 weeks per site. As a rural community with few large parking lots, building code requirements significantly impact existing parking infrastructure.
- Requesting that jurisdictions' Public Works Departments install EVCS trailblazing signage, as opposed to a using a private contractor, resulted in significant cost savings. After purchasing the signs and reimbursing each jurisdiction for time and materials, the total cost was under $7,000. The project team had originally budgeted $18,000 to have a contractor purchase and install the signs.
- The community responded positively to PEV car shows. Due to a lack of dealer participation, a switch to an EV car show format was necessitated after the fourth Ride-and-Drive event. Community members had an opportunity to see and discuss EVs driven by their friends and neighbors.

3.3 Recommendations

The following recommendations are made to increase regional PEV adoption and readiness.

- Encourage the organization of more EVCS workshops for building and planning staff. Workshops provide an opportunity for collaboration and the sharing of best practices between Authority Holding Jurisdictions.
- Continue to update and improve the EVCS Selection Guide. The EVCS Selection Guide provides a critical resource to municipalities and contractors attempting to evaluate all of the different EVCS models. This is the only resource of its kind as of the writing of this report and should continue to be updated and distributed.
- Pursue EVCS installation at the sites identified. These sites were selected based on the Infrastructure Deployment Plan developed as part of the North Coast PEV Readiness Plan and represent locations most critical to the sustainability of a regional EVCS network. Thorough site analysis and willing site hosts make these projects "shovel ready".
- Support research that evaluates the impact of EVCS accessibility requirements in the 2016 California Building Code on rural EVCS deployment. The project team experienced pushback from potential site hosts regarding the parking space requirements.
- Encourage municipalities to embrace EVCS trailblazing signage. The project team received pushback from a few regional municipalities when requesting to install trailblazing signage. These municipalities cited "sign blight" as their primary concern.
- Continue to promote PEVs throughout the region. Ride-and-Drive events and PEV car shows are particularly effective in changing perceptions.
- Provide incentives to fleets for participation in PEV fleet analysis. Access to rebates or credits after participating in an analysis will encourage engagement from fleets with historically low interest in alternative fuels. This is especially true for municipal fleets in rural areas.
- Engage with local fleets, particularly publicly owned fleets, to reduce barriers to the adoption of low and zero emission vehicles and increase awareness of vehicle availability and fleet appropriateness as the market continues to develop.

GLOSSARY

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The CEC's five major areas of responsibilities are:

1. Forecasting future statewide energy needs.
2. Licensing power plants sufficient to meet those needs.
3. Promoting energy conservation and efficiency measures.
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels.
5. Planning for and directing state response to energy emergencies.

Funding for the CEC's activities comes from the Energy Resources Program Account, Federal Petroleum Violation Escrow Account, and other sources.

ELECTRIC VEHICLE (EV)—A broad category that includes all vehicles that are fully powered by electricity or an electric motor.

ELECTRIC VEHICLE CHARGING STATION (EVCS)–An element in the electric vehicle supply equipment that supplies energy to charge electric vehicles.

PLUG-IN ELECTRIC VEHICLE (PEV)—A general term for any car that runs at least partially on battery power and is recharged from the electricity grid. There are two different types of PEVs to choose from—pure battery electric and plug-in hybrid vehicles.

REDWOOD COAST ENERGY AUTHORITY (RCEA)–A local government Joint Powers Agency founded in 2003 whose members include the County of Humboldt, the Cities of Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Rio Dell, and Trinidad, and the Humboldt Bay Municipal Water District.

SCHATZ ENERGY RESEARCH CENTER (SERC)–A research center meant to promote the use of clean and renewable energy by designing, demonstrating, and deploying clean and renewable energy technologies, implementing collaborative programs that support the deployment of clean energy systems, performing lab and field research, engaging in scientific and policy analysis, providing graduate fellowships and work opportunities for student engineers and scientists, and educating the public about clean and renewable energy.

Appendix A:
EVCS Permitting, Codes and Standards Resource Binder

Figure 4 shows EVSE Permitting, Codes and Standards Resources

Figure 4: EVCS Permitting, Codes and Standards Resources

Electric Vehicle Charging Stations

The following provides a summary reference sheet on planning and zoning, codes and standards, and permitting for electric vehicle chargers and charging stations. Resources noted as included can be found in this resource binder.

Planning and Zoning

The following are resources to assist an AHJ with developing language in planning documents.

- AB 1236: Requirement for jurisdictions to streamline permitting processes *(BILL AND EXAMPLE ORDINANCE INCLUDED)*[1]
- Existing North Coast and Upstate planning documents with language related to EVs *(INCLUDED)*[2]
- Governor's Office of Planning and Research (OPR) Zoning Example *(INCLUDED)*[3]
- City of Chelan EVCS Zoning Code *(INCLUDED)*[4]

Codes and Standards

The following summarize relevant codes and standards related to electric vehicle chargers and charging stations.

- Industry Standards
  - Vehicle and Charger Interface (both are included under IEC 62196)
    - Society of Automotive Engineers (SAE): J-1772, J-1773, J-2293, J-2836, J-2841, J-2847
    - CHAdeMO: JEVS G105
  - Electric Vehicle Chargers: NFPA 70 / NEC – Article 625: Electric Vehicle Charging System Equipment
  - Electric Vehicle Charger Components: NRTL Certification Recommended, UL or other as listed by OSHA
    - Underwriter Laboratories (UL): FFTG, FFWA *(UL SUMMARY ARTICLE INCLUDED)*[5]
- 2016 California Building Code *(EXAMPLE SITE PLAN INCLUDED)*[2]
  - Title 24, Part 2, Chapter 11B – Accessibility Requirements: 11B-812 *(SUMMARY OF ACCESSIBILITY REQUIREMENTS INCLUDED)*[2]
  - Title 24, Part 3 – NFPA 70 / NEC Requirements – Article 625: Electric Vehicle Charging System Equipment
  - Title 24, Part 11 – CalGreen Mandatory and Voluntary Requirements
    - Residential: 4.106.4 and A4.106.8
    - Non-Residential: 5.106.5.3 and A5.106.5.3
- Signage and Pavement Markings: CalTrans Policy Directive 13-01 *(INCLUDED)*
- Parking code: California Vehicle Code 22511 *(INCLUDED)*
  - Governor's Office of Planning and Research (OPR) PEV Parking Code Template *(INCLUDED)*[3]
- Health and Safety Code Section 44268: EVCS Open Access Act *(INCLUDED)*

Permitting

The following are resources to assist an AHJ with developing permit processes for electric vehicle charging stations.

- Electric Load Calculation Worksheets *(TWO EXAMPLES INCLUDED)*[6,7]
- Permit Templates for Residential Installations *(THREE EXAMPLES INCLUDED)*[8,9,10]
- Residential and Commercial Installation Checklists *(THREE EXAMPLES INCLUDED)*[6,11,12]
- NECA Inspection Checklist *(INCLUDED)*[13]
- Governor's Office of Planning and Research (OPR) General EVCS Permitting Checklist *(INCLUDED)*[3]

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[1] Example ordinance from https://www.municode.com/library/ca/sonoma_county/codes/code_of_ordinances?nodeId=CH7D5ELVECHSTPEPR
[2] Developed by the Schatz Energy Research Center and/or the Redwood Coast Energy Authority
[3] https://www.opr.ca.gov/s_zero-emissionvehicles.php
[4] http://www.codepublishing.com/WA/Chelan/html/Chelan17/Chelan1763.html
[5] http://www.ul.com/wp-content/uploads/2014/04/UL_electricvehicles.pdf
[6] http://www.cityofsacramento.org/Community-Development/Resources/Forms/Building-Forms
[7] https://www.opr.ca.gov/docs/L2_Load_Calculator.pdf
[8] http://www.afdc.energy.gov/pdfs/EV_charging_template.pdf
[9] http://maps3.cityofirvine.org/evcs/index.html
[10] http://www.mountainview.gov/depts/comdev/building/construction/plancheck/onestop.asp
[11] http://building.saccounty.net/ContractorDeveloper/Pages/HeatAirElectricPV.aspx
[12] https://energycenter.org/pluginsd/resources
[13] http://resources.cleanenergyroadmap.com/EV_P_CCSE_sample_inspection_checklist.pdf

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Assembly Bill No. 1236

CHAPTER 598

An act to add Section 65850.7 to the Government Code, relating to local ordinances.

[Approved by Governor October 8, 2015. Filed with Secretary of State October 8, 2015.]

LEGISLATIVE COUNSEL'S DIGEST

AB 1236, Chiu. Local ordinances: electric vehicle charging stations.

The Planning and Zoning Law, among other things, requires the legislative body of each county and city to adopt a general plan for the physical development of the county or city and authorizes the adoption and administration of zoning laws, ordinances, rules, and regulations by counties and cities. Existing law, the Electric Vehicle Charging Stations Open Access Act, prohibits the charging of a subscription fee on persons desiring to use an electric vehicle charging station, as defined, and prohibits a requirement for persons to obtain membership in any club, association, or organization as a condition of using the station, except as specified.

The bill would require a city, county, or city and county to approve an application for the installation of electric vehicle charging stations, as defined, through the issuance of specified permits unless the city or county makes specified written findings based upon substantial evidence in the record that the proposed installation would have a specific, adverse impact upon the public health or safety, and there is no feasible method to satisfactorily mitigate or avoid the specific, adverse impact. The bill would provide for appeal of that decision to the planning commission, as specified. The bill would provide that the implementation of consistent statewide standards to achieve the timely and cost-effective installation of electric vehicle charging stations is a matter of statewide concern. The bill would require electric vehicle charging stations to meet specified standards. The bill would require a city, county, or city and county with a population of 200,000 or more residents to adopt an ordinance, by September 30, 2016, that creates an expedited and streamlined permitting process for electric vehicle charging stations, as specified. The bill would require a city, county, or city and county with a population of less than 200,000 residents to adopt this ordinance by September 30, 2017. The bill would authorize the city, county, or city and county, in developing the ordinance, to refer to guidelines contained in a specified guidebook. The bill would also authorize the adoption of an ordinance that modifies the checklists and standards found in the guidebook due to unique conditions. By increasing the duties of local officials, this bill would create a state-mandated local program.

The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for a specified reason.

The people of the State of California do enact as follows:

SECTION 1. Section 65850.7 is added to the Government Code, to read:

65850.7. (a) The Legislature finds and declares all of the following:

(1) The implementation of consistent statewide standards to achieve the timely and cost-effective installation of electric vehicle charging stations is not a municipal affair, as that term is used in Section 5 of Article XI of the California Constitution, but is instead a matter of statewide concern.

(2) It is the intent of the Legislature that local agencies not adopt ordinances that create unreasonable barriers to the installation of electric vehicle charging stations and not unreasonably restrict the ability of homeowners and agricultural and business concerns to install electric vehicle charging stations.

(3) It is the policy of the state to promote and encourage the use of electric vehicle charging stations and to limit obstacles to their use.

(4) It is the intent of the Legislature that local agencies comply not only with the language of this section, but also the legislative intent to encourage the installation of electric vehicle charging stations by removing obstacles to, and minimizing costs of, permitting for charging stations so long as the action does not supersede the building official's authority to identify and address higher priority life-safety situations.

(b) A city, county, or city and county shall administratively approve an application to install electric vehicle charging stations through the issuance of a building permit or similar nondiscretionary permit. Review of the application to install an electric vehicle charging station shall be limited to the building official's review of whether it meets all health and safety requirements of local, state, and federal law. The requirements of local law shall be limited to those standards and regulations necessary to ensure that the electric vehicle charging station will not have a specific, adverse impact upon the public health or safety. However, if the building official of the city, county, or city and county makes a finding, based on substantial evidence, that the electric vehicle charging station could have a specific, adverse impact upon the public health or safety, the city, county, or city and county may require the applicant to apply for a use permit.

(c) A city, county, or city and county may not deny an application for a use permit to install an electric vehicle charging station unless it makes written findings based upon substantial evidence in the record that the proposed installation would have a specific, adverse impact upon the public health or safety, and there is no feasible method to satisfactorily mitigate or avoid the specific, adverse impact. The findings shall include the basis

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

for the rejection of potential feasible alternatives of preventing the adverse impact.

(d) The decision of the building official pursuant to subdivisions (b) and (c) may be appealed to the planning commission of the city, county, or city and county.

(e) Any conditions imposed on an application to install an electric vehicle charging station shall be designed to mitigate the specific, adverse impact upon the public health or safety at the lowest cost possible.

(f) (1) An electric vehicle charging station shall meet applicable health and safety standards and requirements imposed by state and local permitting authorities.

(2) An electric vehicle charging station shall meet all applicable safety and performance standards established by the California Electrical Code, the Society of Automotive Engineers, the National Electrical Manufacturers Association, and accredited testing laboratories such as Underwriters Laboratories and, where applicable, rules of the Public Utilities Commission regarding safety and reliability.

(g) (1) On or before September 30, 2016, every city, county, or city and county with a population of 200,000 or more residents, and, on or before September 30, 2017, every city, county, or city and county with a population of less than 200,000 residents, shall, in consultation with the local fire department or district and the utility director, if the city, county, or city and county operates a utility, adopt an ordinance, consistent with the goals and intent of this section, that creates an expedited, streamlined permitting process for electric vehicle charging stations. In developing an expedited permitting process, the city, county, or city and county shall adopt a checklist of all requirements with which electric vehicle charging stations shall comply to be eligible for expedited review. An application that satisfies the information requirements in the checklist, as determined by the city, county, or city and county, shall be deemed complete. Upon confirmation by the city, county, or city and county of the application and supporting documents being complete and meeting the requirements of the checklist, and consistent with the ordinance, a city, county, or city and county shall, consistent with subdivision (b), approve the application and issue all required permits or authorizations. However, the city, county, or city and county may establish a process to prioritize competing applications for expedited permits. Upon receipt of an incomplete application, a city, county, or city and county shall issue a written correction notice detailing all deficiencies in the application and any additional information required to be eligible for expedited permit issuance. An application submitted to a city, county, or city and county that owns and operates an electric utility shall demonstrate compliance with the utility's interconnection policies prior to approval.

(2) The checklist and required permitting documentation shall be published on a publicly accessible Internet Web site, if the city, county, or city and county has an Internet Web site, and the city, county, or city and county shall allow for electronic submittal of a permit application and associated documentation, and shall authorize the electronic signature on

all forms, applications, and other documentation in lieu of a wet signature by an applicant. In developing the ordinance, the city, county, or city and county may refer to the recommendations contained in the most current version of the "Plug-In Electric Vehicle Infrastructure Permitting Checklist" of the "Zero-Emission Vehicles in California: Community Readiness Guidebook" published by the Office of Planning and Research. A city, county, or city and county may adopt an ordinance that modifies the checklists and standards found in the guidebook due to unique climactic, geological, seismological, or topographical conditions. If a city, county, or city and county determines that it is unable to authorize the acceptance of an electronic signature on all forms, applications, and other documents in lieu of a wet signature by an applicant, the city, county, or city and county shall state, in the ordinance required under this subdivision, the reasons for its inability to accept electronic signatures and acceptance of an electronic signature shall not be required.

(h) A city, county, or city and county shall not condition approval for any electric vehicle charging station permit on the approval of an electric vehicle charging station by an association, as that term is defined in Section 4080 of the Civil Code.

(i) The following definitions shall apply to this section:

(1) "A feasible method to satisfactorily mitigate or avoid the specific, adverse impact" includes, but is not limited to, any cost-effective method, condition, or mitigation imposed by a city, county, or city and county on another similarly situated application in a prior successful application for a permit.

(2) "Electronic submittal" means the utilization of one or more of the following:

(A) Email.

(B) The Internet.

(C) Facsimile.

(3) "Electric vehicle charging station" or "charging station" means any level of electric vehicle supply equipment station that is designed and built in compliance with Article 625 of the California Electrical Code, as it reads on the effective date of this section, and delivers electricity from a source outside an electric vehicle into a plug-in electric vehicle.

(4) "Specific, adverse impact" means a significant, quantifiable, direct, and unavoidable impact, based on objective, identified, and written public health or safety standards, policies, or conditions as they existed on the date the application was deemed complete.

SEC. 2. No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because a local agency or school district has the authority to levy service charges, fees, or assessments sufficient to pay for the program or level of service mandated by this act, within the meaning of Section 17556 of the Government Code.

CHAPTER 7D5 - ELECTRIC VEHICLE CHARGING STATION PERMITTING PROCESS

Sec. 7D5-1. - Title and authority.

This chapter is and may be cited as the "Electric Vehicle Charging Station Permitting Process." The chapter is enacted pursuant to Government Code section 65850.7 as established by Assembly Bill 1236 (Chapter 598, Statutes 2015).

(Ord. No. 6175 , § 1, 9-13-2016)

Sec. 7D5-2. - Purpose.

The purpose of this chapter is to create an expedited, streamlined permitting process that complies with AB 1236 and Government Code section 65850.7 to achieve timely and cost-effective installation of electric vehicle charging stations. This chapter encourages the installation and use of electric vehicle charging stations by removing obstacles to and minimizing the cost of permitting for charging stations, and by expanding the ability of residential, agricultural, and commercial property owners to install electric vehicle charging stations. This chapter allows the county to achieve these goals while protecting the public health and safety.

(Ord. No. 6175 , § 1, 9-13-2016)

Sec. 7D5-3. - Applicability.

This chapter applies to the permitting of electric vehicle charging stations in the unincorporated territory of the county of Sonoma.

Electric vehicle charging systems legally established or permitted prior to the building official's implementation of an expedited permitting process are not subject to the requirements of this chapter unless physical modifications or alterations are undertaken that materially change the size, type, or components of an electric vehicle charging station in such a way as to require new permitting.

(Ord. No. 6175 , § 1, 9-13-2016)

Sec. 7D5-4. - Definitions.

The following words and phrases as used in this chapter are defined as follows:

"Electronic submittal" means the utilization of one (1) or more of the following:

1. Email;
2. The Internet; or

3. Facsimile.

"Electric vehicle charging station" or "charging station" means any level of electric vehicle supply equipment station that is designed and built in compliance with Article 625 of the California Electrical Code, as it reads on the effective date of this chapter, and delivers electricity from a source outside an electric vehicle into a plug-in electric vehicle.

"Specific adverse impact" means a significant, quantifiable, direct, and unavoidable impact, based on objective, identified, and written public health or safety standards, policies, or conditions as they existed on the date the application was deemed complete.

"A feasible method to satisfactorily mitigate or avoid the specific adverse impact" includes, but is not limited to, any cost-effective method, condition, or mitigation imposed by the county on another similarly situated application in a prior successful application for a permit.

"Building official" means the officer or other designated authority charged with the administration and enforcement of the Sonoma County Code, or a duly authorized representative.

(Ord. No. 6175 , § 1, 9-13-2016)

Sec. 7D5-5. - Electric vehicle charging stations requirements.

A. All electric vehicle charging stations shall meet applicable health and safety standards and requirements of local, state, and federal law.
B. Electric vehicle charging stations shall meet all applicable safety and performance standards established by the California Electrical Code, the Society of Automotive Engineers, the National Electrical Manufacturers Association, and accredited testing laboratories such as Underwriters Laboratories and, where applicable, rules of the Public Utilities Commission regarding safety and reliability.

(Ord. No. 6175 , § 1, 9-13-2016)

Sec. 7D5-6. - Application standards.

A. No later than September 30, 2017, the chief building official of Sonoma County or his/her designee shall implement an expedited permitting process, after consulting with the local fire department or district, that will allow the building official to administratively approve an application to install electric vehicle charging stations through the issuance of a building permit or similar nondiscretionary permit.
B. The building official shall adopt a checklist of all requirements with which electric vehicle charging stations shall comply to be eligible for expedited review. The checklist and all required permitting documentation shall be published on the county of Sonoma's Internet website.
C. In developing the expedited permitting process and checklist, the building official may refer to the recommendations contained in the most recent version of the "Plug-In Electric Vehicle Infrastructure Permitting Checklist" of the "Zero-Emission Vehicles in California: Community Readiness Guidebook"

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

published by the State of California's Office of Planning and Research. The building official may modify the checklists and standards found in the guidebook due to unique climactic, geological, seismological, or topographical conditions.

D. Electronic submittal of the required permit application and supporting documents shall be made available for all electric vehicle charging station permit applications. The method of electronic submittal shall be at the county's discretion.

(Ord. No. 6175 , § 1, 9-13-2016)

Sec. 7D5-7. - Expedited permitting process and permit review.

A. The applicant may submit the permit application and supporting documents to the permit and resource management department by electronic submittal. In the case of electronic submittal, the electronic signature of the applicant on all forms, applications, and other documents may be used in lieu of a wet signature. If at the time of a permit application, the county's supporting technology does not facilitate electronic signatures, the county, at its discretion, may authorize the acceptance of either electronic signature or wet signature.

B. An application and supporting documents that satisfy the information requirements in the checklist, as determined by the building official, shall be deemed complete. Upon receipt of an incomplete application, the building official shall issue a written correction notice detailing all deficiencies in the application and any additional information that is required to be eligible for expedited permit issuance.

C. Upon confirmation by the building official that the application is complete and meets the requirements of the checklist, and is consistent with this chapter, the building official shall administratively approve the application and issue all required permits or authorizations. The building official may establish a process to prioritize competing applications for expedited permits.

   1. If the county makes a finding, based on substantial evidence, that the electric vehicle charging station could have a specific adverse impact upon the public health or safety, the county may require the applicant to apply for a use permit.

   2. The county may withhold issuance of the permit or authorization if there is a violation on record for any structure associated with the application under review.

   3. The county shall not condition approval for any electric vehicle charging station permit on the approval of an electric vehicle charging station by an association, as that term is defined in Civil Code section 4080.

D. The county shall not deny an application for a use permit to install an electric vehicle charging station unless it makes written findings based upon substantial evidence in the record that the proposed installation would have a specific adverse impact upon the public health or safety, and there is no feasible method to satisfactorily mitigate or avoid the specific adverse impact. The findings shall include the basis for the rejection of potential feasible alternatives of preventing the adverse impact.

E.

Any conditions imposed on an application to install an electric vehicle charging station shall be designed to mitigate the specific adverse impact upon the public health or safety at the lowest cost possible.

F. This expedited permitting process is intended to apply only to applications for permits for electric vehicle charging stations, and will not expedite the review of any other permit applications.

G. The building official's decision pursuant to Sections 7D5-7(C) or (D) may be appealed to the planning commission in accordance with the procedures set forth in Sonoma County Code section 26-92-040, subdivision (b). The planning commission's decision shall be final.

(Ord. No. 6175 , § 1, 9-13-2016)

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

List of Planning Documents in North Coast and Upstate Counties That Include Alternative Transportation (as of July, 2016)

County	Agency	Date	Planning Document / Ordinance	GHG Reduction Goals-	Mention of Alternative Fuels as strategy?	Energy Security / Independence	Criteria pollutant emissions reduction goals	Text	Notes
Colusa	County	2012	General Plan	Yes: Policy CON 2-11 relating to timber and carbon sequestration	Indirectly: Policy CON 2-13	No	Yes: Policy Circ 4-4, Objective CON 2-8	**Policy CON 2-13:** Encourage LEED certification or equivalent for all public and private development, where feasible, and strongly encourage LEED Neighborhood Design (ND) certification or equivalent for other applicable projects, particularly within large-scale developments and Specific Plan areas. **Action CON 2-A:** Amend the Zoning Ordinance to streamline permitting and provide clear development standards for the production of biofuels, biomass, solar, wind and other energy alternatives to reduce dependency on fossil fuels.	
Colusa	Colusa	2007	General Plan	No	Yes	No	No	**Circulation Element - Air Quality and Health Issues:** Given the emphasis on improving air quality, the City should consider programs that encourage less use of gasoline-powered vehicles. As an example, the City could consider parking areas with electrical outlets for electric cars	
Colusa	Williams	2011	General Plan	Yes: 8.n-8	Mentioned: Green building, alternative transportation, biofuels, and the like were opportunities presented as desirable industries for the community.	No	No		
Del Norte	County	2003	General Plan	No	No	No	Yes, although veguly	**Goal 8.D:** To maximize the efficient use of transportation facilities so as to … 3) reduce the quantity of emissions of pollutants from automobiles.	
Del Norte	County	2016	Regional Transportation Plan Update	Yes	Yes	No	No	**Policy 3.9.3.2.2 -** Promote projects that can be demonstrated to reduce air pollution, such as active transportation projects and alternative fuel programs	
Glenn	County	1993	General Plan		Yes	Mentions the economic benefits of energy efficiency for utility and transportation fuels		**3.6: Public Facilities -** "The County may wish to investigate converting the fleet vehicles to run off alternative fuels such as methanol, ethanol, natural gas, or electricity. These fuels are all renewable, have greater efficiencies, and have less harmful emissions."	
Glenn	Orland	2010	General Plan	Yes	Yes	No	No	**Goal 5.5:** REDUCE THE CONTRIBUTION OF GREENHOUSE GASES FROM EXISTING SOURCES AND MINIMIZE THE CONTRIBUTION OF GREENHOUSE GASES FROM NEW CONSTRUCTION AND SOURCES. **Policy 3.9.E:** The City shall support the use of alternatively fueled vehicles and fueling stations for public transit vehicles and City and private vehicles.	
Glenn	Willows	2000	Community Vision Action Plan	No	No	No	No		Recommend adding EVCS language in recently updated multi-family residential guidelines
Humboldt	County	2012	General Plan Update	Yes	Yes	No	Yes	**E-P4:** Transportation Energy Conservation and Alternative Fuels Substitution. Support revitalization and infilling of Urban Development Areas to reduce long-term vehicle miles traveled as an energy conservation strategy. Support the development and implementation of Electric Vehicle (EV) charging stations to encourage substitution of alternative fuels for plug in electrical sources. **E-P5:** Recognize the Redwood Coast Energy Authority (RCEA) as the regional energy authority, which will foster, coordinate, and facilitate countywide strategic energy planning, implementation and education through a Comprehensive Action Plan for Energy. **E-P7:** County Government Energy Consumption. The County government shall reduce building and transportation energy consumption by implementing energy conservation measures and purchasing renewable energy and energy efficient equipment and vehicles whenever cost-effective. Conservation and renewable energy investments should be planned and implemented in accordance with and performance-based action plan and County Greenhouse Gas Emission Reduction goals. **E-P10:** Transportation Management Plans. Major commercial, business, industrial, or mixed-use facility developments shall be required to submit a transportation management plan that addresses energy conservation measures such as connectivity to alternative transportation modes; preferential parking for carpools, vanpools, motorcycles, mopeds, and bicycles; shuttle services; alternative fueling stations; transit passes; bike lockers; and locker-room facilities. **AQ-P10:** County Government Greenhouse Gas Emission Reductions. To lead by example, the County of Humboldt shall reduce its 2003 greenhouse gas emissions from governmental operations consistent with the state Global Warming Solutions Act and subsequent implementing legislation and regulations **AQ-P14:** Electric Vehicle Accommodations. Encourage and provide incentives for commercial and residential design that supports the charging of electric vehicles. **AQ-IM4:** County Government Greenhouse Gas Emission Reductions. The County shall prepare a Climate Action Plan for its governmental operations consistent with the Countywide Climate Action Plan that seeks emission reductions in the following areas: E. Renewable Energy and Low-Carbon Fuels F. Efficient Transportation	

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

List of Planning Documents in North Coast and Upstate Counties That Include Alternative Transportation (as of July, 2016)

County	Agency	Date	Planning Document / Ordinance	GHG Reduction Goals-	Mention of Alternative Fuels as strategy?	Energy Security / Independence	Criteria pollutant emissions reduction goals	Text	Notes
Humboldt	County	2014	Regional Transportation Plan		Yes			**PT-11**: Support the transition to alternative fuels for transit fleet.	
Humboldt	County	2012	Comprehensive Action Plan for Energy	Yes	Yes	Yes	No	-> Vehicle Fleets: Encourage local government and private fleets to maximize the use of high-efficiency vehicles and alternative fuels." -> Alternative Fuels: Encourage when appropriate the use of alternative fuels that will reduce greenhouse gas emissions, which may include hydrogen, biodiesel, ethanol and natural gas.	Not usable for CEQA streamlining
Humboldt	Arcata	2008	General Plan	Yes	Yes	Yes	Yes	**RC-8a**: Encouragement of appropriate energy alternatives. In making energy purchases, the City shall consider how suppliers meet the objectives of this policy. The City shall choose suppliers that provide good tradeoffs among these objectives, giving due consideration to investment in energy conservation as an alternative use of energy funds. In addition, the City shall attempt to purchase at least 10% of its electrical energy (in energy units, not cost) from renewable sources within Humboldt County by the year 2020. The City shall take measures to encourage the availability to, and use by, residents of energy suppliers that best meet the objectives of this policy. The City shall convert City vehicle fleets to a mix of fuels that best meets the objectives of this policy **RC-8c**: Promotion of energy efficiency in transportation. The City shall give strong consideration to energy conservation and the goals of this policy in all transportation and traffic management decisions. It is City policy to reduce the need for motor vehicle trips within the city and between the city and other destinations, and to reduce per-trip energy consumption; this policy applies to trips by residents, non-residents, and city staff. Such measures as bike and pedestrian paths, public transportation, parking and traffic management, and encouraging use of alternative-fueled vehicles shall be used to make these reductions.	
Humboldt	Arcata	2006	Greenhouse Gas Reduction Plan	Yes	Yes	Yes	Yes	**Goal C-1**: "Incorporate energy and climate policy into the city's transportation plan and encourage policies at all levels for efficient and non-polluting transportation." **Goal C-4**: "Improve Mass Transit Infrastructure: ... Purchase more energy efficient transit buses that run on less fuel..." **Goal C-6**: "For both health and environmental reasons, the City should promote ... alternatively fueled vehicles. ..." **Goal C-7**: "Green the City Fleet. Use fuels or energy sources which emit fewer greenhouse gases, such as electricity or natural gas. Create a purchasing policy for acquiring new City vehicles that are more fuel efficient such as hybrids. The City should purchase a variety of vehicles, such as bicycles, electric bicycles, small electric vehicles, and energy efficient automobiles, and should institute policies that require that the most energy-efficient vehicle be used for each City purpose."	Not usable for CEQA streamlining
Humboldt	Blue Lake	2014	Climate Action Plan - Draft	Yes	Yes	Yes	Yes	**LG.3**: "Purchase alternative fuel and/or hybrid vehicles to replace current fleet vehicles." **AT1.a**: "Public education and promotion of low-carbon transportation options, including alternative fuels." **AT3.a**: "Support the installation of EV charging stations."	Not usable for CEQA streamlining
Humboldt	Fortuna	2010	General Plan	Yes	Yes			**HS-3.6**: Greenhouse Gas Emissions Reduction from Transportation. Increase clean-fuel use, promote transit-oriented development and alternative modes of transportation, andreduce travel demand. **LU-1.10** Technological Change. The City shall monitor technological advances — such as, electric vehicle use increases, and new communications systems (e.g., cable and wireless access) in order to plan for changes that may effect land use.	
Humboldt	Trinidad		Climate Action Plan - Draft	Yes	No	No	Yes		Not usable for CEQA streamlining
Mendocino	County Govt.	2016	Feasibility Report for Plug-In Electric Vehicle Charging Stations in Mendocino County	Yes	Yes	No	No	Not yet available	
Mendocino	County Govt.	2013	Mendocino County ZEV Regional Readiness Plan	Yes	Yes	No	No		
Mendocino	MCOG	2011	Regional Transportation Plan	Yes	Yes	no	No	MCOG has a history of supporting and remains committed to AFVs in transit vehicles, but no direct goals stated on their GHG emissions.	They have a ZEV readiness Plan (2013)

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

List of Planning Documents in North Coast and Upstate Counties That Include Alternative Transportation (as of July, 2016)

County	Agency	Date	Planning Document / Ordinance	GHG Reduction Goals-	Mention of Alternative Fuels as strategy?	Energy Security / Independence	Criteria pollutant emissions reduction goals	Text	Notes
Mendocino	County Govt.	2009	General Plan	Yes	Yes	Yes	Yes, from heating sources	**Policy RM-45**: Encourage the use of alternative fuels, energy sources and advanced technologies that result in fewer airborne pollutants. **Policy DE-64**: Promote and encourage environmentally sound industries and practices that achieve or promote General Plan objectives. **Action Item DE-64.1**: Create incentive programs to attract or expand progressive, environmentally sound businesses and industries. **Action Item DE-64.2**: Investigate state and national programs and funding sources that can promote and create sustainable "green" business practices. **Policy DE-66**: Promote activities (such as waste-to-energy) that process, use, recycle or reduce locally generated wastes or materials. **Policy DE-67**: New and expanding industries should incorporate clean technology to the extent possible, and existing industries should work toward this objective.	Because Mendocino County is primarily rural, the amount of greenhouse gases generated by human activities (primarily the burning of fossil fuels for vehicles, heating, and other uses) is small in total compared to other, more urban counties (although higher per capita due to the distances involved in traveling around the county) and miniscule in statewide or global terms.
Mendocino	Ukiah	2004	Ukiah General Plan	Yes	Yes	Yes	Yes	**Goal EG-2:** Improve the efficiency of energy use within the private transportation system. o Policy EG-2.1: Encourage the use of alternatively powered vehicles. **Goal EG-3:** Improve the efficiency of energy use within the City's and County's vehicle fleet. **Policy EG-3.1**: The City and County shall serve as models for programs to operate fleet vehicles at maximum fuel efficiency **Goal OC-37**: Support prgrams that reduce PM10 emissions	
Mendocino	Ukiah	2012	Climate Action Plan	Yes	Yes	Yes	No	**Action TL-3.1a**: Participate in City-wide marketing efforts for Clean Air Days, Bike-to-Work Days, Sunday Streets/Car-Free Sundays, etc. **Action TL-3.1b**: Consider setting aside funding and/or pursuing grant funding to replace the City fleet vehicles with additional electric, hybrid-electric, and alternative fuel vehicles.	
Mendocino	Fort Bragg	2012	Climate Action Plan	Yes	Yes	Yes		**3.** Expand transportation alternatives by encouraging an alternative fueling station, coordinating with the Regional Blueprint Planning effort to improve transportation choices and reduce GHGs.	
Shasta	County	2004	General Plan - Energy Element	Discusses GHGs and state policies, but no explicit GHG reduction goals	Yes	Yes	No	**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.	
Shasta	County	2012	Climate Action Plan Draft	Yes	No	No	No		
Shasta	Anderson	2007	General Plan	No	No	No	No		
Shasta	Redding	2000	General Plan - Air Quality Element	Discusses GHGs and state policies, but no explicit GHG reduction goals	Yes		Yes	**Policy 13:** New Transportation Technology - 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 the technology when it is available; and where reasonable, the City will pursue the development of joint-venture projects involving new technology. **Policy 15:** Replacement of Conventional Fuel Vehicles - 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. **F: Level B Measures, Item 4** - Convert fleet vehicles to clean-burning fuel as appropriate.	
Shasta	Shasta Lake	1999	General Plan	No	Yes	No	Yes	**E-(4)**: Evaluate converting city-owned vehicles to alternative fuels within a specified period of time, subject to budget consideration, to reduce energy consumption. **E-(5)**: Amend the zoning ordinance to permit alternative fuel/recharging facilities in Commercial, Industrial, and Industrial Light districts subject to appropriate standards.	
Siskiyou	County	March, 1993	General Plan - Energy Element	No	Yes	Yes	Mentioned in passing	**Potential Transportation Efficiency Measure:** Alternative fueled/powered vehicles **Significant Issue 1:** Transportation fuels can be diversified through the introduction of alternative fuels such as methanol and electric-powered vehicles. **Policy 20:** Energy efficiency shall be included as a selection criteria in all future County purchases of energy-consuming equipment and vehicles. **Implementation Measure N:** In recognition of new federal legislation requiring federal government purchase of clean-fuel vehicles, and inasmuch as the Forest Service operates the largest public vehicle fleet in the County, the County shall seek a joint clean-fuel demonstration project with the Forest Service to create the basis for wider availability of clean fuels in the County.	Mentions that no alternative fuel infrastructure exists (1993), and that the future may show a meaningful penetration of alternative fuel vehicles **Policy 4:** At least every five years, the County Planning Department shall update the Energy Element to reflect changing energy conditions and determine any need for additional Energy Element provisions.
Siskiyou	County	2008	Strategic Plan	Yes, but no policy commitment	No	Mentioned, but no explicit policy or action	Yes	**F-6 Strategy**: Help develop County policy with regard to climate change and greenhouse gases. Assist in the development of database to help inform County action relative to AB 32, such as carbon sequestration and ghg emissions from wildfires. Also, promote and sustainan RE and EE	

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

List of Planning Documents in North Coast and Upstate Counties That Include Alternative Transportation (as of July, 2016)

County	Agency	Date	Planning Document / Ordinance	GHG Reduction Goals-	Mention of Alternative Fuels as strategy?	Energy Security / Independence	Criteria pollutant emissions reduction goals	Text	Notes
Siskiyou	Weed	2009	General Plan	No	No	No	No		2016 draft update **addresses GHGs. 5.3.5 - Conservation:** The Preferred Growth Scenario focuses on increasing green energy production in the City to reduce dependence on fossil fuels and take advantage of associated cost savings from local power generation. The Plan also aims to implement policies that streamline the permitting system and incentivize residents and visitors to incorporate renewable energy technology into buildings. Increased infrastructure for alternative energy vehicles, such as electric or hydrogen-powered vehicles can promote lowemission vehicle usage in the City. **AQ 1.2.1:** The City shall meet California State greenhouse gas emission reduction goals as established by AB 32 and SB 375. **AQ 1.2.4:** The City shall streamline permit process for electric vehicle chargers. **AQ 1.2.5:** The City shall promote the use of low-emission vehicles, such as electricpowered, hydrogen-powered, or hybrid vehicles.
Siskiyou	Mount Shasta	2016	General Plan	Yes	Yes	No	No	**Open Space and Conservation - Policy 10:** Encourage the use of renewable energy and alternative fuel vehicles. Take active steps towards increasing alternative fuel vehicles in the City's fleet.	
Tehama	County	2009	General Plan - Open Spaces, Air Quality Element	Yes	Yes		Yes	**Table 6-1:** Air Quality Impact Mitigations **OS-2.5(d):** Request that the Tehama County Air Pollution Control District develop Indirect Source Guidelines for the potential air emissions from future development. Require to the extent practical and applicable that all new development adhere to the District Indirect Source Guidelines to mitigate air quality and greenhouse gas impacts. **OS-2.6(g):** Support vehicle improvements and the use of clean vehicles that reduce emissions and improve air quality. **OS-2.6(h):** Replace the County's fleet vehicles with new vehicles that utilize the lowest emission technology available, whenever economically feasible. **OS-2.6(j):** Encourage lowest emission technology buses and vehicles in public transit fleets.	
Tehama	County	2015	Climate Action Plan	Yes	Yes			**AF-1:** Expand the use of alternative and clean fuels (Note this says "Update zoning provisions to encourage alternative fuel stations.")	
Tehama	Red Bluff	2002	General Plan	No	No	No	Yes (Ozone and PM10 specifically)	**Natural Resources Element:** Encourage activities that decrease vehicular emissions, including; the safe use of bicycles, carpooling and mass transit.	
Multiple	Siskiyou County Economic Development Council	2015	Plug-In Electric Vehicle Readiness Plan	Yes	Yes	Yes	No		
Multiple	Redwood Coast Energy Authority	2014	Plug-In Electric Vehicle Readiness Plan	Yes	Yes	Yes	No		

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Governor's Office of Planning and Research (OPR) Zoning Example

Zoning Example for Installation of Plug-In Electric Vehicle Charging Stations

Snapshot: The goal of zoning for plug-in electric vehicles charging stations should be to ensure that charging is an allowed land use in as many types of zoning districts as possible, as either an accessory or a principal use. A template for zoning electric vehicle charging stations is provided. This template is adopted from City of Lancaster's Municipal Code.

Zoning Template

(A) An electric vehicle charging station (EVCS) shall be allowed within any legal single-family or multiple-family residential garage or carport subject to all applicable city code requirements in addition to the following.
- (1) The EVCS shall be protected as necessary to prevent damage by automobiles
- (2) The EVCS shall be designed to:
  - (a) Be safe for use during inclement weather
  - (b) Be tamper-resistant to prevent injury particularly to children
  - (c) Be resistant to potential damage by vandalism
  - (d) Be equipped with a mechanism to prevent the theft of electricity by an unauthorized user
- (3) The EVCS shall have complete instructions and appropriate warnings posted in an unobstructed location next to each EVCS

(B) An EVCS shall be permitted as an accessory use within any existing legal single-family or multiple-family residential garage or carport, or within any existing legal commercial parking space in a parking lot or in a parking garage, subject to all applicable city code requirements and the following.
- (1) EVCS for public use shall be subject to the following requirements:
  - (a) The EVCSs shall be located in a manner that will be easily seen by the public for informational and security purposes and shall be illuminated during evening business hours
  - (b) Be located in desirable and convenient parking locations that will serve as an incentive for the use of electric vehicles
  - (c) The EVCS pedestals shall be protected as necessary to prevent damage by automobiles
  - (d) The EVCS pedestals shall be designed to minimize potential damage by vandalism and to be safe for use in inclement weather
  - (e) Complete instructions and appropriate warnings concerning the use of the EVCS shall be posted on a sign in a prominent location on each station for use by the operator
  - (f) One standard nonilluminated sign, not to exceed 4 square feet in area and 10 feet in height, may be posted for the purpose of identifying the location of each cluster of EVCSs
  - (g) The EVCS may be on a timer that limits the use of the station to the normal business hours of the use(s) that it serves to preclude unauthorized use after business hours
- (2) Electric vehicle charging stations for private use shall:

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

(a) Be located in a manner that will not allow public access to the charging station

(b) Comply with subsections (B)(1)(c) and (B)(1)(d) of this section

(c) Electric vehicle charging stations for private use not located in a single-family residential garage or carport must also comply with subsection (B)(1)(e) of this section.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

City of Chelan EVCS Zoning Code

Chapter 17.63
ELECTRIC VEHICLE CHARGING STATIONS

Sections:

17.63.010 Purpose.

The purpose of this chapter is to ensure the effective installation of electric vehicle charging stations. Where any other provisions of the Chelan Municipal Code directly conflict with this chapter, this chapter shall control. (Ord. 1425 § 3 (part), 2011).

17.63.020 Designation of electric vehicle charging stations.

An electric vehicle charging station is a public or private parking space(s) that is (are) served by battery charging equipment with the purpose of transferring electric energy to a battery or other energy storage device in an electric vehicle and is classified based on the following levels:

A. Level 1 is considered slow charging and operates on a fifteen to twenty amp breaker on a one hundred twenty volt AC circuit.

B. Level 2 is considered medium charging and operated on a forty to one hundred amp breaker on a two hundred eight or two hundred forty volt AC circuit.

C. Level 3 is considered fast or rapid charging and operated on a sixty amp or higher breaker on a four hundred eighty volt or higher three phase circuit with special grounding equipment. Level 3 stations can also be referred to as rapid charging stations that are typically characterized by industrial grade electrical outlets that allow for faster recharging of electric vehicles. (Ord. 1425 § 3 (part), 2011).

17.63.030 Where permitted.

A. Level 1 and 2 electric vehicle charging stations are a permitted use in all zoning districts.

B. Level 3 electric vehicle charging stations are a permitted use in the Warehouse and Industrial (W-I), Highway Service Commercial (C-HS), and Public Lands and Facilities (P) zoning districts, but require a conditional use permit in Downtown Mixed Use (DMU), Tourist Accommodation (T-A), Special Use District (SUD) and Waterfront Commercial (C-W) zoning districts.

C. Battery exchange stations are permitted in the Warehouse and Industrial (W-I), Highway Service Commercial (C-HS), and Public Lands and Facilities (P) zoning districts. (Ord. 1425 § 3 (part), 2011).

17.63.040 Standards for electric vehicle charging stations.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Underwriter Laboratories Summary

Electric Vehicle Charging Systems

Coming to your city soon!

Understanding the applicable UL standards, National Electrical Code requirements and industry terminology will be beneficial to Authorities Having Jurisdiction (AHJ's)that will be tasked to inspect and approve this new electric vehicle charging system equipment.

The National Electrical Code® (NEC®) Article 625 covers the installation of electric vehicle charging systems. Although Article 625 has been in the NEC since the 1996 edition, electrical vehicle charging systems have yet to be widely used or installed. That is about to change: research studies project that approximately 1 million electric vehicles will be on U.S. roads by 2015 and approximately 5 million by 2020. It is expected that there will be at least two electrical vehicle-charging systems installed for every electrical vehicle sold.

There are many reasons for the rapid expansion of electric vehicle charging systems; the U.S. federal governments push to reduce dependency on foreign oil, federal and state tax incentives as well as utility rebates are pushing adoption of plug-in hybrid-electric vehicles and electric vehicles. States and cities also offer additional benefits for owners of electric vehicles such as use of car pool lanes without meeting the occupancy requirement and free parking at city parking meters.

National Electrical Code Requirements

NEC Article 625 contains several sections requiring listing for equipment used to charge plug-in hybrid-electric vehicles and electric vehicles. Some of the key sections include:

- **Section 625.5** — Requires listing of all electrical materials, devices, fittings and associated equipment.
- **Section 625.18** — Requires that EV supply equipment include an interlock that de-energizes an electric vehicle connector and its cable whenever a connector is uncoupled from an electric vehicle.
- **Section 625.19** — Requires that EV supply equipment have a means to automatically de-energize the cable conductors and electric vehicle connector upon exposure to strain that could result in cable rupture or separation of a cable from the electric connector and expose live parts.
- **Section 625.22** — Requires that the electric vehicle supply equipment have a listed system to protect users from electric shock.

UL Listings and Standards

Only those products bearing the appropriate UL Mark together with the word "Listed," a control number and the product name should be considered as being covered by UL's Listing service. The UL Mark provides the evidence of listing as required by the NEC.

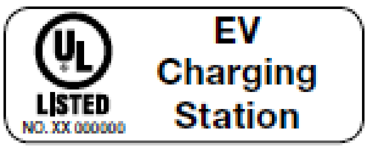
UL Listed EV charging systems have been investigated to a comprehensive set of construction and performance requirements designed to reduce the risk of fire, shock and personal injury. The equipment has also been specifically investigated for installation in accordance with all the safety requirements of NEC Article 625.

For more information visit www.ul.com

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Electric Vehicle Charging Systems (continued)

UL Listed electric vehicle charging equipment is covered by two categories, UL category FFWA (electric vehicle supply equipment) that is evaluated to UL 2594 and UL category FFTG (electric vehicle charging system equipment) that is evaluated to UL 2202. UL category FFWA will cover a majority of the new installations being installed at dwelling and retail type occupancies. Electric vehicle supply equipment typically covered by this category will include level 1 and level 2 charging systems. UL category FFTG will cover the installation of level 3 charging systems, or what industry is calling DC Fast Chargers. It is expected that level 3 charging systems will be installed along major highways that connect metropolitan areas together.



UL Listed Electric Vehicle Supply Equipment (FFWA) provides AC power to an on-board charger that powers an electric vehicle. This type of equipment is identified by one of the following product identities:

- **Electric vehicle cord set or EV cord set** — These devices are typically 120 V up to 16 amperes, and they come in two configurations:
  - — A portable cord set is intended for indoor or outdoor use, is carried from charging location to another, and is transported in the vehicle when not being used.
  - — A stationary cord set is intended for indoor or outdoor use and is intended for installation in a dedicated location used for vehicle charging. A stationary cord set can be routinely moved after installation and it may have provisions for removal from its installation without using a tool.
- **Electric vehicle power outlet or EV power outlet** — These are essentially the same as EV charging stations except that they terminate in a normal NEMA-type receptacle and are intended to be used with an EV power cord set that is then plugged into an EV receptacle inlet.

UL Product Categories correlated to NEC Article 625

2008 NEC Section		UL Category Code	UL Product Category
625.5 625.9 625.13 625.16 625.18	625.19 625.22 625.25 625.29(C) 625.29(D)	FFTG	Electric vehicle charging system equipment (Supplies DC power to the vehicle)
625.5 625.9 625.13 625.16 625.18	625.19 625.22 625.25 625.29(C)	FFWA	Electric vehicle supply equipment (Supplies AC power to the vehicle)

- **Electric vehicle charging station or EV charging station** — These are products that are typically permanently connected.

Ultimately, there are two things to keep in mind when inspecting the installation of electric vehicle charging systems covered by NEC Article 625:

1. The NEC requires this type of equipment to be listed.
2. UL Listed electric vehicle supply equipment (category FFWA) and UL Listed electric vehicle charging system equipment (category FFTG) when installed in accordance with the manufacturers installation instructions will be in compliance with all safety requirements of NEC Article 625.

For more information on either UL category FFWA or FFTG, please go to the Online Certifications Directory, enter the UL category code in the applicable box and search. This will provide a list of all current manufacturers of equipment covered by that specific UL category. To locate information on which models are UL Listed, click on the "link to file" located to the right of each manufacturers name. Finally, once at the link to file page, you can access the applicable UL Guide Information by clicking on the See General Information for Electric Vehicle Supply Equipment link above a manufacturers name and address.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

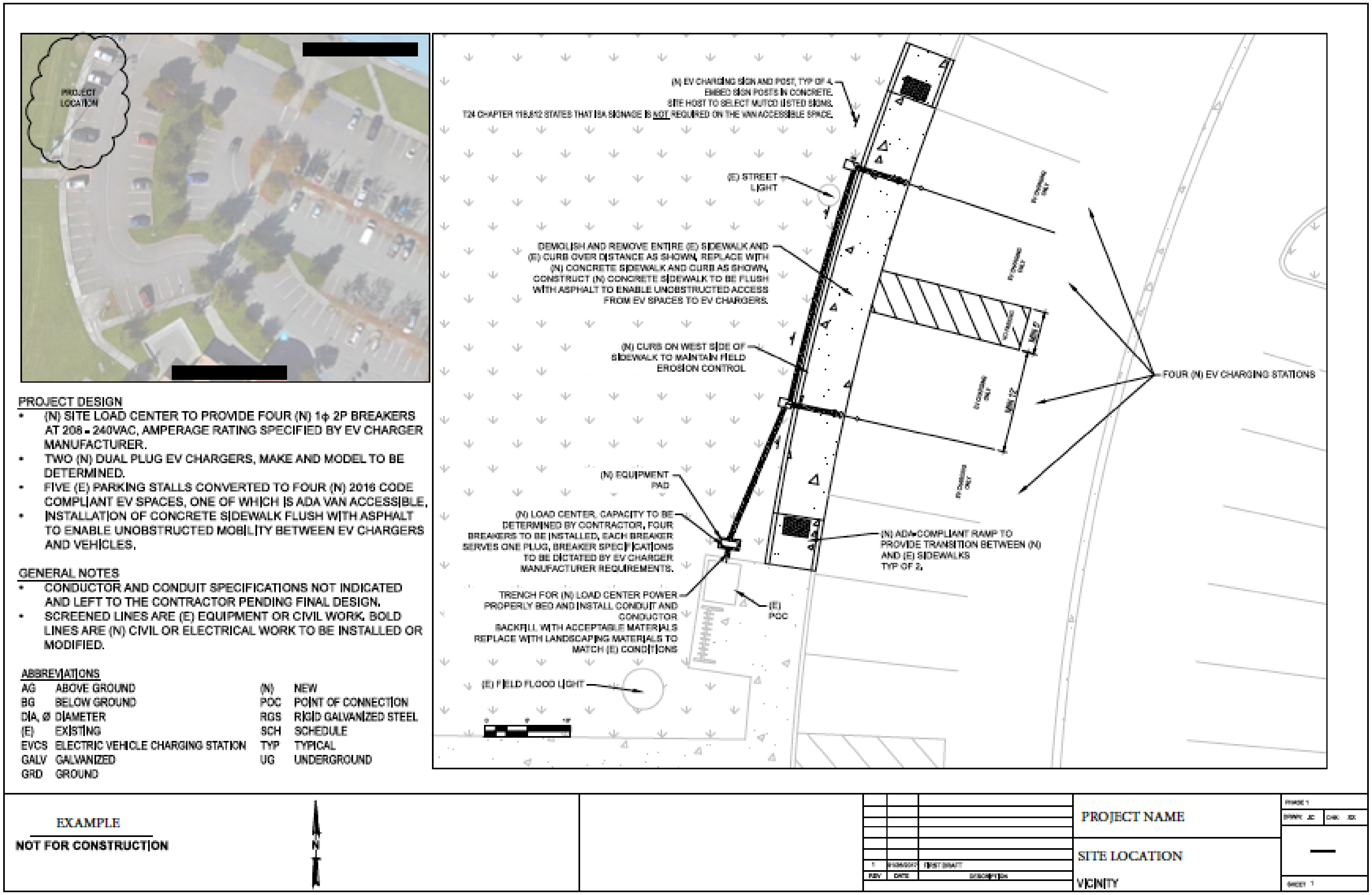


Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

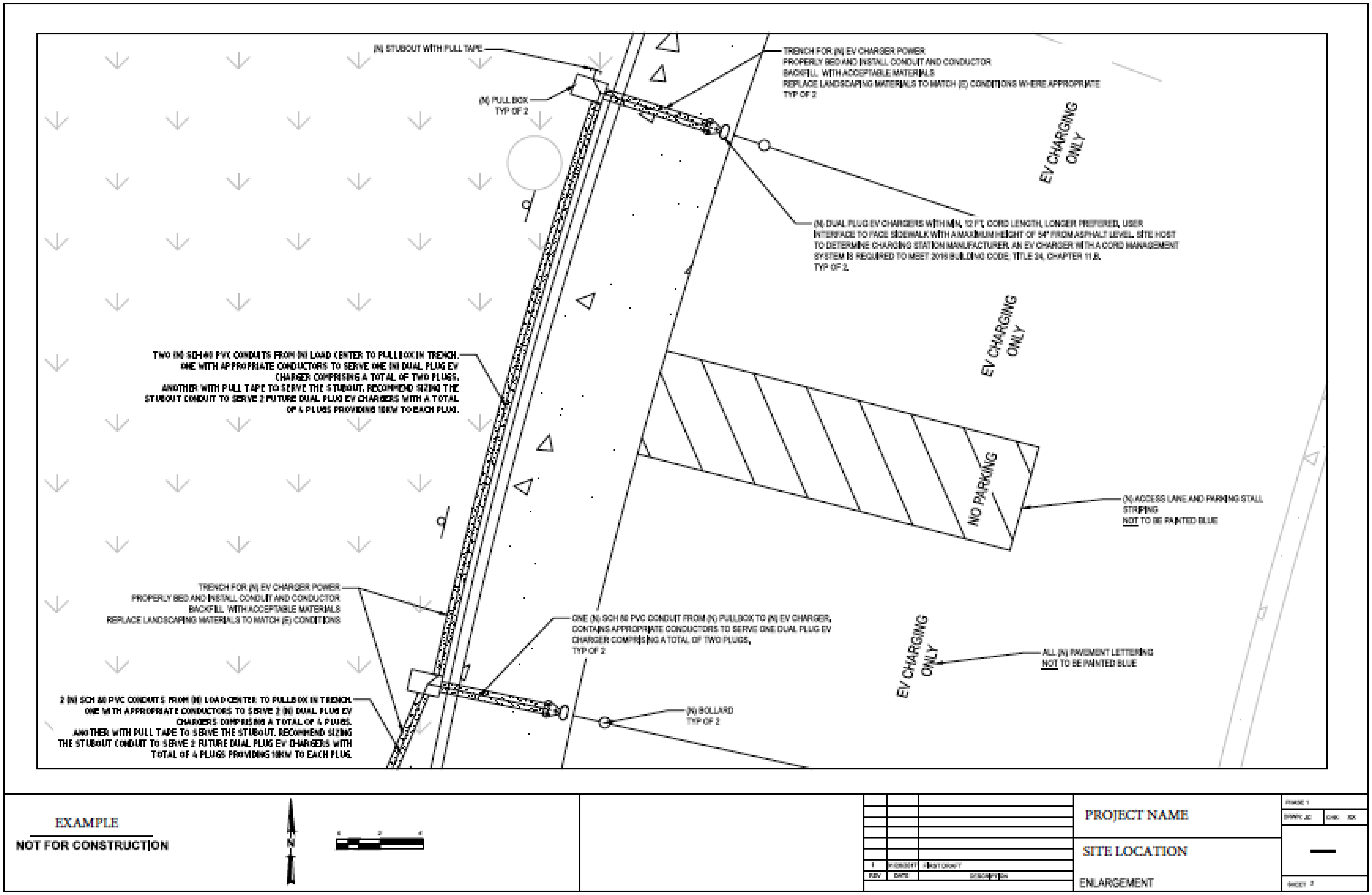


Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

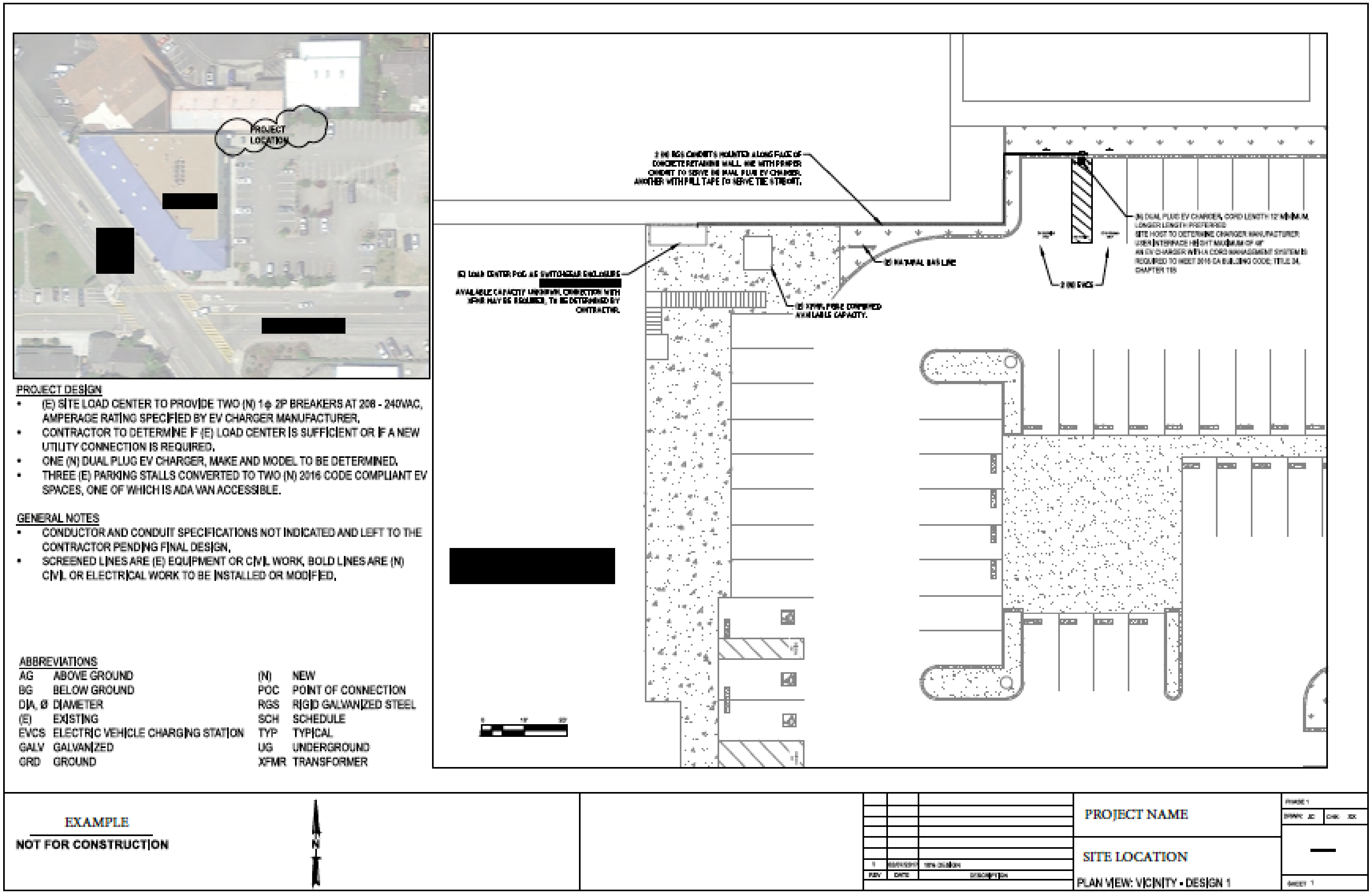


Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

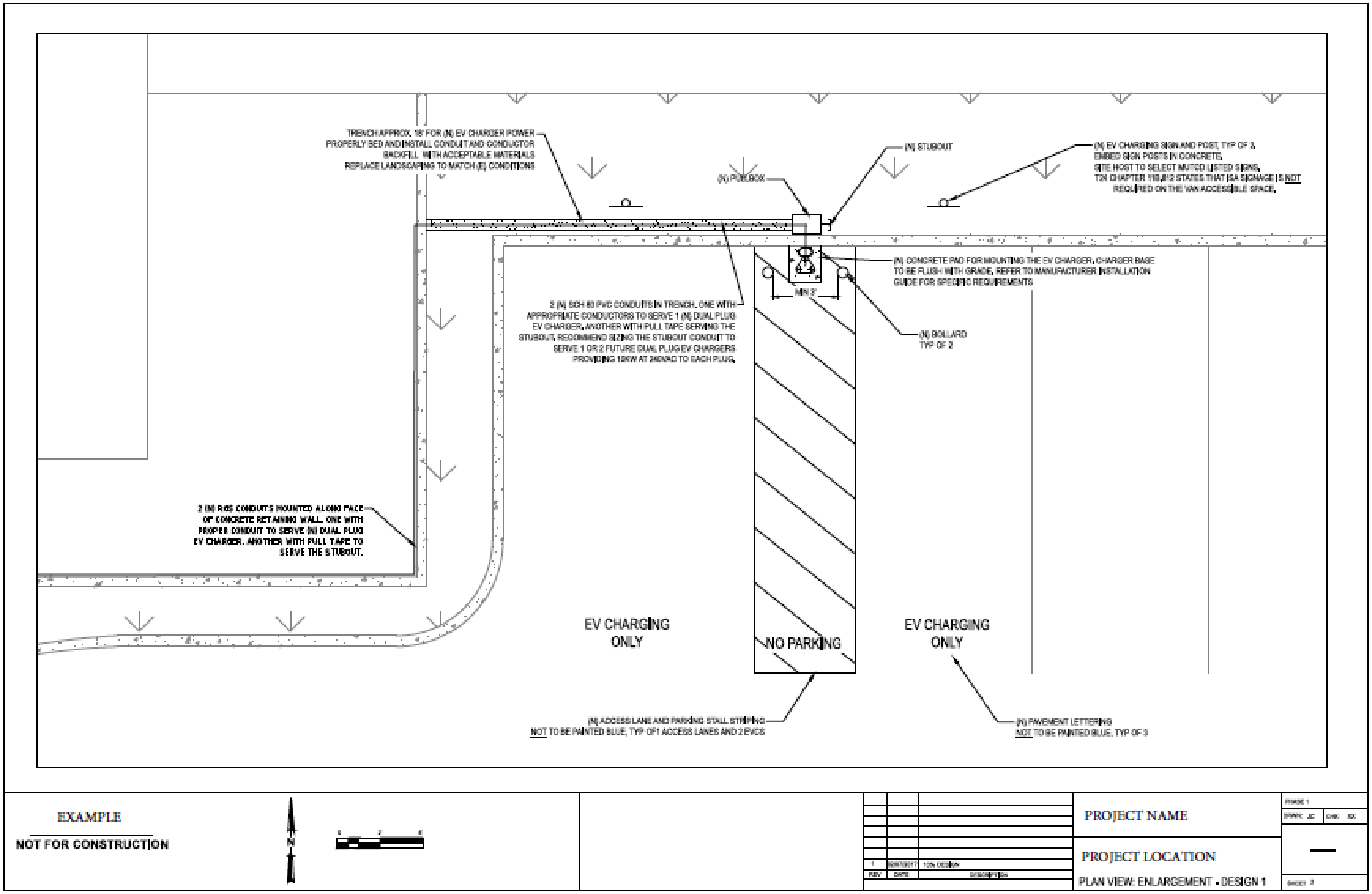


Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA• DEPARTMENT OF TRANSPORTATION
POLICY DIRECTIVE
TR-0011 (REV 9/2006)

Caltrans Policy Directive 13-01

TRAFFIC OPERATIONS POLICY DIRECTIVE	NUMBER: 13-01	PAGE: 1 of 17
DENNIS T. AGAR DIVISION CHIEF (Signature) Dennis T. Agar	DATE ISSUED: March 14, 2013	EFFECTIVE DATE: March 14, 2013
SUBJECT: **Zero Emission Vehicle Signs and Pavement Markings**	DISTRIBUTION ☒ All District Directors ☒ All Deputy District Directors - Traffic Operations ☒ All Deputy District Directors - Maintenance ☒ All Deputy District Directors - Construction ☒ All Deputy District Directors - Design ☒ All Deputy District Directors - Transportation Planning ☐ Chief, Division of Engineering Services ☐ Chief Counsel, Legal Division ☒ Publications (California MUTCD Website) www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd.htm ☒ Headquarters Division Chiefs for: Construction, Maintenance, Design, Public Affairs, and, Transportation Planning	
DOES THIS DIRECTIVE AFFECT OR SUPERSEDE ANOTHER DOCUMENT? ☐YES ☒NO	IF YES, DESCRIBE	
WILL THIS DIRECTIVE BE INCORPORATED IN THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES ☒YES ☐NO	IF YES, DESCRIBE Adopt new sign and markings policy language in sections 2B.46, 2I.03, and 3B.20 of the CA MUTCD	

DIRECTIVE

The Governor's Executive Order B-16-2012, dated March 23, 2012, requires all State entities under the governor's direction and control to support and facilitate the rapid commercialization of zero-emission vehicles (ZEV's). The California Department of Transportation (Caltrans), after consulting with local agencies, the public, and the Governor's Office of Planning and Research will amend the *California Manual on Uniform Traffic Control Devices* (CA MUTCD). Changes include six new signs, one new header plaque, two new optional pavement markings, deleting two existing signs, and updating content in various sections, figures and tables of the CA MUTCD. These policy and specification updates provide regulatory and general information signs and pavement markings to guide and regulate road users who operate ZEV's. The purpose of this directive is to implement Governor's Executive Order B-16-2012, update existing administrative law, and to provide detailed specifications for uniform use by State and local government agencies, as well as use by private entities at facilities open to public travel.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

POLICY DIRECTIVE

TR-0011 (REV 9/2006) Page 2 of 17

DIRECTIVE (continued)

Pursuant to the authority granted to Caltrans in section 21400 and 21401 of the California Vehicle Code (CVC), the following new signs and pavement markings shall be included (or deleted) in Parts 2 and 3 of the CA MUTCD, dated January 13, 2012.

California Code	MUTCD Code	Title of the sign, plaque or pavement markings	CA MUTCD Section
R112(CA)	None	Electric Vehicle Charging Station Tow-Away	2B.46
R113(CA)	None	No Parking EXCEPT FOR EV CHARGING	2B.46
R113A(CA)	None	No Parking EXCEPT FOR ELECTRIC VEHICLE CHARGING	2B.46
R114(CA)	None	HOUR EV CHARGING - AM TO PM	2B.46
R114A(CA)	None	__HOUR ELECTRIC VEHICLE CHARGING - __AM TO PM	2B.46
G66-21B(CA)	None	Electric Vehicle Charging Station symbol	2I.03
G66-21C(CA)	None	FAST Electric Vehicle Charging Station (header plaque)	2I.03
None	D9-11b	(DELETED) Electric Vehicle Charging	2I.02
None	D9-11bP	(DELETED) ELECTRIC VEHICLE CHARGING (plaque)	2I.02
Figure 3B-108(CA)	None	Electric Vehicle Charging Station Pavement Marking Details (optional for 12" and 6" high word messages)	3B.20

IMPLEMENTATION

In this section, for purposes of clarity, italic text is used to denote text that is being added to the CA MUTCD. All other formatting as defined under the Definitions section of this Policy Directive is still applicable.

The following policies shall be included in the CA MUTCD, as follows:

Section 2B.46 Parking, Standing, and Stopping Signs (R7 and R8 Series)
Electric Vehicle Charging Station Signs
Standard:
84 ***If used, the Electric Vehicle Charging Station Tow-Away (R112(CA)) sign shall be placed immediately adjacent to, and visible from, the charging station stall or space, or at each entrance to an off-street parking facility to inform motorists that their vehicles will be towed away if parked in designated stalls or spaces without being connected for electric charging purposes. The sign shall include the address where the towed vehicle can be reclaimed and the telephone number of the local traffic law enforcement agency. Refer to CVC 22511.***
Option:
85 *Local agencies may, at their discretion, include CVC Section 22511 or local municipal code section, or ordinance number on the Electric Vehicle Charging Station Tow-Away R112(CA) sign.*

ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 653-3657 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

POLICY DIRECTIVE

TR-0011 (REV 9/2006) Page 3 of 17

IMPLEMENTATION (continued)

Section 2B.46 Parking, Standing, and Stopping Signs (R7 and R8 Series)
Electric Vehicle Charging Station Signs
Standard:

86 ***If used, the No Parking (symbol) EXCEPT FOR EV CHARGING (R113(CA)), or the No Parking (symbol) EXCEPT FOR ELECTRIC VEHICLE CHARGING (R113A(CA) sign shall be placed immediately adjacent to, and visible from, each charging station stall or space.***

87 ***If used, the __HOUR EV CHARGING __AM TO __PM (R114(CA)), or the __HOUR ELECTRIC VEHICLE CHARGING __AM TO __PM (R114A(CA)) sign shall be placed immediately adjacent to, and visible from, each charging station stall or space to identify the allowable time limit where electric vehicles may be connected, depending upon what time limitations for charging apply to each charging station.***

Section 2I.03 Section 2I.03 General Service Signs for Freeways and Expressways
Electric Vehicle Charging Station Signs (G66-21(CA), *G66-21A(CA), G66-21B(CA), G66-21C(CA)*)
Guidance:

34 To avoid misleading the road user, those services that are more than 0.5 mile from the access point on the major route to the service, should have a *Distance with Arrow (G66-21A(CA))* plaque installed below the service sign.

Option: (in Paragraph 41, subpart #13)

13. Where hydrogen (*HYD*) fuel is available, the Hydrogen (G66-22G(CA)) symbol sign and HYDROGEN (G66-22H(CA)) supplemental plaque may be used *within 3 miles of a State highway and be available to the public at least 16 hours a day*, in addition to the other appropriate signs.

Option:

43 The *Electric Vehicle Charging Station (G66-21B(CA) symbol sign, or the* ELECTRIC VEHICLE CHARGING STATION (G66-21(CA)) sign may be used for Electric Vehicle Charging Stations within 3 miles of a State highway and be available to the public at least 16 hours a day.

Standard:

44 **Follow-up signing, if necessary, shall be placed by local agencies before signs are placed on the State highway.**

Option:

45 The Distance with Arrow (G66-21A(CA)) plaque may be used to supplement the G66-21(CA), *or G66-21B(CA)* sign to provide distance and directional information to the motorist. *It may also be used with other general service signs (See Paragraph 34).*

45a *The FAST (G66-21C(CA)) header plaque may be used to supplement the G66-21(CA), or G66-21B(CA) sign to indicate that a Fast Electric Vehicle Charging Station is located off the State highway.*

Support:

45b *A Fast Electric Vehicle Charging Station is where the rate of battery electric charging is at least 20 kWh in a 30-minute period. Fast charging stations include direct current (DC) fast charging and battery switching.*

ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 653-3657 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS89, Sacramento, CA 95814.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA• DEPARTMENT OF TRANSPORTATION

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IMPLEMENTATION (continued)

Section 3B.20 Pavement Word, Symbol, and Arrow Markings
Electric Vehicle Charging Station Markings
Option:

18 Electric vehicle charging stations in off-street locations may be marked with white EV CHARGING ONLY, or ELECTRIC VEHICLE CHARGING ONLY pavement markings (See details in Figure 3B-108(CA)) to supplement Electric Vehicle Charging Station signs in Section 2B.46 and 2I.03.

For regulatory sign thumbnail graphics and sign codes added to Figure 2B-24(CA), and new entries to Table 2B-1(CA), see Attachment #1. For pavement markings Figure 3B.108(CA), see attachments #10 and #11.

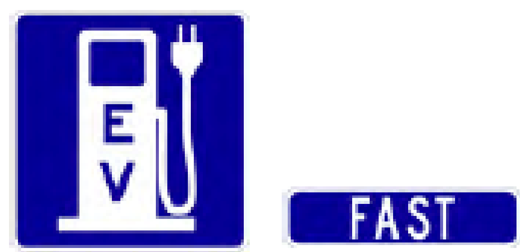
The proposed changes will require deletion of two existing national MUTCD signs, shown in Figure 2I-1 and in Table 2I-1. Currently there is no existing policy language for these two signs. Figure 2I-1(CA) will be edited to include G66-21B(CA) and G66-21C(CA) thumbnail graphics and new sign codes, and Table 2I-1(CA) will be amended to include the following new entries:

Figure 2I-1. General Service Signs and Plaques

D9-11b
Electric Vehicle
Charging

D9-11bP
Electric Vehicle
Charging

Figure 2I-1 (CA). General Service Signs and Plaques



G66-21B(CA)

G66-21C(CA)

Table 2I-1. General Service Sign and Plaque Sizes (Sheet 1 of 2)

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway
~~Electric Vehicle Charging~~	~~D9-11b~~	~~2I.02~~	~~24 x 24~~	~~30 x 30~~
~~Electric Vehicle Charging (plaque)~~	~~D9-11bP~~	~~2I.02~~	~~24 x 18~~	~~30 x 24~~

Table 2I-1 (CA). California General Service Sign and Plaque Sizes

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway
Electric Vehicle Charging Station	G66-21B(CA)	2I.03	24 x 24	30 x 30
FAST (header plaque)	G66-21C(CA)	2I.03	24 x 6	30 x 8

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Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

DELEGATION

No new delegations of authority are created under this policy.

BACKGROUND

The revision of existing signs and inclusion of new signs and markings in the CA MUTCD is a common practice based upon need. Caltrans, pursuant to CVC Section 21400; must conduct public hearings before it can revise existing policies for traffic control devices and approve new signs for use on public roadways. The California Traffic Control Devices Committee (CTCDC) is the forum used to satisfy this requirement.

Governor Brown's Executive Order B-16-2012, dated March 23, 2012, found on the Web address, at <http://gov.ca.gov/news.php?id=17463>, per Governor Brown's Executive Order, Caltrans and Sonoma County, consulted with representatives of the public and California cities and counties to establish new sign and pavement marking policy standards, guidance, options, and support for Caltrans to include in the CA MUTCD 2012 edition.

Agenda Item 12-23, Zero Emission Vehicle Signs and Pavement Markings, was presented as an action item to the CTCDC on December 6, 2012 in Santa Cruz, California. Per discussion at the public hearing, the CTCDC recommended adoption of the electric vehicle signs as proposed in the agenda, with minor suggestions. First, make the use of these signs as optional, which means it is up to local agencies whether they want to install signs or not. The sign specification for the Tow-Away sign will list CVC 22511 or local ordinance on the sign. Second, spell out "ELECTRIC VEHICLE" so agencies have the option to use the "Acceptable Abbreviation" EV (per CA MUTCD, Table 1A-1) or ELECTRIC VEHICLE on both regulatory signs and optional pavement markings. The adopted new policy language provides both the abbreviated and spelled-out language on signs and pavement markings.

DEFINITIONS

When used in this Traffic Operations Policy Directive, the text shall be defined as follows:

1) **Standard** – a statement of required, mandatory or specifically prohibited practice. All standards text appears in **bold** type. The verb **shall** is typically used. Standards are sometimes modified by Options.

2) Guidance – a statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate. All Guidance statements text appears in underline type. The verb should is typically used. Guidance statements are sometime modified by Options.

3) Option – a statement of practice that is a permissive condition and carries no requirement or recommendation. Options may contain allowable modifications to a Standard or Guidance. All Option statements text appears in normal type. The verb may is typically used.

4) Support – an informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. Support statements text appears in normal type. The verbs shall, should and may are not used in Support statements.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

ATTACHMENTS

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA• DEPARTMENT OF TRANSPORTATION

POLICY DIRECTIVE

TR-0011 (REV 9/2006) Page 7 of 17

Attachment #1: 2012 CA MUTCD edits to include regulatory sign thumbnail graphics, sign codes & sizes:

Figure 2B-24(CA). Parking and Standing Signs and Plaques (R7 Series)

R112(CA) R113(CA) R113A(CA) R114(CA) R114A(CA)

Table 2B-1(CA). California Regulatory Sign and Plaque Sizes

Sign or Plaque	Sign Designation	Section	Conventional Road: Single Lane	Conventional Road: Multi-Lane	Expressway	Freeway	Minimum	Oversized
Electric Vehicle Charging Station Tow-Away	R112(CA)	2B.46	*	*	-	-	24 x 24	-
No Parking EXCEPT FOR EV CHARGING	R113(CA)	2B.46	*	*	-	-	12 x 18	-
No Parking EXCEPT FOR ELECTRIC VEHICLE CHARGING	R113A(CA)	2B.46	*	*	-	-	12 x 18	-
__HOUR EV CHARGING __AM TO __PM	R114(CA)	2B.46	*	*	-	-	12 x 18	-
__HOUR ELECTRIC VEHICLE CHARGING __AM TO __PM	R114A(CA)	2B.46	*	*	-	-	12 x 21	-

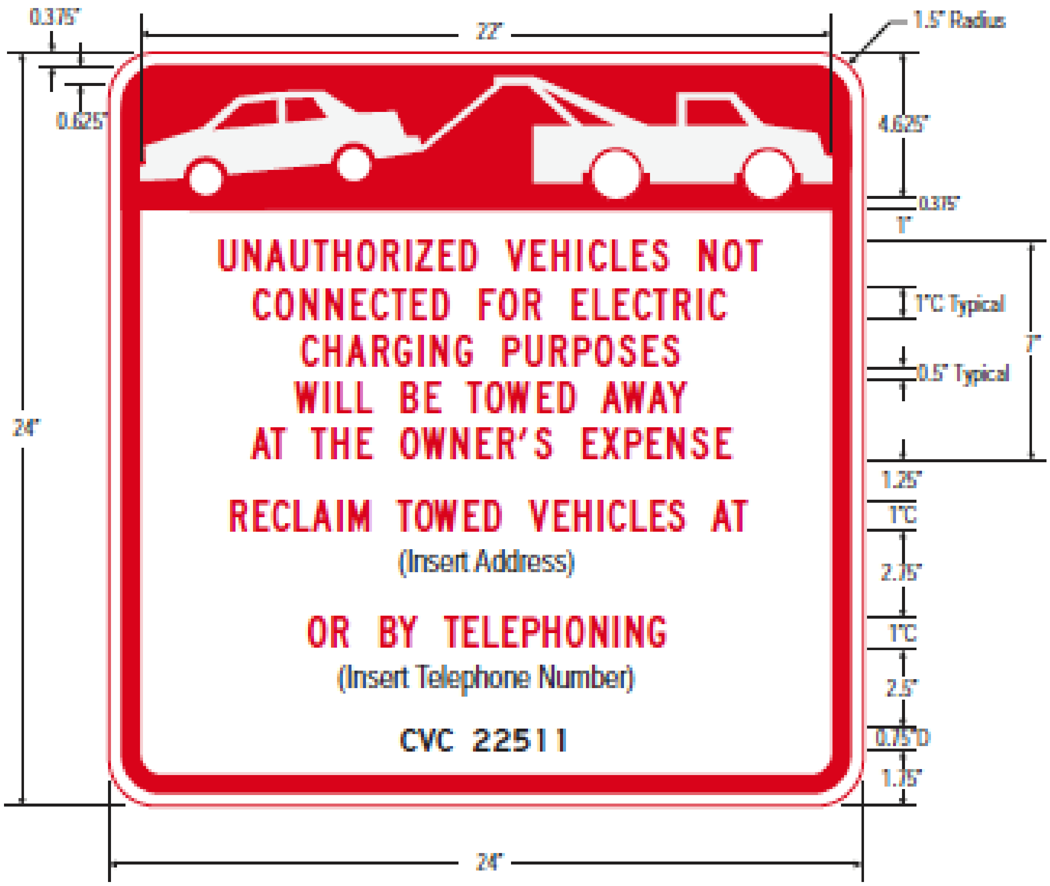
* Note: Electric Vehicle (EV) Charging Station regulatory signs are for off-street EV charging station use, per CVC 22511 and local ordinance.

ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 653-3657 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS89, Sacramento, CA 95814.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Attachment #2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



R112 (CA)

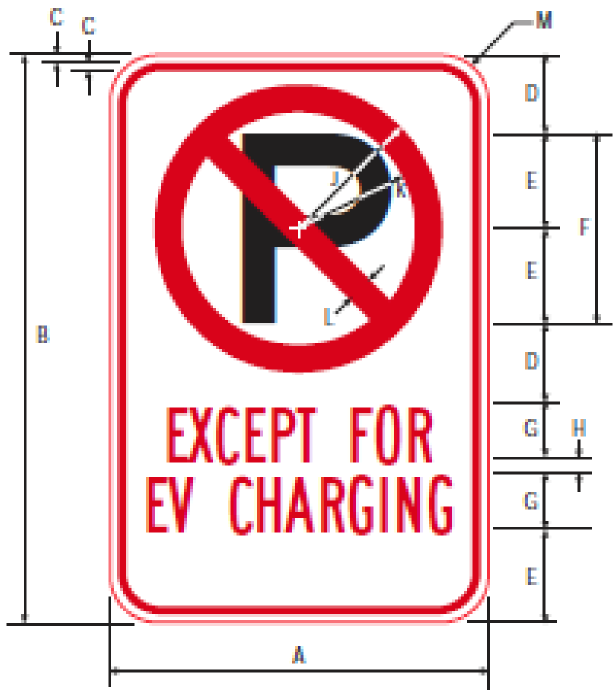
NOTES: Specify address, telephone number, and optional CVC/ordinance information when ordering.
Use R107 GRID (CA) for TOW AWAY symbol.

COLORS: BORDER & LEGEND - RED (RETROREFLECTIVE)
BACKGROUND - WHITE (RETROREFLECTIVE)
ADDRESS, TELEPHONE NUMBER, & OPTIONAL CVC/ORDINANCE LEGEND - BLACK

3/14/13

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



R113 (CA)

ENGLISH UNITS

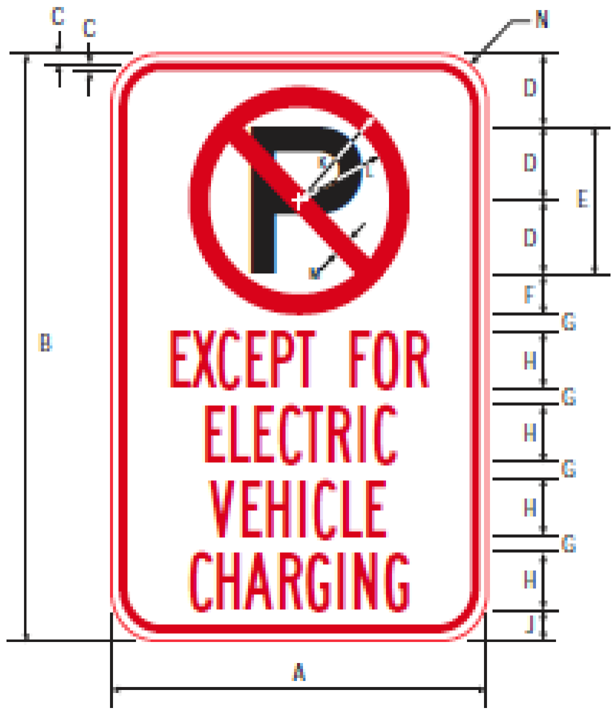
A	B	C	D	E	F	G	H	J	K	L	M
12	18	.25	2.5	3	6E	1.75B	.5	4.5	3.625	.875	1.5

COLORS: BORDER, CIRCLE, DIAGONAL & LEGEND - RED (RETROREFLECTIVE)
LETTER - BLACK
BACKGROUND - WHITE (RETROREFLECTIVE)

3/14/13

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



R113A (CA)

ENGLISH UNITS

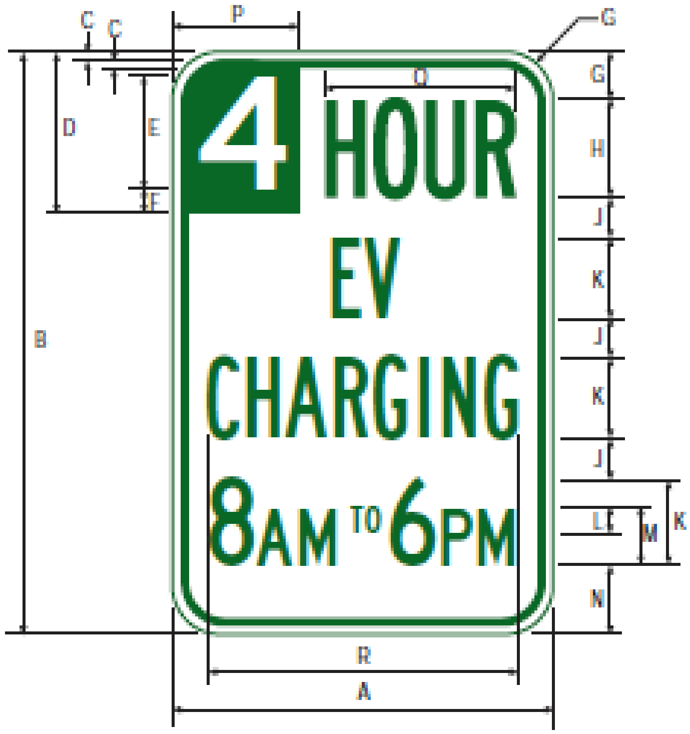
A	B	C	D	E	F	G	H	J	K	L	M	N
12	18	.25	2.25	4.5E	1.25	.5	1.75B	1	3.5	2.875	.625	1.5

COLORS: BORDER, CIRCLE, DIAGONAL & LEGEND - RED (RETROREFLECTIVE)
LETTER - BLACK
BACKGROUND - WHITE (RETROREFLECTIVE)

3/14/13

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



NOTE: Specify number of hours and times when ordering.

R114 (CA)

ENGLISH UNITS

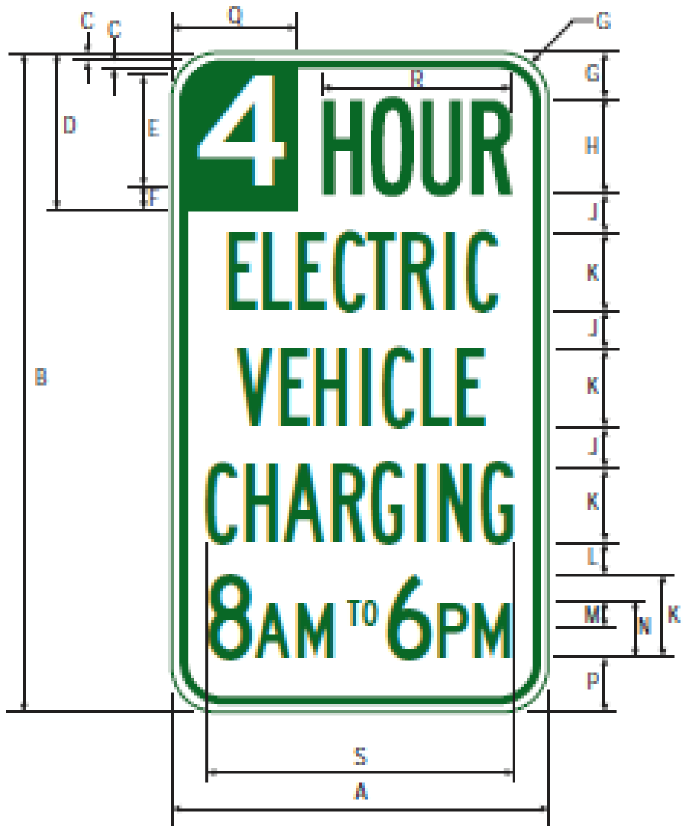
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R
12	18	.25	5	3.5D	.75	1.5	3B	1.25	2.5C	.75C	1.75C	2.25	4	6	9.75

COLORS: BORDER & LEGEND - GREEN (RETROREFLECTIVE)
BACKGROUND - WHITE (RETROREFLECTIVE)

3/14/13

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



NOTE: Specify number of hours and times when ordering.

R114A (CA)

ENGLISH UNITS

A	B	C	D	E	F	G	H	J	K	L	M	N
12	21	.25	5	3.5D	.75	1.5	3B	1.25	2.5C	1	.75C	1.75C

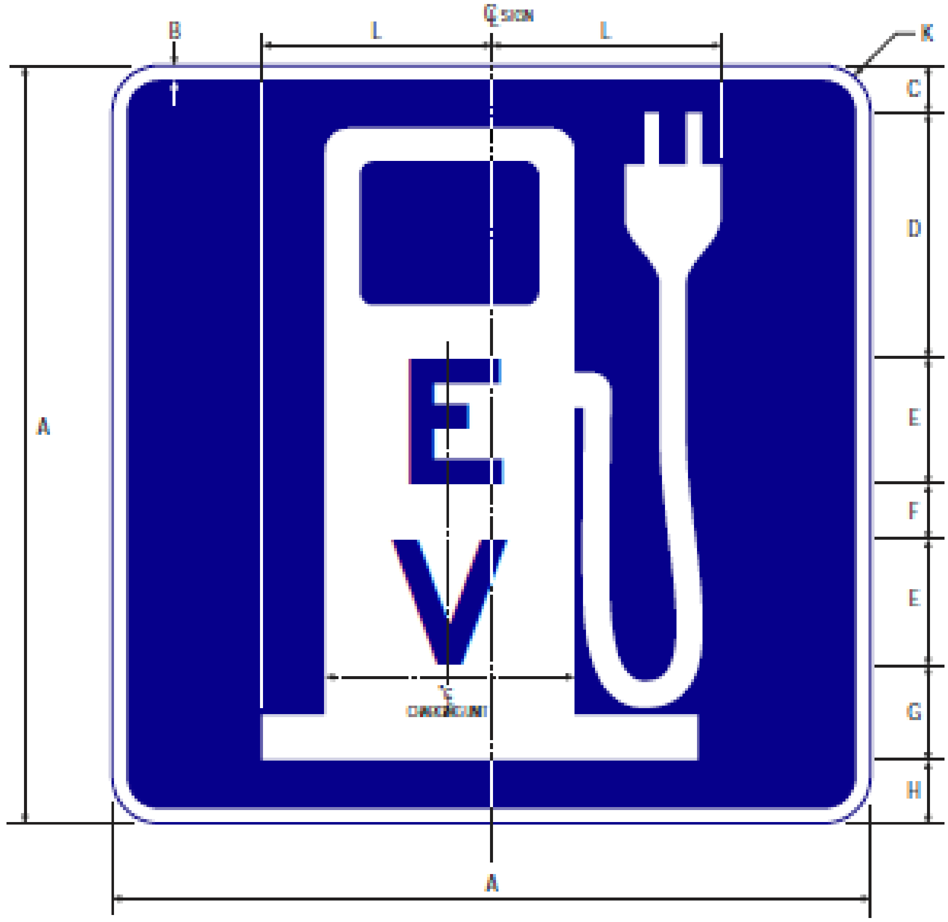
P	Q	R	S
1.75	4	6	9.75

COLORS: BORDER & LEGEND - GREEN (RETROREFLECTIVE)
BACKGROUND - WHITE (RETROREFLECTIVE)

3/14/13

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



* Optically space the "EV" letters vertically with the charging unit.

G66-21B (CA)

ENGLISH UNITS

A	B	C	D	E	F	G	H	J	K	L
12	.375	.75	3.875	2EM	.875	1.5	1	10.25	1.5	3.625
18	.375	1.125	5.75	3EM	1.375	2.25	1.5	15.375	1.5	5.1625
24	.5	1.5	7.75	4EM	1.75	3	2	20.5	1.5	7.25
30	.75	1.875	9.625	5EM	2	4	2.5	25.625	1.875	9.063

COLORS: BORDER & SYMBOL - WHITE (RETROREFLECTIVE)
LEGEND & BACKGROUND - BLUE (RETROREFLECTIVE)

3/14/13

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

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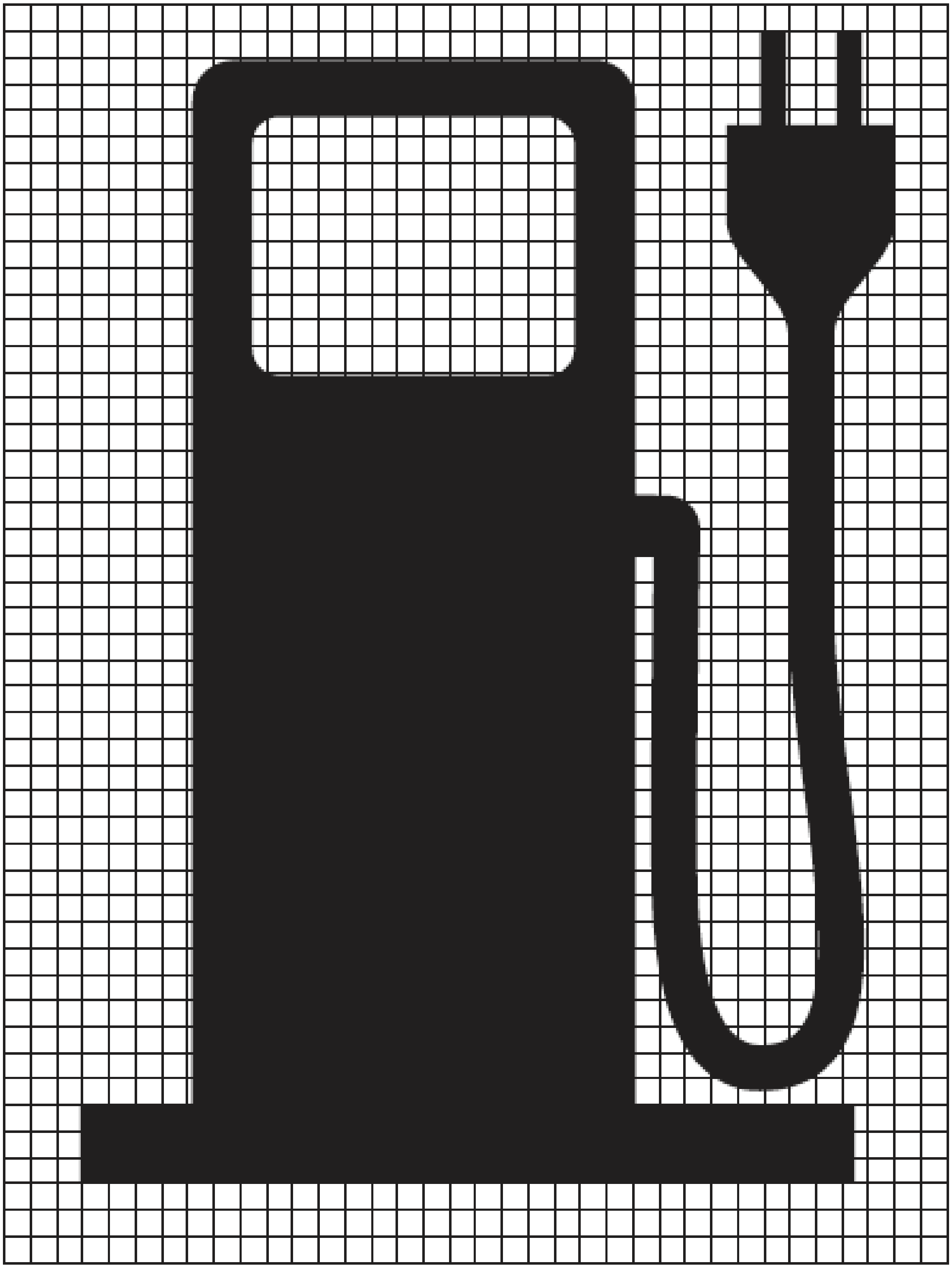
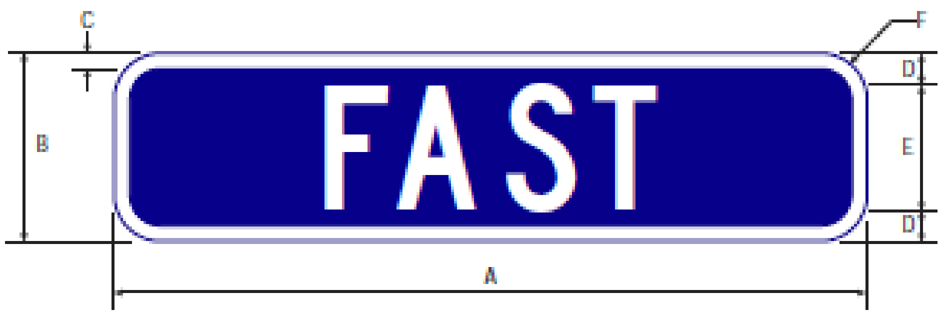
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



G66-12B (CA) Grid
3/14/13

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



G66-21C (CA)

ENGLISH UNITS

A	B	C	D	E	F
12	5	.375	1	3B	1.5
18	5	.375	1	3C	1.5
24	6	.5	1	4C	1.5
30	8	.75	1.5	5D	1.875

COLORS: BORDER & LEGEND - WHITE (RETROREFLECTIVE)
BACKGROUND - BLUE (RETROREFLECTIVE)

3/14/13

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Figure 3B-108 (CA). Electric Vehicle Charging Station Pavement Marking Details (Sheet 1 of 2)

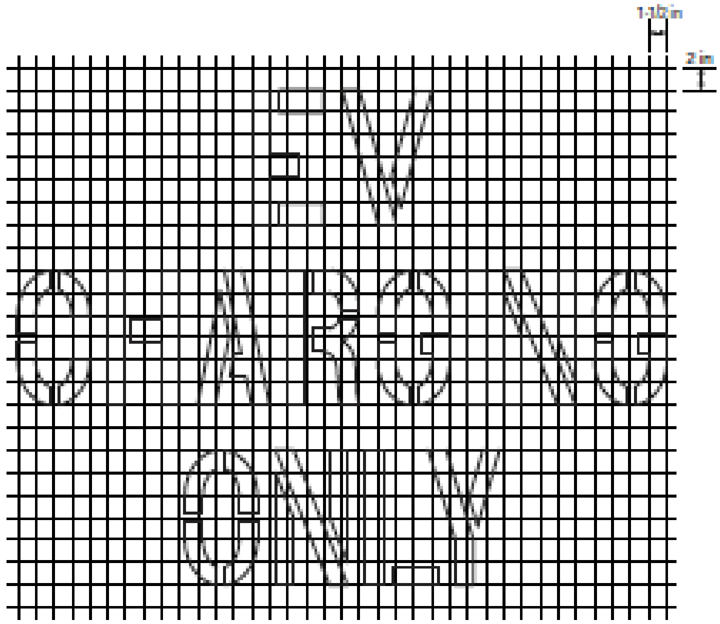
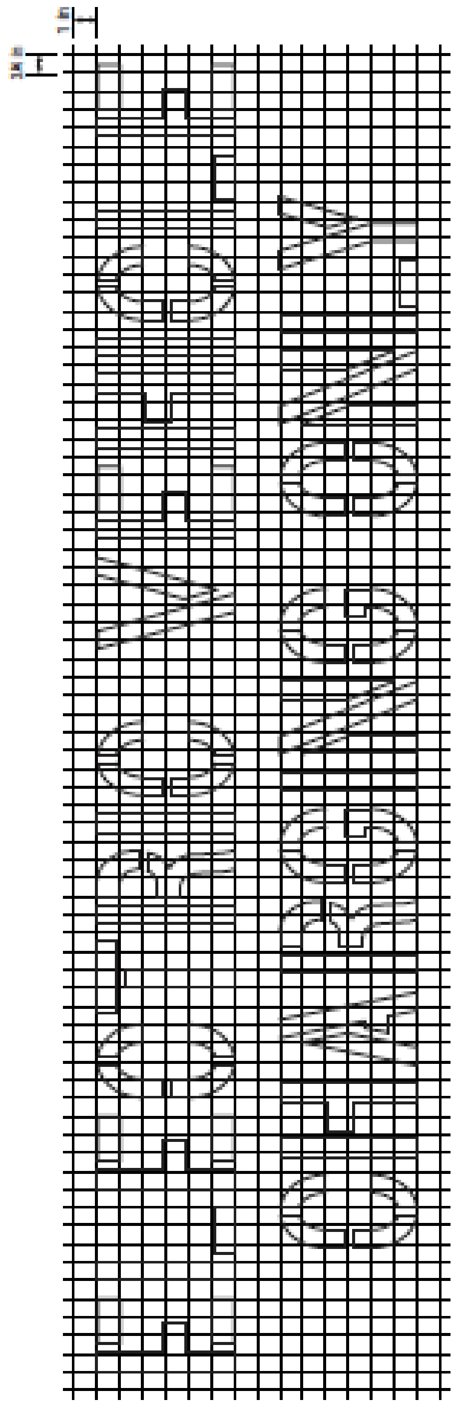


Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Figure 3B-108 (CA). Electric Vehicle Charging Station Pavement Marking Details (Sheet 2 of 2)



California Vehicle Code 22511

State of California

VEHICLE CODE

Section 22511

22511. (a) A local authority, by ordinance or resolution, and a person in lawful possession of an offstreet parking facility may designate stalls or spaces in an offstreet parking facility owned or operated by that local authority or person for the exclusive purpose of charging and parking a vehicle that is connected for electric charging purposes.

(b) If posted in accordance with subdivision (d) or (e), the owner or person in lawful possession of a privately owned or operated offstreet parking facility, after notifying the police or sheriff's department, may cause the removal of a vehicle from a stall or space designated pursuant to subdivision (a) in the facility to the nearest public garage if the vehicle is not connected for electric charging purposes.

(c) If posted in accordance with subdivision (d), the local authority owning or operating an offstreet parking facility, after notifying the police or sheriff's department, may cause the removal of a vehicle from a stall or space designated pursuant to subdivision (a) in the facility to the nearest garage, as defined in Section 340, that is owned, leased, or approved for use by a public agency if the vehicle is not connected for electric charging purposes.

(d) The posting required for an offstreet parking facility owned or operated either privately or by a local authority shall consist of a sign not less than 17 by 22 inches in size with lettering not less than one inch in height that clearly and conspicuously states the following: "Unauthorized vehicles not connected for electric charging purposes will be towed away at owner's expense. Towed vehicles may be reclaimed at

____ or by telephoning
(Address)
____."
(Telephone number of local law enforcement agency)

The sign shall be posted in either of the following locations:

(1) Immediately adjacent to, and visible from, the stall or space.

(2) In a conspicuous place at each entrance to the offstreet parking facility.

(e) If the parking facility is privately owned and public parking is prohibited by the posting of a sign meeting the requirements of paragraph (1) of subdivision (a) of Section 22658, the requirements of subdivision (b) may be met by the posting of a sign immediately adjacent to, and visible from, each stall or space indicating that a vehicle not meeting the requirements of subdivision (a) will be removed at the owner's

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

expense and containing the telephone number of the local traffic law enforcement agency.

(f) This section does not interfere with existing law governing the ability of local authorities to adopt ordinances related to parking programs within their jurisdiction, such as programs that provide free parking in metered areas or municipal garages for electric vehicles.

(Amended by Stats. 2011, Ch. 274, Sec. 1. (AB 475) Effective January 1, 2012.)

State of California

VEHICLE CODE

Section 22511.1

22511.1. (a) A person shall not park or leave standing a vehicle in a stall or space designated pursuant to Section 22511 unless the vehicle is connected for electric charging purposes.

(b) A person shall not obstruct, block, or otherwise bar access to parking stalls or spaces described in subdivision (a) except as provided in subdivision (a).

(Amended by Stats. 2011, Ch. 274, Sec. 2. (AB 475) Effective January 1, 2012.)

Governor's Office of Planning and Research (OPR) PEV Parking Code Template

Plug-In Electric Vehicle Parking Code Example

Snapshot: The California Vehicle Code (CVC) provides local governments the authority to place traffic control devices in their jurisdictions (including county highways) to guide, warn and regulate traffic as necessary to carry out the provisions of the CVC and local traffic ordinances. Traffic Operations Policy Directive 13-01 includes several plug-in electrical vehicle signs and pavement markings for communities. These signs that restrict parking to PEVs, or limit the amount of time a vehicle can be parked, must be supported by local codes to become legally enforceable. The following example is adapted from the City of Santa Monica's Municipal Code.

Parking Code Template

The local government of ______________, or designee, is authorized to designate parking spaces or stalls in an off-street parking facility owned and operated by _____________ or the Parking Authority of the ___________ for the exclusive purpose of charging and parking a vehicle that is connected for electric charging purposes.

When a sign provides notice that a parking space is a publicly designated electric vehicle charging station, no person shall park or stand any nonelectric vehicle in a designated electric vehicle charging station space. Further, no person shall park or stand an electric vehicle in a publicly designated electric vehicle charging station space when not electrically charging or parked beyond the days and hours designated on the regulatory signs posted. For purposes of this subsection, charging means an electric vehicle is parked at an electric vehicle charging station and is connected to the charging station equipment.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Senate Bill No. 454

CHAPTER 418

An act to add Chapter 8.7 (commencing with Section 44268) to Part 5 of Division 26 of the Health and Safety Code, relating to air resources.

[Approved by Governor September 28, 2013. Filed with Secretary of State September 28, 2013.]

LEGISLATIVE COUNSEL'S DIGEST

SB 454, Corbett. Public resources: electric vehicle charging stations.

Existing law establishes the Alternative and Renewable Fuel and Vehicle Technology Program, administered by the State Energy Resources Conservation and Development Commission, which authorizes, among other things, upon appropriation by the Legislature, a grant program to provide funding for homeowners who purchase a plug-in electric vehicle to offset costs associated with modifying electrical sources that include a residential plug-in electric vehicle charging station.

Existing law also creates a grant program for the purchase and lease of zero-emission vehicles, as defined, in the state to be developed and administered by the State Air Resources Board in conjunction with the commission. The program provides grants to specified recipients in an amount equal to 90% of the incremental cost above $1,000 of an eligible new zero-emission light-duty car or truck, as defined.

This bill would create the Electric Vehicle Charging Stations Open Access Act, which would prohibit the charging of a subscription fee on persons desiring to use an electric vehicle charging station, as defined, and would prohibit a requirement for persons to obtain membership in any club, association, or organization as a condition of using the station, except as specified. The bill would require the total actual charges for the use of an electric vehicle charging station to be disclosed to the public at the point of sale. The bill would require an electric vehicle charging station to provide to the general public 2 specified options of payment.

This bill would require the service provider of electric vehicle service equipment, as defined, at an electric vehicle charging station, as defined, to disclose to the National Renewable Energy Laboratory the charging station's geographic location, a schedule of fees, accepted methods of payment, and the amount of network roaming charges for nonmembers, if any.

This bill, if no interoperability billing standards have been adopted by a national standards organization by January 1, 2015, would authorize the state board to adopt interoperability billing standards, as defined, for network roaming payment methods for electric vehicle charging stations, and would require, if the state board adopts standards, all electric vehicle charging stations that require payment to meet those standards within one year.

The people of the State of California do enact as follows:

SECTION 1. The Legislature finds and declares all of the following:

(a) California is the nation's largest market for cars and light-duty trucks.

(b) The transportation sector is the biggest contributor to California's greenhouse gas emissions and accounts for approximately 40 percent of these emissions.

(c) California should encourage the development and success of zero-emission vehicles to protect the environment, stimulate economic growth, and improve the quality of life in the state.

(d) California should encourage and support the development of infrastructure for open and accessible public charging stations.

(e) In order to reach the goal of 1.5 million electric drive vehicles in California by 2025, electric vehicle (EV) consumers need confidence that they can access a robust network of publicly available EV charging stations. Any EV driver should be able to access any publicly available EV charging station, regardless of the system provider.

(f) EV consumers and drivers need to be able to find the stations and know how much they cost.

(g) It is the intent of the Legislature to (1) promote a positive driving experience by assisting in the widespread deployment of electric vehicles, (2) not limit the ability of a property owner or lessee of publicly available parking spaces, as defined in Section 44268, to restrict use of or access to those parking spaces to its customers, and (3) facilitate expanded EV driver access to electric vehicle charging stations in public places.

SEC. 2. Chapter 8.7 (commencing with Section 44268) is added to Part 5 of Division 26 of the Health and Safety Code, to read:

Chapter 8.7. Electric Vehicle Charging Stations Open Access Act

44268. As used in this chapter, the following terms have the following meanings:

(a) "Battery" means an electrochemical energy storage system powered directly by electrical current.

(b) "Electric vehicle" means a vehicle that uses a plug-in battery to provide all or part of the motive power of the vehicle, including battery electric, plug-in hybrid electric, or plug-in fuel cell vehicle.

(c) "Electric vehicle charging station" means one or more publicly available parking spaces served by electric vehicle service equipment.

(d) "Electric vehicle service equipment" means an electric component assembly or cluster of component assemblies designed specifically to charge batteries within electric vehicles by permitting the transfer of electric energy to a battery or other storage device in an electric vehicle.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

(e) "Interoperability billing standards" means the ability for a member of one electric charging station billing network to use another billing network.

(f) "Network roaming" means the act of a member of one electric vehicle charging station billing network using a charging station that is outside of the member's billing network with his or her billing network account information.

(g) "Publicly available parking space" means a parking space that has been designated by a property owner or lessee to be available to, and accessible by, the public and may include on-street parking spaces and parking spaces in surface lots or parking garages. "Publicly available parking space" shall not include a parking space that is part of, or associated with, a private residence, a parking space that is reserved for the exclusive use of an individual driver or vehicle or for a group of drivers or vehicles, such as employees, tenants, visitors, residents of a common interest development, or residents of an adjacent building, or a parking space provided by a producer of electric vehicles as a service. Nothing in this article limits the ability of an owner or lessee of a publicly available parking space whose primary business is other than electric vehicle charging from restricting use of the parking space, such as limiting use to customers and visitors of the business.

44268.2. (a) (1) Persons desiring to use an electric vehicle charging station that requires payment of a fee shall not be required to pay a subscription fee in order to use the station, and shall not be required to obtain membership in any club, association, or organization as a condition of using the station. The total actual charges for the use of an electric vehicle charging station, including any additional network roaming charges for nonmembers, shall be disclosed to the public at the point of sale. An electric vehicle charging station that requires payment of a fee shall allow a person desiring to use the station to pay via credit card or mobile technology, or both.

(2) Notwithstanding paragraph (1), an electric vehicle charging station may offer services on a subscription- or membership-only basis provided those electric vehicle charging stations allow nonsubscribers or nonmembers the ability to use the electric vehicle charging station through the payment options detailed in paragraph (1).

(b) The service provider of electric vehicle service equipment at an electric vehicle charging station or its designee shall disclose to the National Renewable Energy Laboratory the electric vehicle charging station's geographic location, a schedule of fees , accepted methods of payment, and the amount of network roaming charges for nonmembers, if any.

(c) Electric vehicle charging stations shall be labeled in accordance with Part 309 of Title 16 of the Code of Federal Regulations, and, where commercially reasonable and feasible, may be clearly marked with appropriate directional signage in the parking area or facility where they are located.

(d) If no interoperability billing standards have been adopted by a national standards organization by January 1, 2015, the state board may adopt

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

interoperability billing standards for network roaming payment methods for electric vehicle charging stations. If the state board adopts interoperability billing standards, all electric vehicle charging stations that require payment shall meet those standards within one year. Any standards adopted by the state board shall consider other governmental or industry-developed interoperability billing standards and may adopt interoperability billing standards promulgated by an outside authoritative body.

City of SACRAMENTO
Community Development

300 Richards Blvd., 3rd Floor
Sacramento, CA 95811
Help Line: 916-264-5011
CityofSacramento.org/dsd

Electrical Load Calculation Worksheet

2013 C.E.C 220.82 (100 AMP Minimum)

THIS SHALL BE ON THE JOB SITE AT ALL TIMES **SUBMIT TWO COPIES**

Permit # ______________________ **Date:** ______________

Contractor/Owner: ______________________ **Size of service panel:** ______________ **AMPS**

Job Address: ______________________ **Total SF:** ______________

Phone # ______________________ **Email:** ______________________

ITEM	WATTS	EXAMPLES
________ Sq.Ft. @ 3 watts per Sq.Ft.		1) - A/C with gas heat
20 amp appliance circuits @ 1,500 watts each		- compressor 20 amps
Range (NPR - nameplate rating) Gas: Yes No		- fan(s) 5 amps
Oven (NPR) Gas: Yes No		TOTAL 25 amps x 240 volts = 6,000 watts
Cooking Units (NPR) Gas: Yes No		2) - A/C with 5 kw electric heater
Water Heater (NPR) Gas: Yes No		- compressor 20 amps
Dishwasher (NPR)		- fan(s) 5 amps
Disposal (NPR)		TOTAL 25 amps x 240 volts = 6,000 watts
Washer @ 1,500 watts (min)		- 5,000 watt heater x 65% = 3,250 watts
Dryer @ 5,000 watts (min) Gas: Yes No		- Use larger of A/C or heater - i.e. - 6,000 watts
Motors (NPR)		3) - A/C with 10 kw electric heater
Electric vehicle supply equipment (NPR)		- compressor 20 amps
Other (NPR)		- fan(s) 5 amps
Other (NPR)		TOTAL 25 amps x 240 volts = 6,000 watts
SUBTOTAL:		- 10,000 watt heater x 65% = 6,500 watts
		- Use larger of A/C or heater - i.e. - 6,500 watts
1st 10,000 watts of SUBTOTAL @ 100%		4) - A/C with heat pump
Remaining __________ watts @ 40%		- compressor 20 amps
Largest of A/C or electric heater or heat pump*		- fan(s) 5 amps
TOTAL WATTS:		SUBTOTAL 25 amps x 240 volts = 6,000 watts
		- 5,000 watt heat strips @ 65% = 3,250 watts
TOTAL WATTS DIVIDED BY 240 VOLTS =	AMPS	TOTAL 9,250 watts

** Use largest of 100% of air conditioner or 65% of the heater or when residence has a heat pump, add 65% of auxiliary heat strips to 100% of air conditioner / heat pump*

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

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.	
KITCHEN CIRCUITS			
☐	Kitchen circuits	3,000 watts	
☐	Electric oven	2,000 watts	
☐	Electric stove top	5,000 watts	
☐	Microwave	1,500 watts	
☐	Garbage disposal under kitchen sink	1,000 watts	
☐	Automatic dish washer	3,500 watts	
☐	Garbage compactor	1,000 watts	
☐	Instantaneous hot water at sink	1,500 watts	
LAUNDRY CIRCUIT			
☐	Laundry circuit	1,500 watts	
☐	Electric clothes dryer	4,500 watts	
HEATING AND AIR CONDITIONING CIRCUITS			
☐	Central heating and air conditioning	6,000 watts	
☐	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	
☐			
☐			
☐			
ELECTRIC VEHICLE CHARGER CIRCUIT			
	Level 2 electric vehicle charger wattage rating		
		TOTAL WATTS USED	0

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

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	
☐	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.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Department of Energy (DOE) Permit Template for Residential Installations

Permit for Charging Equipment Installation

Electric Vehicle Supply Equipment (EVSE)

Jurisdiction: City, State

Compliance with the following permit will allow the installation and operation of electric vehicle charging equipment at a residence in the City, State jurisdiction. This permit addresses one of the following situations:

- Only an additional branch circuit would be added at the residence
- A hard-wired charging station would be installed at the residence. The attached requirements for wiring the charging station are taken directly out of the 2011 edition of the National Electrical Code® (NEC)® NFPA 70, Article 625 Electric Vehicle Charging System. This article does not provide all of the information necessary for the installation of electric vehicle charging equipment. Please refer to the current edition of the electrical code adopted by the local jurisdiction for additional installation requirements. Reference to the 2011 NEC may be made at www.nfpa.org/70.

This permit contains a general reference to the NEC or electrical code used in the jurisdiction. All work and installed equipment will comply with the requirements of the NEC or the electrical code used in the jurisdiction. The jurisdiction maintains the authority/responsibility to conduct any inspections deemed necessary to protect public safety. The charging station installer shall also be responsible for notifying or coordinating any work with the utility company where needed.

Section 1 of the permit application requires basic identifying information be submitted. Note that there is a separate portion of the form requesting information on the property owner who may not be the individual requesting the installation.

Section 2 of the permit application identifies which code needs to be complied with depending on whether a branch circuit and meter or a hard-wired charging station is being installed.

The technical installation requirements address the following specific elements of electric vehicle charging station safety:

- Listing and labeling requirements
- Wiring methods
- Breakaway requirements
- Overcurrent protection
- Indoor siting
- Outdoor siting

Section 3 consists of standard certification statement that could be modified as needed by the jurisdiction. By signing the certification statement, the applicant agrees to comply with the standard permit conditions and other applicable requirements. This consent would give the jurisdiction the option of allowing the applicant to proceed with installation and operation of the charging equipment.

Section 4 of the document gives an example of a checklist the jurisdiction could develop to track key information on the application. The example under section 4 contains only a few items of the many that the jurisdiction might wish to track.

This permit package also includes a schematic drawing depicting a typical indoor installation. In this installation the wiring path follows the exterior of the structure, and the charging station is located indoors. The NEC® allows for interior wiring and outdoor installations. The purpose of the schematic is only to show how the charging station equipment could be arranged and is not intended to convey any permit requirements.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Application for Installation of Electric Vehicle Charging Equipment

NOTICE: The system must be installed in compliance with NFPA 70, National Electric Code, Article 625 or applicable Electrical Code currently adopted and enforced within the jurisdiction of installation. All associated work with circuits, electrical service and meters shall be completed in compliance with NFPA 70, national electric code, or applicable electrical code currently adopted and enforced within the jurisdiction of installation.

Section 1: Permit Applicant Information

Name:			
Installation Street Address (P.O. box not acceptable):	Contact Person:		Phone Number: ( ) -
City:	County:	State:	ZIP Code:
Owner Name:	Street Address:		Phone Number: ( ) -
City:	State:		ZIP Code:
Submitter's Name/Company	Street Address:		Phone Number: ( ) -
City:	State:		ZIP Code:
General description of equipment to be installed:			

Section 2: Permit Code Information

Requirements for wiring the charging station are taken directly out of the 2011 edition of the National Electrical Code® (NEC) ® NFPA 70, Article 625 Electric Vehicle Charging System. This article does not provide all of the information necessary for the installation of an electric vehicle charging equipment. Please refer to the current edition of the electrical code adopted by the local jurisdiction for additional installation requirements. Reference to the 2011 NEC may be made at www.nfpa.org/70.

NEC® Chapter or Article	DESCRIPTION
Chapter2 and 3	**Branch Circuit** A new electrical box added on a branch circuit shall comply with NFPA 70 National Electrical Code® Chapter 2 Wiring and Protection and Chapter 3 Wiring Methods and Materials and all administrative requirements of the NEC or the electrical code in effect in the jurisdiction
625.4	**VOLTAGES** Unless other Voltages are specified, the nominal ac system voltages of 120, 120/240, 208Y/120, 240, 480Y/277, 480, 600Y/347, and 600 Volts shall be used to supply equipment
625.5	**LISTED OR LABELED** All electrical materials, devices, fittings, and associated equipment shall be listed or labeled.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

625.9	WIRING METHODS The electric vehicle coupler shall comply with 625.9(A) through (F). (A) Polarization. The electric vehicle coupler shall be polarized unless part of a system identified and listed as suitable for the purpose. (B) Noninterchangeability. The electric vehicle coupler shall have a configuration that is noninterchangeable with wiring devices in other electrical systems. Nongrounding-type electric vehicle couplers shall not be interchangeable with grounding-type electric vehicle couplers. (C) Construction and Installation. The electric vehicle coupler shall be constructed and installed so as to guard against inadvertent contact by persons with parts made live from the electric vehicle supply equipment or the electric vehicle battery. (D) Unintentional Disconnection. The electric vehicle coupler shall be provided with a positive means to prevent unintentional disconnection. (E) Grounding Pole. The electric vehicle coupler shall be provided with a grounding pole, unless part of a system identified and listed as suitable for the purpose in accordance with Article 250. (F) Grounding Pole Requirements. If a grounding pole is provided, the electric vehicle coupler shall be so designed that the grounding pole connection is the first to make and the last to break contact.
625.13	ELECTRIC VEHICLE SUPPLY EQUIPMENT Electric vehicle supply equipment rated at 125 volts, single phase, 15 or 20 amperes or part of a system identified and listed as suitable for the purpose and meeting the requirements of 625.18, 625.19, and 625.29 shall be permitted to be cord-and-plug-connected. All other electric vehicle supply equipment shall be permanently connected and fastened in place. This equipment shall have no exposed live parts.
625.14	**Rating** Electric vehicle supply equipment shall have sufficient rating to supply the load served. For the purposes of this article, electric vehicle charging loads shall be considered to be continuous loads.
625.15	**Markings** The electric vehicle supply equipment shall comply with 625.15(A) through (C). (A) General. All electric vehicle supply equipment shall be marked by the manufacturer as follows: FOR USE WITH ELECTRIC VEHICLES (B) Ventilation Not Required. Where marking is required by 625.29(C), the electric vehicle supply equipment shall be clearly marked by the manufacturer as follows: VENTILATION NOT REQUIRED The marking shall be located so as to be clearly visible after installation. (C) Ventilation Required. Where marking is required by 625.29(D), the electric vehicle supply equipment shall be clearly marked by the manufacturer, "Ventilation Required." The marking shall be located so as to be clearly visible after installation.
625.16	**Means of Coupling** The means of coupling to the electric vehicle shall be either conductive or inductive. Attachment plugs, electric vehicle connectors, and electric vehicle inlets shall be listed or labeled for the purpose.
625.17	**Cable** The electric vehicle supply equipment cable shall be Type EV, EVJ, EVE, EVJE, EVT, or EVJT flexible cable as specified in Article 400 and Table 400.4. Ampacities shall be as specified in Table 400.5(A)(1) for 10 AWG and smaller, and in Table 400.5(A)(2) for 8 AWG and larger. The overall length of the cable shall not exceed 7.5 m (25 ft) unless equipped with a cable management system that is listed as suitable for the purpose. Other cable types and assemblies listed as being suitable for the purpose, including optional hybrid communications, signal, and composite optical fiber cables, shall be permitted.
625.18	**Interlock** Electric vehicle supply equipment shall be provided with an interlock that de-energizes the electric vehicle connector and its cable whenever the electrical connector is uncoupled from the electric vehicle. An interlock shall not be required for portable cord-and-plug-connected electric vehicle supply equipment intended for connection to receptacle outlets rated at 125 volts, single phase, 15 and 20 amperes.
625.19	**Automatic De-Energization of Cable** The electric vehicle supply equipment or the cable-connector combination of the equipment shall be provided with an automatic means to de-energize the cable conductors and electric vehicle connector upon exposure to strain that could result in either cable rupture or separation of the cable from the electric connector and exposure of live parts. Automatic means to de-energize the cable conductors and electric vehicle connector shall not be required for portable cord-and-plug-connected electric vehicle supply equipment intended for connection to receptacle outlets rated at 125 volts, single phase, 15 and 20 amperes.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

625.21	**Overcurrent Protection** Overcurrent protection for feeders and branch circuits supplying electric vehicle supply equipment shall be sized for continuous duty and shall have a rating of not less than 125 percent of the maximum load of the electric vehicle supply equipment. Where noncontinuous loads are supplied from the same feeder or branch circuit, the overcurrent device shall have a rating of not less than the sum of the noncontinuous loads plus 125 percent of the continuous loads.
625.22	**Personnel Protection System** The electric vehicle supply equipment shall have a listed system of protection against electric shock of personnel. The personnel protection system shall be composed of listed personnel protection devices and constructional features. Where cord-and-plug-connected electric vehicle supply equipment is used, the interrupting device of a listed personnel protection system shall be provided and shall be an integral part of the attachment plug or shall be located in the power supply cable not more than 300 mm (12 in.) from the attachment plug.
625.23	**Disconnecting Means** For electric vehicle supply equipment rated more than 60 amperes or more than 150 volts to ground, the disconnecting means shall be provided and installed in a readily accessible location. The disconnecting means shall be capable of being locked in the open position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed. Portable means for adding a lock to the switch or circuit breaker shall not be permitted.
625.25	**Loss of Primary Source** Means shall be provided such that, upon loss of voltage from the utility or other electrical system(s), energy cannot be back fed through the electric vehicle and the supply equipment to the premises wiring system unless permitted by 625.26.
625.26	**Interactive Systems** Electric vehicle supply equipment and other parts of a system, either on-board or off-board the vehicle, that are identified for and intended to be interconnected to a vehicle and also serve as an optional standby system or an electric power production source or provide for bi-directional power feed shall be listed as suitable for that purpose. When used as an optional standby system, the requirements of Article 702 shall apply, and when used as an electric power production source, the requirements of Article 705 shall apply.
625.28	**Hazardous (Classified) Locations** Where electric vehicle supply equipment or wiring is installed in a hazardous (classified) location, the requirements of Articles 500 through 516 shall apply.
625.29	**Indoor Sites** Indoor sites shall include, but not be limited to, integral, attached, and detached residential garages; enclosed and underground parking structures; repair and nonrepair commercial garages; and agricultural buildings. (A) Location. The electric vehicle supply equipment shall be located to permit direct connection to the electric vehicle. (B) Height. Unless specifically listed for the purpose and location, the coupling means of the electric vehicle supply equipment shall be stored or located at a height of not less than 450 mm (18 in.) and not more than 1.2 m (4 ft) above the floor level. (C) Ventilation Not Required. Where electric vehicle nonvented storage batteries are used or where the electric vehicle supply equipment is listed or labeled as suitable for charging electric vehicles indoors without ventilation and marked in accordance with 625.15(B), mechanical ventilation shall not be required. (D) Ventilation Required. Where the electric vehicle supply equipment is listed or labeled as suitable for charging electric vehicles that require ventilation for indoor charging, and is marked in accordance with 625.15(C), mechanical ventilation, such as a fan, shall be provided. The ventilation shall include both supply and exhaust equipment and shall be permanently installed and located to intake from, and vent directly to, the outdoors. Positive pressure ventilation systems shall be permitted only in buildings or areas that have been specifically designed and approved for that application. Mechanical ventilation requirements shall be determined by one of the methods specified in 625.29(D)(1) through (D)(4). (1) Table Values. For supply voltages and currents specified in Table 625.29(D)(1) or Table 625.29(D)(2), the minimum ventilation requirements shall be as specified in Table 625.29(D)(1) or Table 625.29(D)(2) for each of the total number of electric vehicles that can be charged at one time. (2) Other Values. For supply voltages and currents other than specified in Table 625.29(D)(1) or Table 625.29(D)(2), the minimum ventilation requirements shall be calculated by means of general formulas stated in article 625.39(D)(2). (3) Engineered Systems. For an electric vehicle supply equipment ventilation system designed by a person qualified to perform such calculations as an integral part of a building's total ventilation system, the minimum ventilation requirements shall be permitted to be determined in accordance with calculations specified in the engineering study. (4) Supply Circuits. The supply circuit to the mechanical ventilation equipment shall be electrically interlocked with the electric vehicle supply equipment and shall remain energized during the entire electric vehicle charging cycle. Electric vehicle supply equipment shall be marked in accordance with 625.15. Electric vehicle supply equipment receptacles rated at 125 volts, single phase, 15 and 20 amperes shall be marked in accordance with 625.15(C) and shall be switched, and the mechanical ventilation system shall be electrically interlocked through the switch supply power to the receptacle.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

625.30	**Outdoor Sites** Outdoor sites shall include but not be limited to residential carports and driveways, curbside, open parking structures, parking lots, and commercial charging facilities. (A) Location. The electric vehicle supply equipment shall be located to permit direct connection to the electric vehicle. (B) Height. Unless specifically listed for the purpose and location, the coupling means of electric vehicle supply equipment shall be stored or located at a height of not less than 600 mm (24 in.) and not more than 1.2 m (4 ft) above the parking surface.

Section 3: Certification Statement

I hereby certify that the electrical work described on this permit application shall be/has been installed in compliance with the conditions in this permit, NFPA 70, National Electrical Code®, Article 625, or applicable electrical code currently adopted and enforced within the jurisdiction of installation. Furthermore, all associated work with circuits, electrical service and meters shall be/has been completed in compliance with NFPA 70, National Electrical Code® , or applicable electrical code currently adopted and enforced within the jurisdiction of installation. By agreeing to the above requirements, the licensee or owner shall be permitted to install and operate the charging station. The licensee also insures that appropriate load calculations have been done to insure that the residence has adequate electrical capacity to support electric vehicle charging equipment.

> Existing circuits provided for garages may supply other loads and may not have sufficient capacity for electric vehicle charging equipment.
>
> In some older installations the residential electrical service may not have sufficient capacity to supply electric vehicle charging equipment. Capacity problems are likely to be encountered on 60 ampere services or on 100 ampere services with multiple 240 volt loads. In such cases load calculations must be performed to insure adequate capacity.

Signature of Licensee:	Date:
Signature of Owner:	Date:

Section 4: Jurisdiction Checklist

Information each jurisdiction would add to permit:

- Date utility notified of work completed
- Information on installation sent to tax assessor
- Indoor/outdoor location
- Modification to existing service required
- Other items as determined by the jurisdiction

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

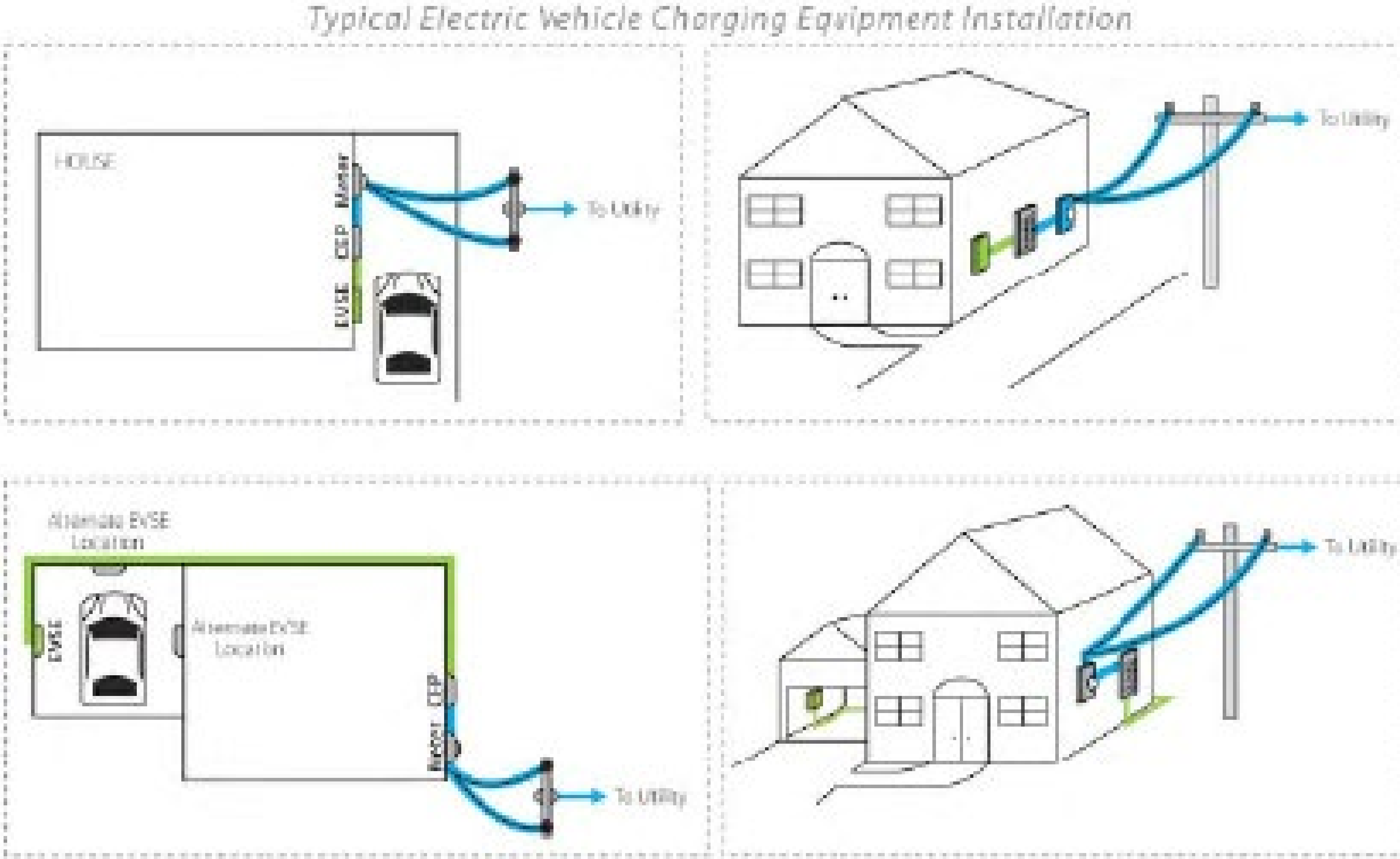


Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

COMMUNITY DEVELOPMENT
Building and Safety

Print Form

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 ____________

FORM 66-114 REV 06/11

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

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

FORM 66-114 REV 06/11
PAGE 2 of 2

CITY OF MOUNTAIN VIEW

Community Development Department • Building Inspection Division
500 Castro Street • Post Office Box 7540 • Mountain View, California 94039-7540 • 650-903-6313 • FAX 650-903-6474

ELECTRIC VEHICLE CHARGER INSTALLATION SUBMITTAL REQUIREMENTS FOR ONE-TO-TWO FAMILY DWELLINGS

The following plan check submittal requirements are provided to help get your electric vehicle charger installation through the Building Division review and permitting process. Your cooperation in providing this information will ensure that your project qualifies for over-the-counter review. Designated appointment time must be requested by the applicant, this over-the-counter review service is available Fridays, between 1:00 pm – 3:00 pm.

Planning review and approval is required for properties managed by an HOA. Please provide a letter of approval or documentation to the Planning Division prior to your appointment time. For questions please contact the Planning and Zoning Division directly at (650) 903-6306.

SUBMITTAL REQUIREMENTS

Provide two (2) complete sets of plans, load calculations, and manufacture cutsheets or specifications. Both sets of plans must be wet-signed by the designer/architect, contractor or homeowner. All plans submitted must be legible; the documentation provided will be digitally imaged as a permanent record for the property.

SITE PLAN

Show the location of:

a. Existing or proposed structure(s) for which the electric vehicle charger shall be affixed
b. Parcel dimensions and outline
c. Label street(s) frontage and access
d. Location and size of main service panel
e. Location and size of subpanel, existing and/or proposed
f. Location of electric vehicle charger
g. Pathway for electrical connection to EV

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

ELECTRICAL

Provide a single line diagram with the following items:

a. Existing or proposed main service panel size
b. Panel schedule
c. Dedicated circuit for electric vehicle charger
d. Wiring method and sizing
e. Grounding and disconnect

Provide a load calculation breakdown:

a. Design your project using CEC Article 625 and NEC 220

SYSTEM INFORMATION

Provide manufacturers cut sheets and listing information for all components:

a. All UL listed equipment

For additional questions regarding the submittal requirements, review and permitting process, contact the Building Division at (650) 903-6313 during regular business hours.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

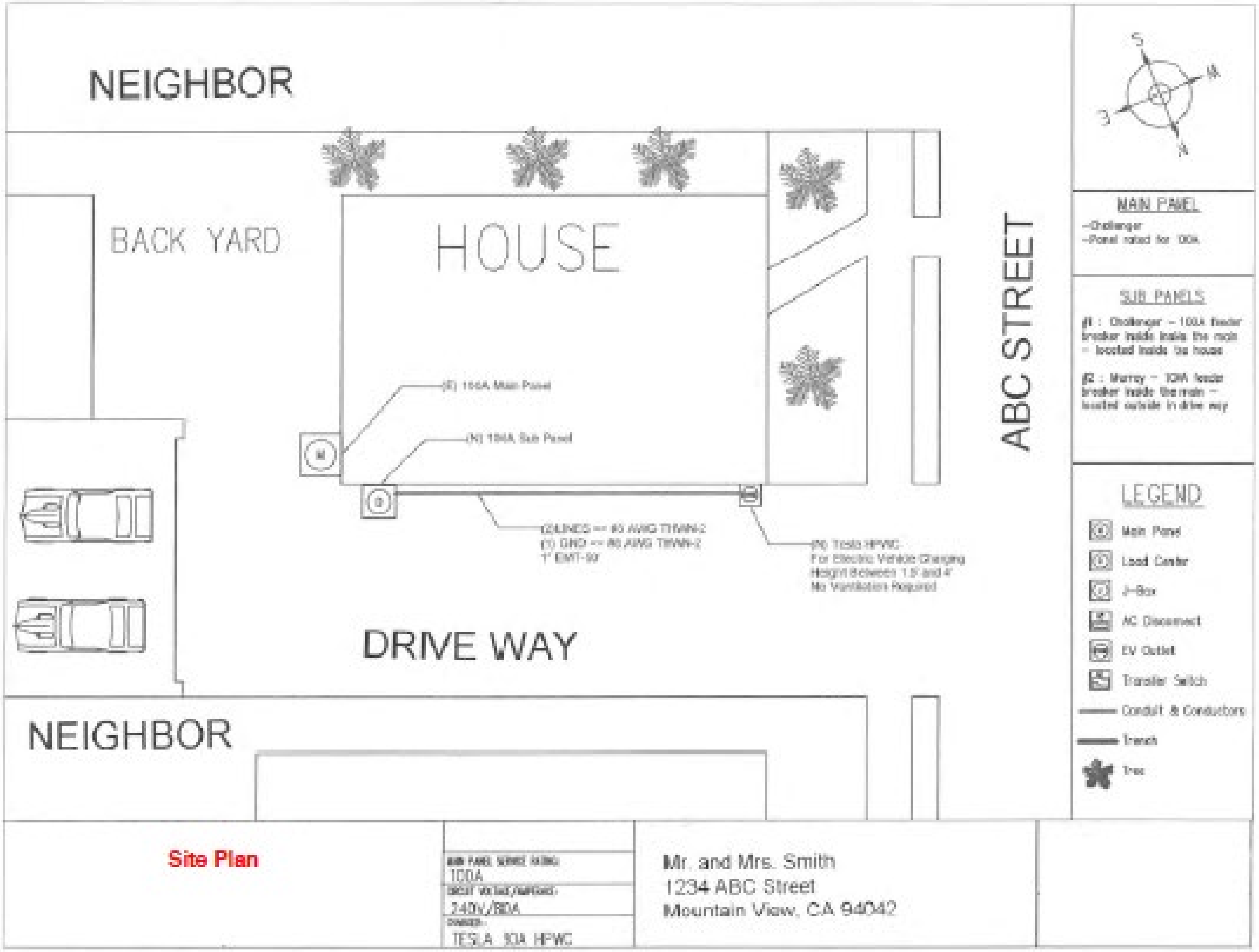


Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

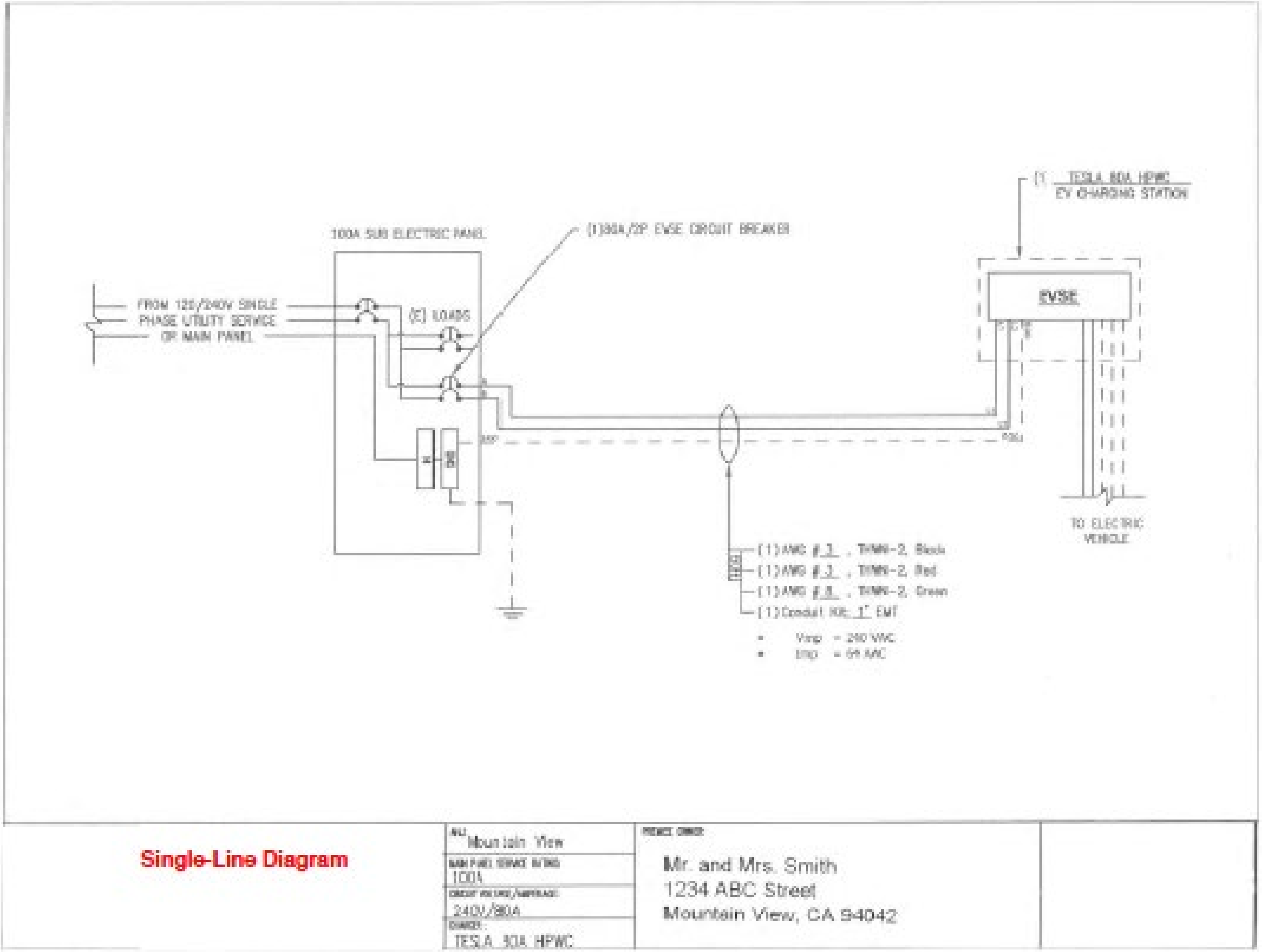


Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

NEC 220.83 - Adding a Circuit to an Existing Dwelling Unit

Square Feet: 2,100 Panel Breaker Rating: 100 A L1/L2 240 Vac

NEC 220.83(A)(1)

"General lighting and general use receptacles ... @ 3 voltamperes per square foot as determined by 220.12"

2,100 square feet x 3w/sq ft 6,300 VA

NEC 220.83(A)(2)

Small appliance and laundry branch circuits @1500VA per 20 amp circuit

Number of circuits 3 x 1500= 4,500 VA

NEC 220.83(A)(3)(b)

"Household Range(s), wall-mounted oven(s), and counter-mounted cooking unit(s)"

Oven	7,680	VA
Microwave	0	VA
	7,680	total VA

NEC 220.83(A)(3)(a)

"All other appliances that are permanently connected, fastened in place, or connected to a dedicated circuit, at nameplate rating"

Dishwasher/Disposal	2,800	VA
Refrigerator	1,760	VA
Cooktop/Hood	1,760	VA
Washer	1,760	VA
Dryer	800	VA
Jacuzzi	1,500	VA
	0	VA
	0	VA
	0	VA
	0	VA
	0	VA
Tesla HPWC	15,360	VA
EVSE 1:		VA
EVSE 2:		VA
	25,740	total VA
Total of non air-conditioning loads:	44,220	total VA
First 8kVA of load at 100%	8,000	VA
Remainder of load at 40%	14,488	VA
Adjusted total of non air-conditioning load	22,488	VA

NEC 220.83(B)

"Where additional air-conditioning equipment or electric space-heating equipment is to be installed..."

A/C Equipment Unit #1 and #2	0	VA
A/C Equipment Unit #3 and #4	0	VA
Total of A/C Loads and All Other Loads:	22,488	total VA

Total Proposed Calculated Load 93.70 Amps

Load Calculation(s)

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Community Development
Building Permits and Inspection
General Information: (916) 875-5296
www.building.saccounty.net

Full Service Center 827 7th Street, Room 102 Sacramento, CA 95814 (916) 875-5296 M-F 8:30am-4:30pm	East Area Service Center 5229 Hazel Ave, Ste. B Fair Oaks, 95628 (916) 875-2367 M&T 9am-4pm
Bradshaw Campus 9700 Goethe Road, Ste. A Sacramento, CA 95827 (916) 875-5296 M-F 8:30am-4:30pm	North Area Service Center 3331 Peacekeeper Way McClellan, CA 95652 (916) 874-2424 W&Th 9am-4pm

COMMERCIAL & RESIDENTIAL PLUG-IN ELECTRIC VEHICLE (PEV) INFRASTUCTURE PERMITTING CHECKLIST *

New Installations

Plans shall consist of the following:

Commercial: 3 sets of plans on 18"x24" to 36" x 48" sheets, or Electronic Submittal.

Residential: 3 sets of plans on 11"x17" to 36"x48" sheets, or Electronic Submittal.

Req'd — General Information (required to be included on the drawings):

- ☐ Site address on all plan sheets.
- ☐ Site/lot plan drawn to scale, show all allowed parking.
- ☐ Vicinity map.

- ☐ Show protection from physical damage, per current codes.
- ☐ Electrical site plan that shows the location of PEV charging equipment.
- ☐ Location of existing service/meter panel and Utility Transformer.
- ☐ Single-line-diagram and Panel Schedule.
- ☐ Show Existing/New lighting to avoid tripping hazards from cords etc.
- ☐ Show dimension of PEV Parking Stall/Space.
- ☐ Show the location of any Hazardous Materials on site.
- ☐ PEV Charging Equipment cut-sheets for each type of unit proposed.
- ☐ Provide details that height of all controls and connectors, including cord management.
- ☐ Show that a minimum of 36" pathway is maintained at all times.
- ☐ Commercial – Show compliance with the current Accessibility Codes.
- ☐ Identify appropriate codes.
- ☐ Sacramento Municipal Utility District (SMUD) approval may be required.

- ☐ Structural calculations (if applicable).

Plan review and zone check fees must be paid upon submittal of plans.

*AKA ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE) SUBMITTAL LIST

Accepted: Date __________ B.I. Initials __________

Document #EC- 07.1 8/4/16 Page 1 of 1

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

San Diego Multi-Family Housing Installation Checklist

INSTALLATION CHECKLIST FOR MULTI-UNIT DWELLING ELECTRIC VEHICLE CHARGING STATION (EVCS)

Adapted from materials developed by SANDAG, available at http://www.sandag.org/pluginsd

Installations must be completed by a licensed electrical contractor (C-10). (Local Regulations, California Electrical Code CEC Article 625) Plans must show conformance with the California Electrical Code Title 24, Part 3, the California Building Code (Volume 1 and 2), Title 24, Part 2, and other applicable local municipal codes.

Submittal Documents required*

- ☐ **Permit Application**
    - i. Include job address (a unique address for the EVCS installation that is used for billing), parcel number, existing use, description of work, name, address, and contact information of the applicant and the owner.
- ☐ **Plan Sets (#, size of plans)**
    - a. **Site/Plot Plan**
        - i. Show full property extent (property lines, parking areas, structures, etc.).
        - ii. List relevant property information, such as existing parking counts and ratios.
        - iii. Provide a detailed site plan showing where the charging unit is located within the parking garage or lot, and any necessary accessibility improvements
        - iv. As required by type of EVCS, installation mounting method, and local jurisdiction requirements provide necessary structural details.
    - b. **Electrical Plan**
        - i. Provide a complete electrical single line drawing showing the main service, sub panels and disconnecting means as applicable, and proposed EV charging unit, include; size of overcurrent protection devices (in amperes) for main service, sub panels, disconnects and EV charger circuit supply, show conduit sizes and types, and conductor sizes and types.
        - ii. Provide a trenching detail and call out trench work in the scope of work on the plan if trenching is required. Trenching may result in a structural plan review if conduit trenches undermine foundations.
        - iii. Note electrical feeder requirements when trenching structure to structure (CEC 225). The feeder from structure to structure should be noted in the scope of work. Verify that trenching is in compliance of minimum cover requirements for wiring methods or circuits (18" for direct burial per CEC 300).
        - iv. Provide EVSE manufacturer's specification sheets showing Nationally Recognized Testing Laboratory (NRTL) approved listing mark for indoor or outdoor (UL 2202/UL 2594).
- ☐ **Electrical Load Calculation Worksheet**
    - i. Include existing and proposed load to estimate if existing electrical service will handle the new load from EVCS and wiring methods. Note: Unless electrical service equipment is 100% rated, the calculated load demand on the main

service shall not exceed 80% of the nameplate rating of the main service over-current protection device (OCPD).

***All plans and documents listed above must be provided for multi-unit dwelling electric vehicle charging stations at time of permit submittal prior to issuance.**

<u>Pre-Installation Work</u>

1. Determine units to be installed. Follow all manufacturer specifications for installation. Must be NRTL listed and suitable for the location, indoor or outdoor.

2. Conduct site assessment and submit quote to customer for approval of work and utility upgrades or new service if applicable. Assess the site for:
   a. All electrical system elements (main service, sub-panels, disconnecting means, etc.)
   b. Current electrical code deficiencies
   c. Existing electrical load
   d. Wet and dry utility locations (affecting trench paths for electrical)
   e. Presence of corrosive conditions (e.g. salt air, etc.) affecting recommended equipment
   f. Water drainage (to avoid locating EVCS in areas with possible standing water)
   g. Site accessible parking, and / or accessibility of proposed EVCS
      i. Site slope at proposed EVCS location
      ii. Surface conditions
      iii. Access path(s) connectivity to on-site uses
   h. Visibility of proposed EVCS from uses on site, and/or from public rights-of-way (safety)
   i. Site lighting for use of EVCS and general safety
   j. Placement of EVCS to serve only one versus multiple parking stalls (dependent on hosts intended use of the EVCS)
   k. EVCS protection from vehicle damage through proper placement, and then physical protection (e.g. wheel stops, bollards)
   l. EVCS orientation
      i. Facilitating ease of human interface
      ii. Minimizing sun exposure on digital screens
      iii. Facilitating ease of cable management
   m. Placement and/or screening of electrical support equipment (e.g. transformers, meter pedestals/cabinets, etc.) as it relates to site aesthetics
   n. Need for signage and / or stenciling at the EVCS location(s), and / or as directional signage on large sites

3. Complete permit application from local jurisdiction and electrical load calculation for proposed stations (Include load calculations for EVCS):
   a. Mandatory requirements for new construction in new multifamily dwellings of 17 or more units to be EV Capable. 3% of the total parking spaces, but not less than one, shall be capable for supporting future EVCS. (CALGreen Code Section 4.106.4.2)

4. Contact electrical utility for service work order for utility upgrades/notification of new service. File Service and Meter Request Form.
   a. Ensure utility work order is approved. Any work on the utility side of the electric service requires a work order and disconnect/re-connect.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

b. Following utility approval, permit is approved, issued and appropriately posted.

5. Construction plans indicate requirements for types of wiring and installation siting. Show compliance with requirements of NFPA 70, CEC Article 625.

6. Construction plans show compliance with the California Building Code Title 24, Part 2, Section 11B-812 and Section 11B-228.

   a. Signage for EVCS (International Symbol of Accessibility (ISA) signage for ADA accessible spots be provided in compliance with Section 11B-812.8).
   b. For a facility for public and common use, minimum number of EVCS required to comply with Section 11B-812.

Equipment and Scheduling

7. Schedule all necessary contract work for installation of new service (if applicable), and pulling wires from electric panel(s) / meter pedestals to parking structure(s) or lot(s):
   a. Boring, trenching, concrete and/or paving restoration if these operations are included in project scope
   b. Indoor-rated EVCS can be installed in a garage (CEC 625.29)
   c. Outdoor installations require outdoor-rated EVCS (CEC 625.30)
   d. Coordinate with property manager, Homeowners Association, property owner(s), and/or tenants for scheduling installation

8. Coordinate with the utility for markings of existing power lines, gas lines or other infrastructure is completed and utilize "call before you dig" services (811), service upgrade, new service/meter pull.

Installation

9. Secure the construction area appropriately (e.g. temporary fencing, barriers and signage) for safe working conditions. Prepare mounting surface prior to installation.

10. Remove material to run conduit and/or wiring (i.e., drywall, insulation, pavers, concrete, pavement, earth, etc.).

11. Install rough electrical conduit, boxes and fittings, subpanels etc. in walls, ceilings, floors and trenches to be covered.

12. Request a rough inspection from the building inspection office prior to covering any rough electrical installations.

13. Install charging unit(s) per manufacturer instructions and permitted construction plans. (CEC 110.3)

    a. Install circuit conductors of appropriate size to comply with rating of the overcurrent protection. Securely fasten wiring to the structure. (CEC 300.11, CEC 210.19, CEC 215.2(A), CEC 110.3(B); CEC 310.15(B))

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

b. Identify and install properly sized equipment grounding conductor with the branch circuit. Connect at the EVCS and panelboard or service. (CEC 250.110, 112, 114, 119, 120, 122; CEC 300.3(B))

c. Bring grounded conductor to the service disconnect and bond to the enclosure. (CEC 250.24 (C))

d. Install overcurrent protection for any newly installed service equipment and conductors. (CEC 230.90, 91)

e. Install disconnect in proper readily accessible location for EVCS that is rated more than 60 amperes or more than 150 Volts to ground (CEC 625.23) If additional service disconnects are installed, verify that they are grouped and do not exceed the maximum number of service disconnects. (CEC 230.71, 72)

f. Identify branch circuit device and disconnects. (CEC 408.4 (A); CEC 110.22(A))

g. Install properly sized supply-side bonding jumpers. (CEC 250.50, 104(A) and (B))

14. Install wheel blocks/safety bollards as needed, and per approved plans. (CEC 110.27(B))

15. Perform finish work to repair existing surfaces, infrastructure, and landscaping, and parking lot striping (if applicable).

16. Make electrical connection and schedule for inspection with local jurisdiction Building Inspector

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

San Diego Commercial Installation Checklist

INSTALLATION CHECKLIST FOR NON-RESIDENTIAL ELECTRIC VEHICLE CHARGING STATION (EVCS)

Adapted from materials developed by SANDAG, available at http://www.sandag.org/pluginsd

Installations must be completed by a licensed electrical contractor (C-10). (Local Regulations, California Electrical Code CEC Article 625) Plans must show conformance with the California Electrical Code Title 24, Part 3, the California Building Code (Volume 1 and 2), Title 24, Part 2, and other applicable local municipal codes.

Submittal Documents required*

- ☐ **Permit Application**
  - a. Include job address (a unique address for the EVCS installation that is used for billing), parcel number, existing use, description of work, name, address, and contact information of the applicant and the owner.
- ☐ **Plan Sets (#, size of plans)**
  - a. **Site/Plot Plan**
    - i. Show full property extent (property lines, parking areas, structures, etc.).
    - ii. List relevant property information, such as existing parking counts and ratios.
    - iii. Provide a detailed site plan showing where the charging unit is located within the parking garage or lot, and any necessary accessibility improvements
    - iv. As required by type of EVCS, installation mounting method, and local jurisdiction requirements provide necessary structural details.
  - b. **Electrical Plan**
    - i. Provide a complete electrical single line drawing showing the main service, sub panels and disconnecting means as applicable, and proposed EV charging unit, include; size of overcurrent protection devices (in amperes) for main service, sub panels, disconnects and EV charger circuit supply, show conduit sizes and types, and conductor sizes and types.
    - ii. Provide a trenching detail and call out trench work in the scope of work on the plan if trenching is required. Trenching may result in a structural plan review if conduit trenches undermine foundations.
    - iii. Note electrical feeder requirements when trenching structure to structure (CEC 225). The feeder from structure to structure should be noted in the scope of work. Verify that trenching is in compliance of minimum cover requirements for wiring methods or circuits (18" for direct burial per CEC 300).

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

iv. Provide EVSE manufacturer's specification sheets showing Nationally Recognized Testing Laboratory (NRTL) approved listing mark for indoor or outdoor (UL 2202/UL 2594).

- **Electrical Load Calculation Worksheet**
  a. Include existing and proposed load to estimate if existing electrical service will handle the new load from EVCS and wiring methods Note: Unless electrical service equipment is 100% rated, the calculated load demand on the main service shall not exceed 80% of the nameplate rating of the main service over-current protection device (OCPD).

***All plans and documents listed above must be provided for non-residential electric vehicle charging stations at time of permit submittal prior to issuance.**

<u>Pre-Installation Work</u>

1. Determine unit to be installed. Follow all manufacturer specifications for installation. Must be NRTL listed and suitable for the location, indoor or outdoor.

2. Conduct site assessment and submit quote to customer for approval of work and utility upgrades or new service if applicable. Assess the site for:

   a. All electrical system elements (main service, sub-panels, disconnecting means, etc.)
   b. Current electrical code deficiencies
   c. Existing electrical load
   d. Wet and dry utility locations (affecting trench paths for electrical)
   e. Presence of corrosive conditions (e.g. salt air, etc.) affecting recommended equipment
   f. Water drainage (to avoid locating EVCS in areas with possible standing water)
   g. Site accessible parking, and / or accessibility of proposed EVCS
      i. Site slope at proposed EVCS location
      ii. Surface conditions
      iii. Access path(s) connectivity to on-site uses
   h. Visibility of proposed EVCS from uses on site, and/or from public rights-of-way (safety)
   i. Site lighting for use of EVCS and general safety
   j. Placement of EVCS to serve only one versus multiple parking stalls (dependent on hosts intended use of the EVCS)
   k. EVCS protection from vehicle damage through proper placement, and then physical protection (e.g. wheel stops, bollards)
   l. EVCS orientation
      i. Facilitating ease of human interface
      ii. Minimizing sun exposure on digital screens
      iii. Facilitating ease of cable management
   m. Placement and/or screening of electrical support equipment (e.g. transformers, meter pedestals/cabinets, etc.) as it relates to site aesthetics

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

n. Need for signage and/or stenciling at the EVCS location(s), and / or as directional signage on large sites

3. Complete permit application from local jurisdiction and electrical load calculation for proposed stations:
    a. Mandatory requirements for new construction to be EV Capable (CALGreen Code Section 4.106.4 and 5.106.5.3)

    b. Comply with zoning setbacks and easements. (Local Regulations)

4. Contact electrical utility for service work order for utility upgrades/notification of new service. File Service and Meter Request Form.

    a. Ensure utility work order is approved. Any work on the utility side of the electric service requires a work order and disconnect/re-connect.
    b. Following utility approval, permit is approved, issued and appropriately posted.

5. Construction plans show compliance with the California Building Code Title 24, Part 2, Section 11B-812 and Section 11B-228:
    a. Signage for EVCS (International Symbol of Accessibility (ISA) signage for accessible spots be provided in compliance with Section 11B-812.8)
    b. For a facility for public and common use, minimum number of EVCS required to comply with Section 11B-812.

6. Construction plans must show compliance with requirements of NFPA 70, CEC Article 625.

<u>Equipment and Scheduling</u>

7. Schedule all necessary contract work for installation of new service (if applicable), and pulling wires from electric panel/meter pedestal to parking structure or lot:
    a. Boring, trenching, concrete and/or paving restoration
    b. Coordinate with building managers, tenants and/or property owner(s) for scheduling installation, including site cleanup/closeout

8. Coordinate with the utility for markings of existing power lines, gas lines or other infrastructure is completed and utilize "call before you dig" services (811), service upgrade, new service/meter pull.

<u>Installation</u>

9. Secure the construction area appropriately (e.g. temporary fencing, barriers and signage) for safe working conditions. Prepare mounting surface prior to installation.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

10. Remove material to run conduit and/or wiring (i.e., drywall, insulation, pavers, concrete, pavement, earth, etc.).

11. Install rough electrical conduit, boxes and fittings, subpanels etc. in walls, ceilings, floors and trenches to be covered.

12. Request a rough inspection from the building inspection office prior to covering any rough electrical installations.

13. Install charging unit(s) per manufacturer instructions and permitted construction plans. (CEC 110.3)

    a. Install circuit conductors and wiring of appropriate size to comply with rating of the overcurrent protection. Securely fasten wiring to the structure. (CEC 300.11, CEC 210.19, CEC 215.2(A), CEC 110.3(B); CEC 310.15(B))

    b. Identify and install properly sized equipment grounding conductor with the branch circuit. Connect at the EVCS and panelboard or service. (CEC 250.110, 112, 114, 119, 120, 122; CEC 300.3(B))

    c. Bring grounded conductor to the service disconnect and bond to the enclosure. (CEC 250.24 (C))

    d. Install overcurrent protection for any newly installed service equipment and conductors. (CEC 230.90, 91)

    e. Install disconnect in proper readily accessible location for EVCS that is rated more than 60 amperes or more than 150 Volts to ground (CEC 625.23) If additional service disconnects are installed, verify that they are grouped and do not exceed the maximum number of service disconnects. (CEC 230.71, 72)

    f. Identify branch circuit device and disconnects. (CEC 408.4 (A); CEC 110.22(A))

    g. Install properly sized supply-side bonding jumpers. (CEC 250.50, 104(A) and (B))

14. Install wheel blocks/safety bollards as needed, and per approved plans. (CEC 110.27(B))

15. Perform finish work to repair existing surfaces, infrastructure, and landscaping, and parking lot striping (if applicable).

16. Make electrical connection and schedule for inspection with local jurisdiction Building Inspector.

Center for Sustainable Energy Plug-in SD Installation Best Practices Report

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

NECA Inspection Checklist

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE) INSPECTION CHECKLIST

Key Concerns for Electric Vehicle Supply Equipment Inspections

1. Is the appropriate permit secured and is there a plan and calculation as required by the AHJ?
2. What type of electric vehicle supply equipment (EVSE) is being installed (i.e. Level 1, Level 2, other)?
3. Where is the EVSE located in relation to the charging location and the service or supply source?
4. Is the EVSE listed by an NRTL and are the installation instructions available for reference?
5. Is the EVSE going to be cord-and-plug connected (and so listed) or direct wired to an individual branch circuit?
6. What amount of voltage and current is required for the type of EVSE (nameplate information)?
7. Is the EVSE securely mounted to the structure and individual branch circuit wiring installed per NEC?
8. Is the properly sized equipment grounding conductor connected and proper overcurrent protection provided?
9. Does the service or source have adequate capacity for the load served?
10. Are separate utility meter(s) and/or service disconnecting means installed for special utility rates?

INSPECTION CHECKLIST (non-inclusive)

EVSE Inspection Activity Details

	Item	Inspection Activity	Code Reference	Comments
	1.	Verify permit is posted and all plans, calculations and installation instructions are available as required. May require use of examples in NEC Chapter 9. A calculation may be required to determine adequate capacity.	Local Regulations and NEC 90.8, 220.12, 220.14, 220.16, 220.82	
	2.	Verify that the EVSE is listed by an NRTL and installation instructions are provided.	NEC 90.7, 625.5, 110.3(B)	
	3.	Verify the EVSE location and that it is securely fastened to the structure and guarded from physical damage as required.	NEC 110.13, 110.27(B), 625.29, 625.30	
	4.	Determine if EVSE is directly wired to the branch circuit or is cord-and-plug connected. Must be listed for cord-and-plug connection. Individual receptacle reqd.	NEC 110.3(B), 625.13, 625.18, 625.19, 625.29	
	5.	Verify an individual branch circuit is installed for the EVSE. Applies to Level 1, Level, 2, and fast chargers. Branch circuit and feeders (if applicable) must be sized 125% of nameplate current.	NEC Article 100 continuous load, 210.19(A)(1), 215.2(A), 625.21	
	6.	Verify installed branch circuit wiring method is listed and securely fastened to the structure. Listed wiring and fittings must be installed. Check fished and surface wiring.	NEC 300.11 and the applicable .30 section of article	
	7.	Verify the size of the branch circuit overcurrent protection is per nameplate and protects the conductors.	NEC 110.3(B), 240.4	
	8.	Verify circuit conductors are sized not less than 125% of EVSE nameplate current. Be sure that the conductor ampacity complies with the rating of the overcurrent protection.	NEC 210.19(A)(1), 215.2(A), 110.3(B), Table310.15(B)(16), 310.15(B).	
	9.	Verify properly sized equipment grounding conductor is installed with the branch circuit and connected at the EVSE and to panelboard or service. Verify the equipment grounding conductor is identified.	NEC 250.110, 250.112, 250.114, 250.120, 300.3(B), 250.119, 250.122.	

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

	10.	Check the electrical connections of the circuit conductors and equipment grounding conductor connections.	NEC 110.14, 250.148(A) Annex I	
	11.	Verify disconnecting means is provided and properly located for EVSE rated greater than 60 amperes and 150 volts.	NEC 625.23	
	12.	Verify installation of EVSE is in a neat and workmanlike manner.	NEC 110.12, NECA 1, NECA 413	
	13.	Verify existing service conductors are of adequate size. For Level 2 EVSE installations, identify any existing service conductor sizes that might have been installed using NEC 310.15(B)(7) and Table 310.15(B)(7)	NEC 230.31, 230.42, 310.15(B)(7) and Table 310.15(B)(7)	
	14.	Verify circuit breaker compatibility with existing panelboard or service equipment. Must be manufactured by the panelboard or service equipment manufacturer.	NEC 110.3(B), Article 240 Part VII, Article 408 part I	
	15.	Branch circuit device and any disconnects must be identified as to the use.	NEC 408.4(A), 110.22(A)	
	16.	Where separate utility metering and enclosures are installed, verify NEC compliance for service equipment and conformance to applicable utility regulations.	Utility company regulations and NEC Article 230	
	17.	Verify equipment is suitable for connection to the line side of the service disconnecting means.	NEC 230.82	
	18.	Verify sufficient working space is provided at EVSE, Panelboards, service equipment, and disconnects.	NEC 110.26	
	19.	Verify additional service disconnects (if installed) are grouped.	NEC 230.72	
	20.	Verify the maximum number of service disconnects has not been exceeded	NEC 230.71	
	21.	Verify that any additional service disconnect is properly rated.	NEC 230.79	
	22.	Verify the wiring method used for the additional service conductors installed.	NEC 230.43	
	23.	Verify that additional service disconnects are properly identified.	NEC 230.70(B)	
	24.	Verify service disconnect is listed as suitable for use as service equipment.	NEC 230.70(C)	
	25.	Verify the overcurrent protection for any newly installed service equipment and conductors.	NEC 230.90, 230.91	
	26.	Verify grounded conductor (neutral) is brought to the service disconnect and bonded to the enclosure.	NEC 250.24(C)	
	27.	Verify metal service equipment enclosures and raceways are bonded together effectively.	NEC 250.92, 250.92(B)	
	28.	Supply-side bonding jumpers are sized properly	NEC 250.102(C), 250.66	
	29.	Verify existing service grounding and bonding.	NEC 250.50, 250.104(A) and (B)	
	30.	Verify EVSE that is intended to be used as interactive systems, bi-directional, or optional standby systems be listed for that purpose.	NECA Articles 702 and 705	

* *Note: These items included in the checklist are non-inclusive and are to serve as a guide or basis for inspection. They do not include any local Code requirements or regulations.*

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

Governor's Office of Planning and Research (OPR) General Permitting Checklist

Plug-In Electric Vehicle Infrastructure Permitting Checklist

Snapshot: Once a local government decides what information to require in an electric vehicle supply equipment (EVSE) permit application, it is a best practice to combine requirements and guidance into a single document that can guide plug-in electric vehicle owners through the process. This document should contain information on the conditions under which an EVSE permit is required, EVSE permit application requirements, the number and type (e.g., preinstallation, postinstallation) of inspections required and applicable codes and guidance regarding EVSE installation. The California Plug-In Electric Vehicle Collaborative created the following checklist.

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

<table>
<tr><th colspan="3">Permitting Checklist</th></tr>
<tr><th></th><th>Residential</th><th>Non-Residential</th></tr>
<tr><td rowspan="2">Phase 1
Pre-Work Contractor</td><td>✓ Understands intended use of the EVSE (i.e. personal)</td><td>✓ Obtain an address for the location
✓ Determine the ownership of the site and/or authorization to install equipment at site
✓ Understands intended use of the EVSE (i.e., fleet, employee, customer, visitor, etc.)
✓ Determine number of vehicles charging and connectors per charging station
✓ Determine source of power and authorization to use source</td></tr>
<tr><td colspan="2">✓ Determine type of vehicle(s) to be charged at EVSE
✓ Evaluate mounting type options (i.e., bollard, pole-mount, wall-mount, ceiling-mount)
✓ Clarify communication requirements (i.e., Ethernet, cellular, Wi-Fi, none or other)
✓ Determine the NEMA Enclosure type
✓ Determine the physical dimensions of the space(s)
✓ Inspect the type of circuit breaker panel board intended for the installation</td></tr>
<tr><td>Phase 2
Pre-Work Customer</td><td colspan="2">✓ Identify incentives or rate structures through the utility
✓ Determine size of electrical service at the site
✓ Identify and contact applicable local permit office(s) to identify specific requirements, including local fire, environmental, construction, building, concealment and engineering requirements
✓ Identify incentives available through local, state or federal programs
✓ Contact insurance company to acquire additional insurance or separate coverage as needed
✓ Hire the contractor and verify credentials with all subcontractors; ensure electrical contractor's license for electrical work is current</td></tr>
<tr><td>Phase 3
On-Site Evaluation</td><td colspan="2">✓ Verify EVSE meets UL requirements and is listed by UL or another nationally recognized testing laboratory
✓ Verify EVSE has an appropriate NEMA rated enclosure (NEC 110.28) based on environment and customer needs, such as weatherization or greater levels of resistance to water and corrosive agents
✓ Determine the level or charger meets customer's PEV requirements (most vehicles require the maximum of a 240V/32A (40A breaker)
✓ Based on proposed EVSE location, determine if cord length will reach a vehicle's charging inlet without excessive slack and does not need to be more than 25' in length (NEC 625.17)
✓ Cord management methodologies have been considered to reduce the risk of tripping hazards and accidental damage to the connector
✓ Mounting type selection based on requirements to meet site guidelines
✓ Determine whether EVSE communication options are beneficial to customer and/or local utility</td></tr>
<tr><td>Phase 4
On-Site Survey</td><td>✓ Ensure overhead doors and vehicle parking spot do not conflict with EVSE location
✓ Place EVSE in a location convenient to charging port on vehicle and</td><td>✓ Space(s) should be visible to drivers and pedestrians
✓ Determine proximity to building entrance (could be considered an incentive for PEV use)</td></tr>
</table>

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

	typical orientation of the vehicle in garage (i.e., backed in or head-first) ✓ Ensure functionality of lighting in the garage to meet NEC code 210-70	✓ Select spaces proximate to existing transformer or panel with sufficient electrical capacity ✓ EVSE installation should maintain a minimum parking space length to comply with local zoning requirements ✓ If available, use wider spaces to reduce the risk of cord damage and minimize the intersection of cords with walking paths ✓ Ensure sufficient lighting at proposed space(s) to reduce the risk of tripping and damage to charging station from vehicle impact or vandalism; light levels above two foot candles are recommended ✓ Address accessibility requirements (refer to the Plug-In Electric Vehicle Infrastructure and Equipment Accessibility section of the Guidebook for more information) ✓ Determine availability of space for informative signing ✓ EVSE with multiple cords should be placed to avoid crossing other parking spaces ✓ All available charging station mounting options should be considered and optimized for the space ✓ Determine if hazardous materials were located at the site PARKING DECKS ✓ Place EVSE towards the interior of a parking deck to avoid weather-related impacts on equipment PARKING LOTS ✓ Avoid existing infrastructure and landscaping to mitigate costs, potential hazards and other negative impacts ON-STREET ✓ Install on streets with high foot and vehicle traffic to mitigate vandalism ✓ Avoid existing infrastructure to mitigate costs, potential hazards and other negative impacts ✓ Address accessibility requirements (refer to the Plug-In Electric Vehicle Infrastructure and Equipment Accessibility section of the Guidebook for more information) ✓ For pull-in spaces, EVSE should be placed in front of the space and either centered on the space if placed between two spaces (if

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

<table>
<tr><td rowspan="2"></td><td></td><td>two connectors are available); EVSE with more than two connectors should not be used in on-street applications
✓ For parallel parking locations, the charging station should be installed at the front third of the parked vehicle and based on the direction of traffic flow; EVSE with a single connector is recommended to reduce potential trip hazards</td></tr>
<tr><td colspan="2">✓ Mount the connector at a height between 36" and 48" from the ground (NEC 625.29) unless otherwise indicated by the manufacturer
✓ Install wall or pole-mount stations and enclosures at a height between 36" and 48"
✓ Ensure sufficient space exists around electrical equipment for safe operation and maintenance (NEC 110.26); recommended space is 30" wide, 3' deep and 6'6" high
✓ Minimize tripping hazards and utilize cord management technologies when possible
✓ Equipment operating above 50 volts must be protected against physical damage (NEC 110.27); ensure the vehicle is out of the line of vehicle travel and use wheel stops or other protective measures
✓ EVSE must be located such that ADA routes maintain a pathway of 36" at all times</td></tr>
<tr><td>Phase 4
Contractor Installation Preparation</td><td colspan="2">✓ Price quote submitted to customer and approved including utility upgrades
✓ Order equipment
✓ Provide stamped engineering calculations as needed
✓ Provide site plan modification with diagrams as necessary
✓ Complete all necessary service upgrades and/or new service assessments
✓ Complete permit applications as required by local permitting department
✓ Ensure permit is approved and collected
✓ Schedule all necessary contract work (i.e., boring, concrete and/or paving restoration) and utility work (i.e., utility marking, service upgrade, new service and/or meter pull)
✓ Ensure utility marking of existing power lines, gas lines or other infrastructure is completed and utilize "call before you dig" services</td></tr>
<tr><td rowspan="2">Phase 5
Installation</td><td>✓ Residential garages may permit the use of nonmetallic-sheathed cable in lieu of conduit</td><td>✓ Run conduit from power source to station location
✓ For EVSE greater than 60 amperes, a separate disconnect is required (NEC 625.23) and should be installed concurrently with conduit and visible from the EVSE</td></tr>
<tr><td colspan="2">✓ Post permit at site in visible location
✓ Remove material to run conduit and/or wiring (i.e., drywall, insulation, pavers, concrete, pavement, earth, etc.
✓ Contractors are encouraged to examine requirement for installation sites and types of wiring in Chapter 3 of the NEC
✓ Pull wiring; charging stations require a neutral line and a ground line and equipment is considered to be a continuous load
✓ Conductors should be sized to support 125% of the rated equipment load (NEC 625.21)
✓ Preparing mounting surface and install per equipment manufacturer instructions
✓ Floor-mount: typically requires a concrete foundation with J-bolts on station base; place with space to allow conductors to enter through the base
✓ Wall/pole/ceiling-mount: install brackets for mounting of the equipment</td></tr>
</table>

Figure 4: EVCS Permitting, Codes and Standards Resources (cont'd)

	✓ Install bollard(s) and/or wheel stop(s) as needed ✓ Install informative signage to identify the EVSE and potential trip hazards ✓ Install additional electrical panels or subpanels as needed ✓ Install service upgrades, new service and/or new meter as needed; utility may also pull a meter to allow for charging station wires to be connected to a panel ✓ Make electrical connection ✓ Perform finish work to repair existing infrastructure, surfaces and landscaping
Phase 6 Inspection	✓ An initial electrical inspection by applicable building, fire, environmental and electrical authorities should occur after conduit has been run and prior to connecting equipment and running wires; if necessary, contractor should correct any issues and schedule a second rough inspection ✓ If required, the inspector will perform a final inspection to ensure compliance with NEC and other codes adopted within the jurisdiction by inspecting wiring, connections, mounting and finish work ✓ Contractor should verify EVSE functionality
Additional Resources	✓ National Codes and Standards ✓ American National Standards Institute (ANSI) ✓ National Fire Protection Association (NFPA) ✓ Underwriters Laboratories, Inc. (UL) ✓ International Association of Electrical Inspectors (IAEI) ✓ International Code Council (ICC) ✓ NECA-NEIS Standards ✓ NECA and NFPA Webinars ✓ Electrical Vehicle Infrastructure Training Program (EVITP) Installer Training Course/Certification

Source: Redwood Coast Energy Authority

Appendix B: Accessible EVCS Fact Sheets

Figure 5 shows information about accessible EVCS locations.

Figure 5: Accessible EVCS Fact Sheets

Accessible Electric Vehicle Charging Stations

This guide applies to Electric Vehicle Charging Stations (EVCS) that will be installed in existing parking lots and intended for use by the general public.

Photo by the Town of Danville, California

EV drivers with disabilities need to have access to EVCS, but the best way to ensure this access is still evolving. Changes to the 2016 edition of the California Building Code include requirements for accessible EVCS.[1]

As of January 2017, the requirements described in this fact sheet will represent California Building Code requirements regarding the installation of electric vehicle charging stations.

Design

If the EVCS will be available for use by the public, the first station needs to be accessible by EV drivers with disabilities. Code will require the first EVCS to be installed at a "van accessible" space. While this first space is designed to be van accessible, it is available for use by all EV drivers and not placarded for exclusive use by disabled EV drivers.[2] **Installation of an EVCS at an existing ADA parking space will not satisfy this requirement.[3]**

- Van accessible requirements as shown in Figure 1:
  - 216 inches long minimum
  - 144 inches wide minimum
  - Adjacent to an access aisle on the passenger's side.
  - The access aisle is at least 60 inches wide.
- The access aisle for the EVCS space can be shared with another accessible parking space.

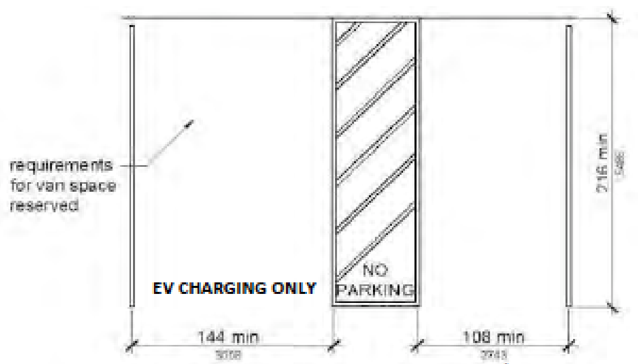


Figure 1, On-site EVCS Spaces Dimensions.[4]

- Access aisles need to be on the same level as the parking space and have no more than a 1:48 slope in any direction.
- An accessible route needs to be provided between the EVCS space and the EV Service Equipment[4]

---

[1] See the 2016 CBC at: http://codes.iccsafe.org/app/book/toc/2016/California/Building%20Volume%201/index.html

[2] When less than five EVCS are installed. When five or more are installed, the van accessible space becomes ADA exclusive. 11B-812.8.2 http://codes.iccsafe.org/app/book/toc/2016/California/Building%20Volume%201/index.html

[3] This is DSA's interpretation of the proposed code as provided by Dennis Corelis, Deputy State Architect: California Department of General Services, Division of the State Architect. Personal email communication, February 4th, 2016.

[4] PEVs: Universal Charging Access, Pg 9. www.opr.ca.gov/docs/PEV_Access_Guidelines.pdf

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Figure 5: Accessible EVCS Fact Sheets (cont'd)

EVCS Thresholds

Total Number of EVCS at the Facility	Van Accessible: 144 inches wide	Standard Accessible: 108 inches wide
1 to 4	1	0
5 to 25	1	1

Table 1, EVCS Thresholds[1]

Accessibility requirements vary based on the number of EVCS installed.

The code considers the number of EVCS equivalent to the number of EVs that can charge simultaneously.

As shown in Table 1, if four or fewer stations will be installed, one needs to be van accessible. If between five and 25 stations will be installed, one station needs to be van accessible and one needs to be standard accessible.

Configuration

Installing one accessible EVCS (with two charging heads) will require reconfiguration of three standard parking spaces. The following examples show how to maximize space while accommodating an accessible EVCS.

- In Figure 2, two EVs can be charged simultaneously.
- The first space needs to be van accessible, while the second has no accessibility requirements.
- The access aisle for the van accessible EVCS space can be shared with a standard accessible parking space.

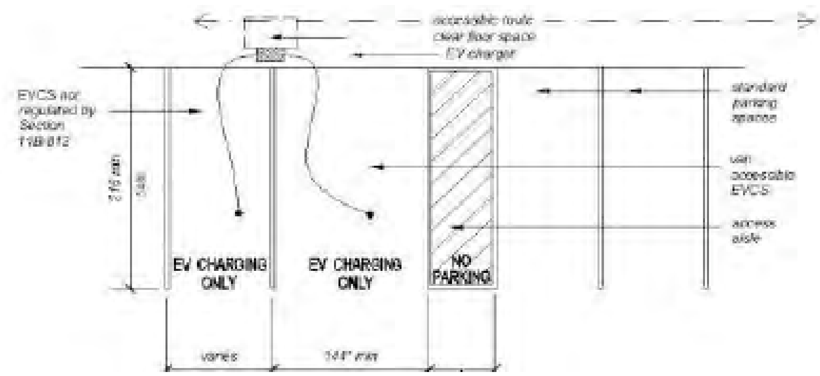

Figure 2, Configuration with two EVCS[2]

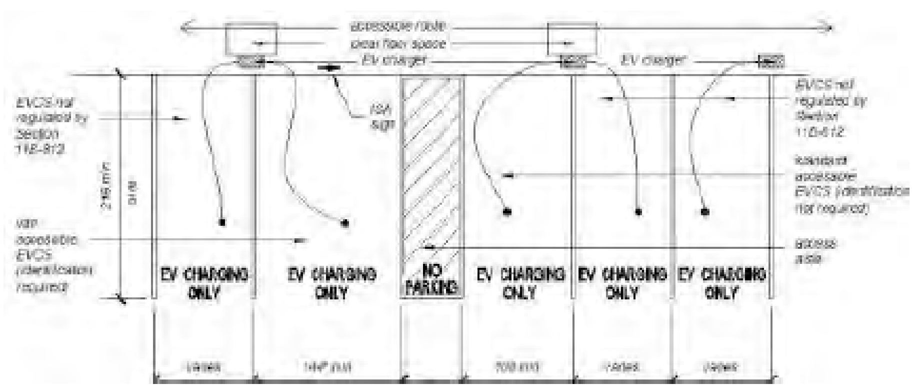

Figure 3, Configuration with five EVCS[3]

- In Figure 3, five EVs can be charged simultaneously.
- One space needs to be van accessible and one needs to be standard accessible.
- The van accessible space is now reserved for ***exclusive use*** by EV drivers with disabilities.

---

[1] TABLE 11B-228.3.2.1 Electric Vehicle Charging Stations for Public and Common Use, Pg. 81, www.documents.dgs.ca.gov/dsa/access/2016-Pt2_Final-Express-Terms_12-22-15.pdf

[2] Access California, presentation by Dennis Corelis, DSA. Slide 18. www.pevcollaborative.org/webinars

[3] Access California, presentation by Dennis Corelis, DSA. Slide 21. www.pevcollaborative.org/webinars

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Figure 5: Accessible EVCS Fact Sheets (cont'd)

Signage

Two signs need to be displayed at the accessible space:

- A standard EV charging sign
- A sign stating the space is "Van Accessible"
- **Even though the first space is designed for disabled access, it is available for use by the general public when less than five stations are installed.[1]**

MUTCD # D9-6p

MUTCD # D9-11b (alternate)

Accessible route illustration[3]

Location

Unlike regular accessible parking, accessible EVCS spaces are not required to be on the shortest accessible route to a facility. While they must be on an accessible route and should be as close as possible to the facility, other factors such as the location of electric infrastructure and terrain features may determine their final placement. An accessible path of travel is defined as a "continuous, unobstructed way of pedestrian passage"[2] from the EVCS to the facility.

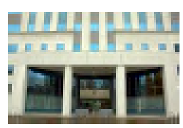
This accessible path requirement only applies to EVCS serving accessible parking spaces. For example, if a site host wanted to install to install two dual-head EVCS, only one would need to be located on an accessible route. The placement of the remaining EVCS is up to the site host.[3]

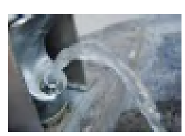
Primary Function

Beyond accessibility to the EVCS, requirements for additional accessibility upgrades differ based on the facility's "primary function". The primary function is a major activity for which the facility is intended. If the facility's primary function is not vehicle fueling, recharging, parking or storage and the installation does not affect access to the facility, no other ADA upgrades are required.[4]

If the facility's primary function is vehicle fueling, recharging, parking or storage, path of travel upgrades are required when installing an EVCS. Path of travel elements include services offered by the facility to the public. If not already in compliance, these elements need to be upgraded[5]:

- The facility's primary entrance
- The route to the EVCS
- Toilet and bathing facilities
- Drinking fountains
- Public telephones
- Signage



Freeimages.com

[1] 11B-812.8.2 Where five to twenty-five total EVCS are provided, one van accessible EVCS shall be identified by an ISA. http://codes.iccsafe.org/app/book/toc/2016/California/Building%20Volume%201/index.html

[2] See 49 CFR § 37.43 (2013)

[3] See Part 2, Chapter 11B-202.4, Exception 10:codes.iccsafe.org/app/book/toc/2016/California/Building%20Volume%201/index.html

[4] Federal 2010 ADA standards require "path of travel" upgrades for alterations, but make an exception for projects that do not affect the usability or accessibility of the facility. See chapter 11B-202.4 of the California Building Code.

[5] See Item 11B.51.03, pg. 79 codes.iccsafe.org/app/book/toc/2016/California/Building%20Volume%201/index.html

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Figure 5: Accessible EVCS Fact Sheets (cont'd)

For facilities with pull-through fueling, an accessible route must be provided to all path of travel elements present at the location. If none of these elements are present, an accessible route should be provided to a pedestrian walkway if some of these elements can be found nearby (i.e. a coffee shop located a few blocks away).[1]

To reduce the financial burden on site hosts, for projects with costs below the "valuation threshold" (currently $105,244) the code **limits the cost of accessibility upgrades to 20% of the total project cost.** For example:

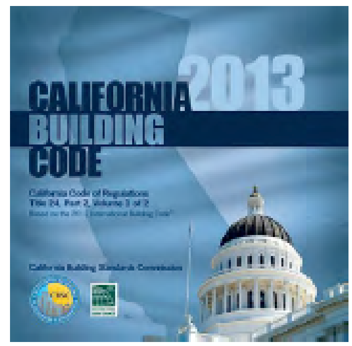
Project Cost	Maximum Cost of Upgrades
$10,000	$2,000
$100,000	$20,000

* If all of the path of travel elements cannot be upgraded within the 20% budget, the preceding list is in order of priority. For projects with costs above the valuation threshold, a single code compliant path of travel serving the area of alteration is required. If the cost of full compliance would make the project financially infeasible, the code allows the enforcing agency to make a finding of "unreasonable hardship" on a case-by-case basis to limit the cost of upgrades, with 20% of the project cost as a minimum.[2]

Safe Harbor

To reduce the burden of upgrading path of travel elements, the code will use a "Safe Harbor" exception.

- If any path of travel elements were in compliance with the immediately preceding edition of the California Building Code, they do not need to be upgraded.[3]
- For example, if the bathroom facilities are in compliance with the 2013 California Building Code, and an EVCS is installed, no upgrades are required.
- They also address a grievance process for "unreasonable hardship".



©California Building Standards Commission

For general information about electric vehicle charging in the North Coast region, please contact:

REDWOOD COAST EnergyAuthority

(707) 269-1700
www.redwoodenergy.org
info@redwoodenergy.org

For more information about accessible EVCS, please consult:

The 2016 California Building Code, Title 24, Part 2.
http://codes.iccsafe.org/app/book/toc/2016/California/Building%20Volume%201/index.html

A presentation by the Division of the State Architect on the proposed changes:
http://www.pevcollaborative.org/sites/all/themes/pev/files/DSA_EVCS%20Webinar%2009%20Sep%202015.pdf

[1] In response to a proposed unmanned fueling station scenario, explained by Dennis Corelis, Deputy State Architect: California Department of General Services, Division of the State Architect. Personal email communication, January 22nd, 2016.

[2] For more information on unreasonable hardship, see section (b)(4)(iii) of 28 CFR 35.151 found in the 2010 ADA Standards for Accessible Design: www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm

[3] For more information on the safe harbor exception, see section (b)(4)(ii)(c) of 28 CFR 35.151 found in the 2010 ADA Standards for Accessible Design: www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm

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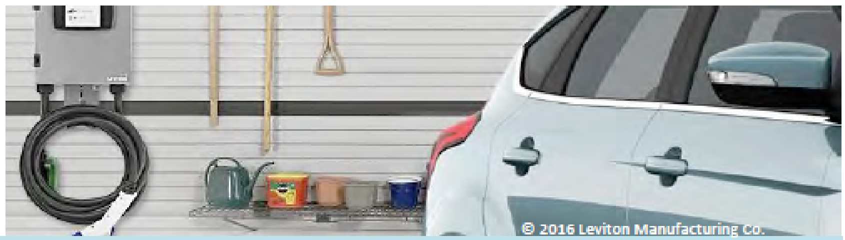
Source: Redwood Coast Energy Authority

Appendix C:
City of Eureka and Humboldt County EVCS Permitting Guides

Figure 6 shows the permitting guides for EVCS installation in the City of Eureka and the County of Humboldt

Figure 6: City of Eureka and Humboldt County EVCS Permitting Guides

EUREKA
CALIFORNIA



Plug-In Electric Vehicle Residential Charging

Considering a plug-in electric vehicle? Going electric has many advantages:

- Zero tailpipe emissions result in better air quality and community health
- Fewer greenhouse gas emissions per mile traveled
- Supports clean energy job creation
- In California it costs on average $1.50 per gallon equivalent to run an electric vehicle
- Incentives may be available: check out **driveclean.ca.gov/pev/Incentives.php**

Choose a **Battery Electric Vehicle (BEV)** that exclusively relies on a battery or a **Plug-In Hybrid Electric Vehicle (PHEV)** that uses both a battery-electric system and a gasoline engine.

Ditch gas and take advantage of special rates on electricity

When charging at home, PG&E provides you with a number of rate options:

- **Keep your existing PG&E plan** and pay your existing rate for electricity you use to charge your vehicle.
- **Choose a whole house rate for a shared EV-A meter** with a "time-of-use" billing rate for both the house and the vehicle. Time-of-use charging offers a lower rate for charging at night compared to the day.
  - The EV-A rate eliminates tiered rates for the whole household so that EV drivers are not penalized for an increase in electricity consumption. We recommend this rate for most EV drivers.
- **Choose a separate EV-B meter** to install a dedicated time-of-use meter just for your vehicle.

Many electric vehicle owners elect to install a level 2 charger at home as opposed to using their existing level 1 wall outlets in order to receive a quicker charge.
Note that a network of level 2 and DC fast chargers are available for use while driving during the day, e.g., charge at the supermarket while grocery shopping or overnight while staying at a hotel.

Types of Electric Vehicle Charging Stations

	Vehicle Type	Approximate Charge Time	Voltage
LEVEL 1	All PHEVs and BEVs	5 miles/ hour of charge	120V e.g. Standard Outlet
LEVEL 2	All PHEVs and BEVs	13-25 miles/ hour of charge	240V e.g. Dryer Outlet
DC FAST CHARGING	Most Battery Electric Vehicles, check with auto manufacturer for details	30 minutes for 80% of a full charge	480V e.g. non-residential

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Figure 6: City of Eureka and Humboldt County EVCS Permitting Guides (cont'd)

Step 1: Assessment

- Research your vehicle's charging specifications. What voltage is the onboard charger capable of? (Most are capable of receiving 240V.)
- Make sure your car will fit completely on your property while it is charging. It must be clear of the sidewalk. (When attached to the side of a building, the charging system must be at least 3' from the property line.)
- Have your electrical system assessed by a licensed electrician to determine if any upgrades are needed.
- Choose a level 2 charger that meets your needs. For example, you may need it to be outdoor-rated. Visit https://pluginamerica.org/get-equipped/charging/ for detailed comparisons of charging options.
- Determine which jurisdiction your property is in, i.e. City of Eureka or the County. If your property is on the outskirts of the city, it may be administered by the County.
- Contact City of Eureka Building (707) 441-4155 and Planning (707) 441-4160 and/or Humboldt County Building (707) 445-7245 and Planning (707) 445-7541 to determine jurisdiction and permitting requirements.

Step 2: Permitting

- Contact PG&E to apply for service and learn more about rate options. Call 1-877-743-7782.
- Apply for the required permit(s) with the City of Eureka or the County, depending on your property's jurisdiction. (The fee for the building permit will be approximately $300, part to be paid before the work and part after.)
- Once the permit is obtained, work with your electrical contractor to install the level 2 charger.

Step 3: Approval

- Contact PG&E to set-up rate and/or service. Call 1-877-743-7782.
- Work with your electrical contractor to obtain a final inspection from the City of Eureka or the County once the permitted work is complete. Call (707) 441-4155 for City of Eureka or (707) 445-7245 for the County.

Note: a coastal permit may also be required for projects located in the Coastal zone.

- The fee for a coastal permit, if required, will be approximately $300.

Permit Application Submittal Requirements:

To determine your project's permitting requirements, contact the City of Eureka **Building (707) 441-4155** and **Planning (707) 441-4160** or the Humboldt County Building (707) 445-7245 and Planning (707) 445-7541 departments, depending on your property's jurisdiction. The agency may be able to issue a permit over-the-counter. If not, agency staff can determine what information will need to be submitted to permit your project. Information that may be required includes, but is not limited to:

- Size (height, width and depth) of charging system, with a single one-line electrical plan;
- Type of charging system: level 1/level 2, with approved product listing agency number (i.e., UL);
- Manufacturer's specifications, installation guidelines, and, if applicable, ventilation requirements;
- Existing panel rating, proposed charging load & calculations for systems over 240V and/or 40A;
- If installing an EV-B meter, meter must be labeled as "PEV Charging Only."
- Assessor's parcel number (APN)

Application Submittal:

Depending on your jurisdiction, you may submit your application(s) to and obtain your permits from:

- City of Eureka building and/or planning departments on the 3rd floor of City Hall, 531 K Street, Eureka. The department hours are 8:00 a.m. to noon and 1:00 p.m. to 5:00 p.m. Monday through Friday.
- Humboldt County building and/or planning departments at 3015 H Street, Eureka. The department hours are 8:30 a.m. to 5:00 p.m. Monday through Friday.

Resources & Incentives:

City of Eureka Building Department: www.ci.eureka.ca.gov/depts/building/permit.asp
PG&E Information: www.pge.com/electricvehicles
PG&E Bill & Meter Rate Calculator: www.pge.com/pevcalculator
Incentives: driveclean.ca.gov/pev/Incentives.php

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Figure 6: City of Eureka and Humboldt County EVCS Permitting Guides (cont'd)

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- Zero tailpipe emissions result in better air quality and community health
- Fewer greenhouse gas emissions per mile traveled
- Supports clean energy job creation
- In California it costs on average $1.50 per gallon equivalent to run an electric vehicle
- Incentives may be available: check out **driveclean.ca.gov/pev/Incentives.php**

Choose a **Battery Electric Vehicle (BEV)** that exclusively relies on a battery or a **Plug-In Hybrid Electric Vehicle (PHEV)** that uses both a battery-electric system and a gasoline engine.

Ditch gas and take advantage of special rates on electricity

When charging at home, PG&E provides you with a number of rate options:

- **Keep your existing PG&E plan** and pay your existing rate for electricity you use to charge your vehicle.
- **Choose a whole house rate for a shared EV-A meter** with a "time-of-use" billing rate for both the house and the vehicle. Time-of-use charging offers a lower rate for charging at night compared to the day.
  - The EV-A rate eliminates tiered rates for the whole household so that EV drivers are not penalized for an increase in electricity consumption. We recommend this rate for most EV drivers.

Many electric vehicle owners elect to install a level 2 charger at home as opposed to using their existing level 1 wall outlets in order to receive a quicker charge.
Note that a network of level 2 and DC fast chargers are available for use while driving during the day, e.g., charge at the supermarket while grocery shopping or overnight while staying at a hotel.

Types of Electric Vehicle Charging Stations

	Vehicle Type	Approximate Charge Time	Voltage
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Figure 6: City of Eureka and Humboldt County EVCS Permitting Guides (cont'd)

Step 1: Assessment

- Research your vehicle's charging specifications. What voltage is the onboard charger capable of? (Most are capable of receiving 240V.)
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- Have your electrical system assessed by a licensed electrician to determine if any upgrades are needed.
- Choose a level 2 charger that meets your needs. For example, you may need it to be outdoor-rated. Visit https://pluginamerica.org/get-equipped/charging/ for detailed comparisons of charging options.
- Determine which jurisdiction your property is in, i.e. City of Eureka or the County. If your property is on the outskirts of the city, it may be administered by the County.
- Contact Humboldt County Building (707) 445-7245 and Planning (707) 445-7541 to determine jurisdiction and permitting requirements.

Step 2: Permitting

- Contact PG&E to apply for service and learn more about rate options. Call 1-877-743-7782.
- Apply for the required permit(s) with the County. These permits are available over the counter. (The fee for the building permit will be approximately $125, part to be paid before the work and part after.)
- Once the permit is obtained, work with your electrical contractor to install the level 2 charger.

Step 3: Approval

- Contact PG&E to set-up rate and/or service. Call 1-877-743-7782.
- Work with your electrical contractor to obtain a final inspection from the County once the permitted work is complete. Call 707-445-7245.
- **Note: a coastal permit may also be required for projects located in the Coastal zone.**
- The fee for a coastal permit, if required, will be approximately $300.

Permit Application Submittal Requirements:

To determine your project's permitting requirements, contact the Humboldt County Building (707) 445-7245 and Planning (707) 445-7541 departments, depending on your property's jurisdiction. The agency may be able to issue a permit over-the-counter. If not, agency staff can determine what information will need to be submitted to permit your project. Information that may be required includes, but is not limited to:

- Size (height, width and depth) of charging system, with a single one-line electrical drawing;
- Type of charging system: level 1/level 2, with approved product listing agency number (i.e., UL);
- Manufacturer's specifications, installation guidelines, and, if applicable, ventilation requirements;
- Assessor's parcel number (APN)

Application Submittal:

You may submit your application(s) to and obtain your permits from: .

- Humboldt County building and/or planning departments at 3015 H Street, Eureka. The department hours are 8:30 a.m. to 5:00 p.m. Monday through Friday.

Resources & Incentives:

County of Humboldt Planning and Building Departments: http://www.humboldtgov.org/156/Planning-Building
PG&E Information: www.pge.com/electricvehicles
PG&E Bill & Meter Rate Calculator: www.pge.com/pevcalculator
Incentives: driveclean.ca.gov/pev/Incentives.php

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Source: Redwood Coast Energy Authority

Appendix D: Workshop Presentation on EVCS Permitting Codes and Standards

Figure 7 shows a presentation featuring information on EVCS permitting codes and standards.

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

North Coast Plug-in Electric Vehicle Readiness Plan

EV Workshop – EVCS Permitting, Codes, and Standards

Presented by: Jerome Carman

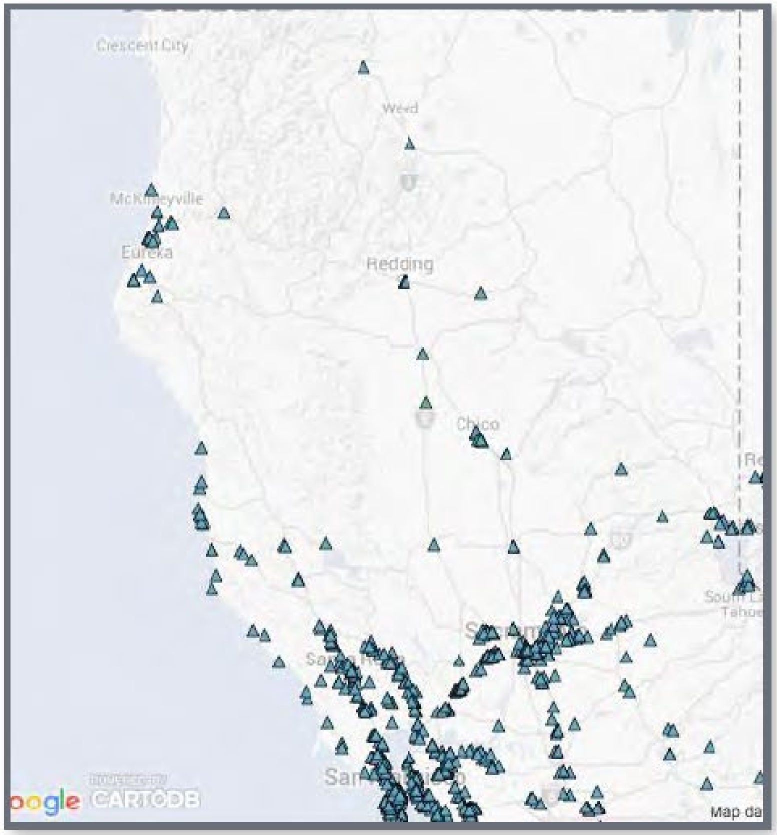
Title: Research Engineer

Contact Info: jerome.carman@humboldt.edu

707-826-4364

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

Agenda



- Sign In
- Introductions
- EVCS Permitting
  - Planning Dept.
  - Short Break
  - Building Dept.
- Break
- ADA Requirements
- Signage
- Codes and Standards
- Parking Rules and Regulations

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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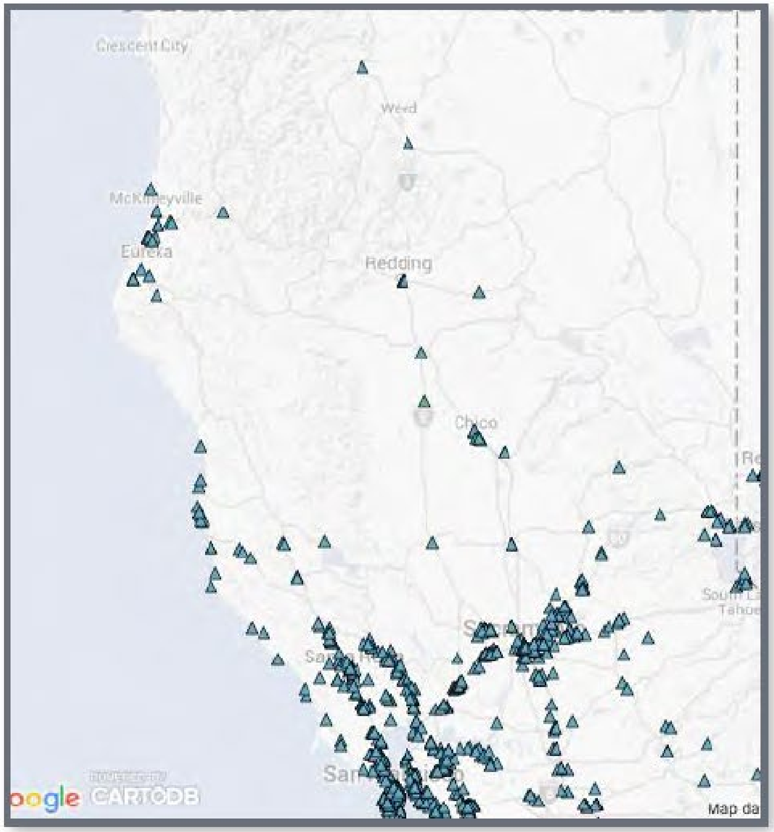
Goals Of This Workshop



- Provide the information and details planning and building department staff need to effectively plan for and permit electric vehicle charging stations
- Provide recommendations for streamlining planning and permitting processes

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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AB 1236 – Streamline Permitting Process

Heads Up → There are permitting and installation checklist templates included in your handout which can be used as a starting point for your local jurisdiction!

AB1236: Passed October 2015 - Bill requires Counties and Cities to adopt an ordinance to streamline and expedite the permitting process for EV charging stations

- September 30, 2017 requirement for smaller cities (population<200,000)
  - Checklist for expedited permit review
  - Publish checklist and permit documents on the web
  - Allow for electronic submittal

See handout for bill language

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

Vocabulary – CBC

EV Charger

Cord Management

User Interface

Plug

EV Charging Station

EV Charger

\+

EV Space

=

EV Charging Station (EVCS)

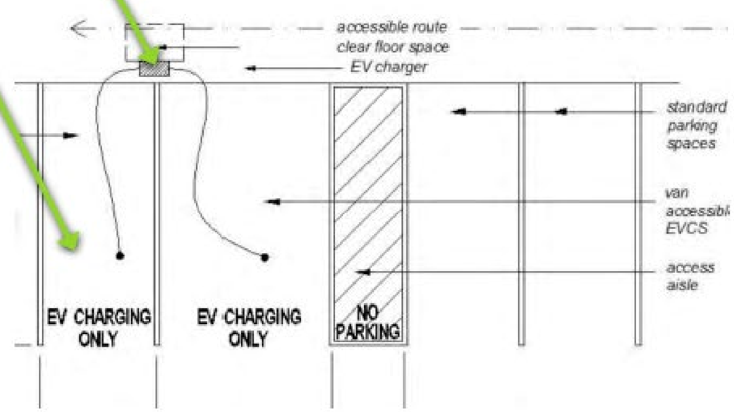

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

Vocabulary - NEC

Electric Vehicle Supply Equipment (EVSE) refers to everything **EXTERNAL** to the vehicle

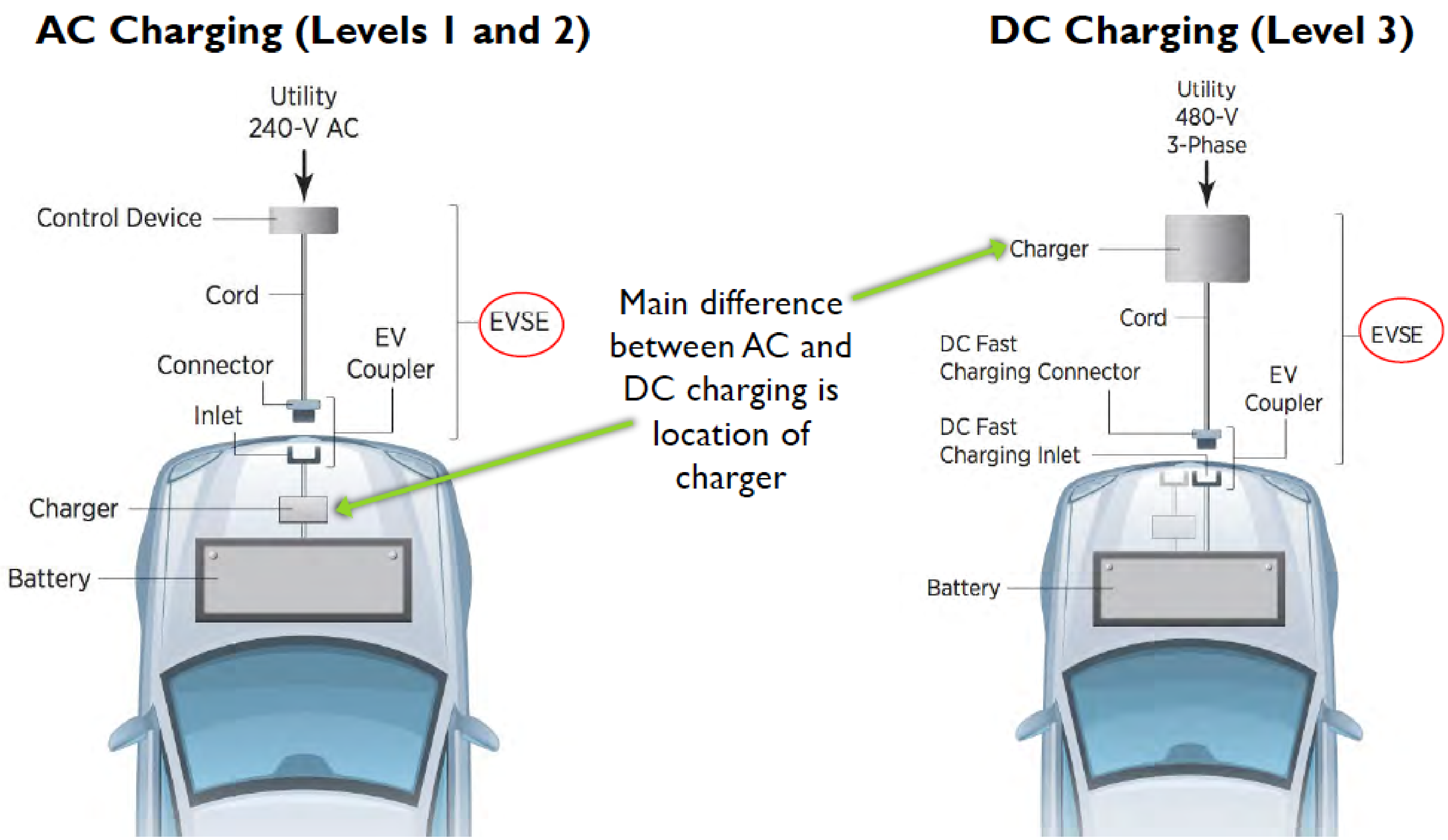

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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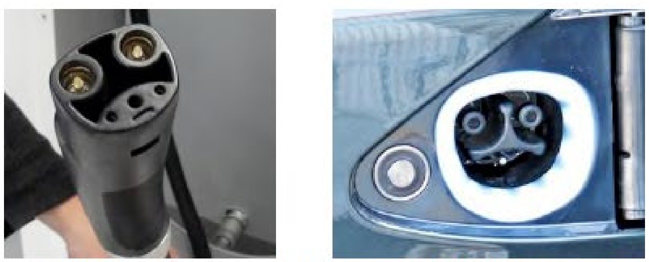
Vocabulary – Plugs and Charging Types

AC Charging (Levels 1 and 2)

SAE J1772: 240VAC, max 19.2kW (80A)



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DC Charging (Level 3)

SAE J1772: 200-500VDC, max 100kW (200A)

CHAdeMO: 200-500VDC, max 150kW (350A)

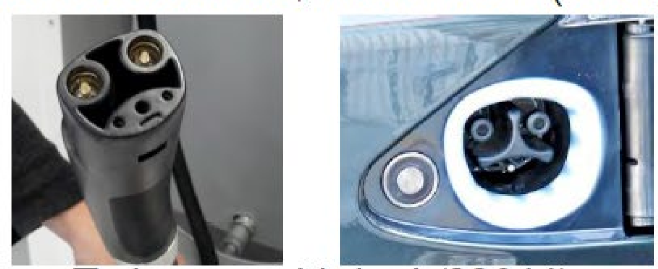

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

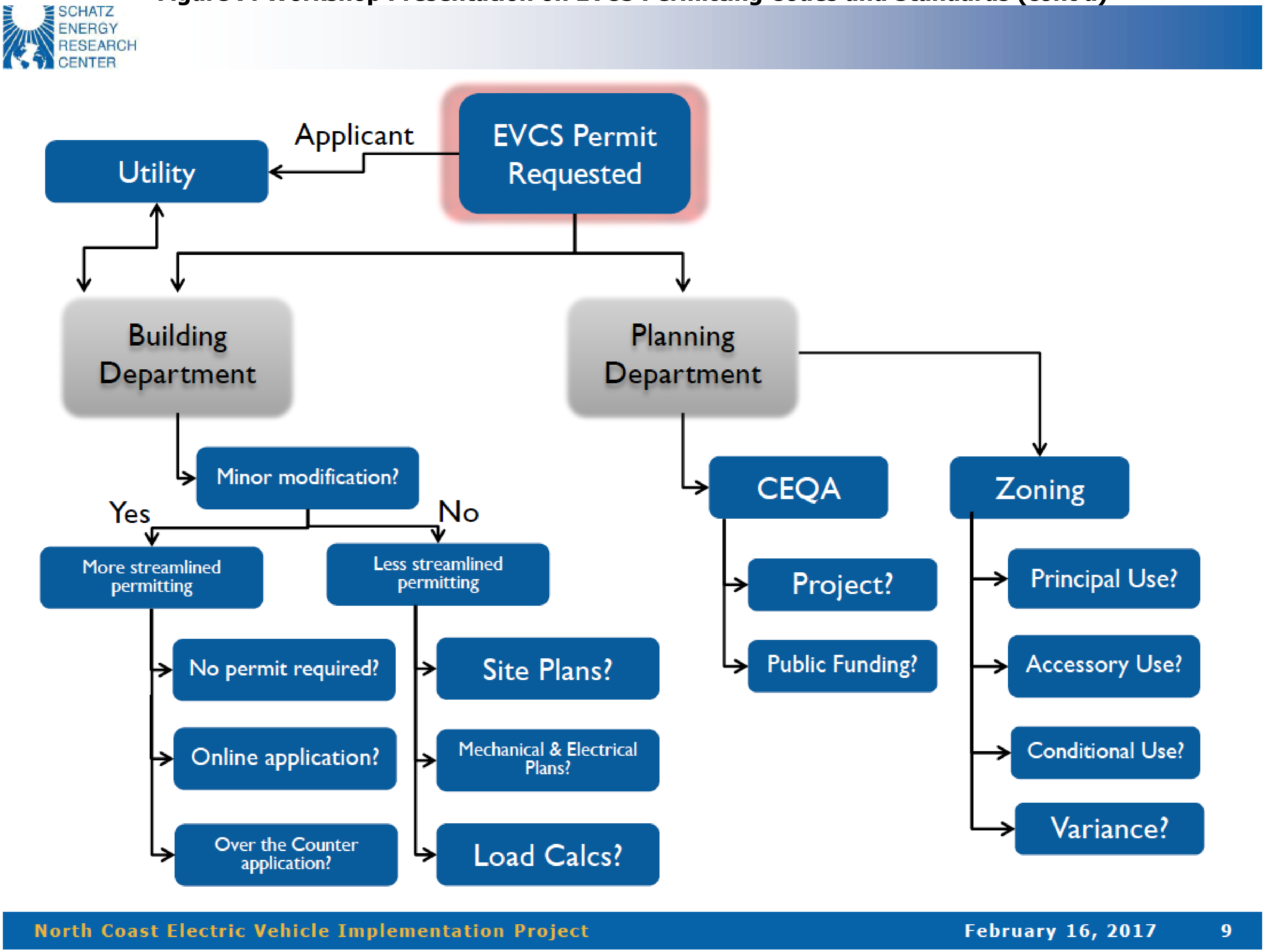

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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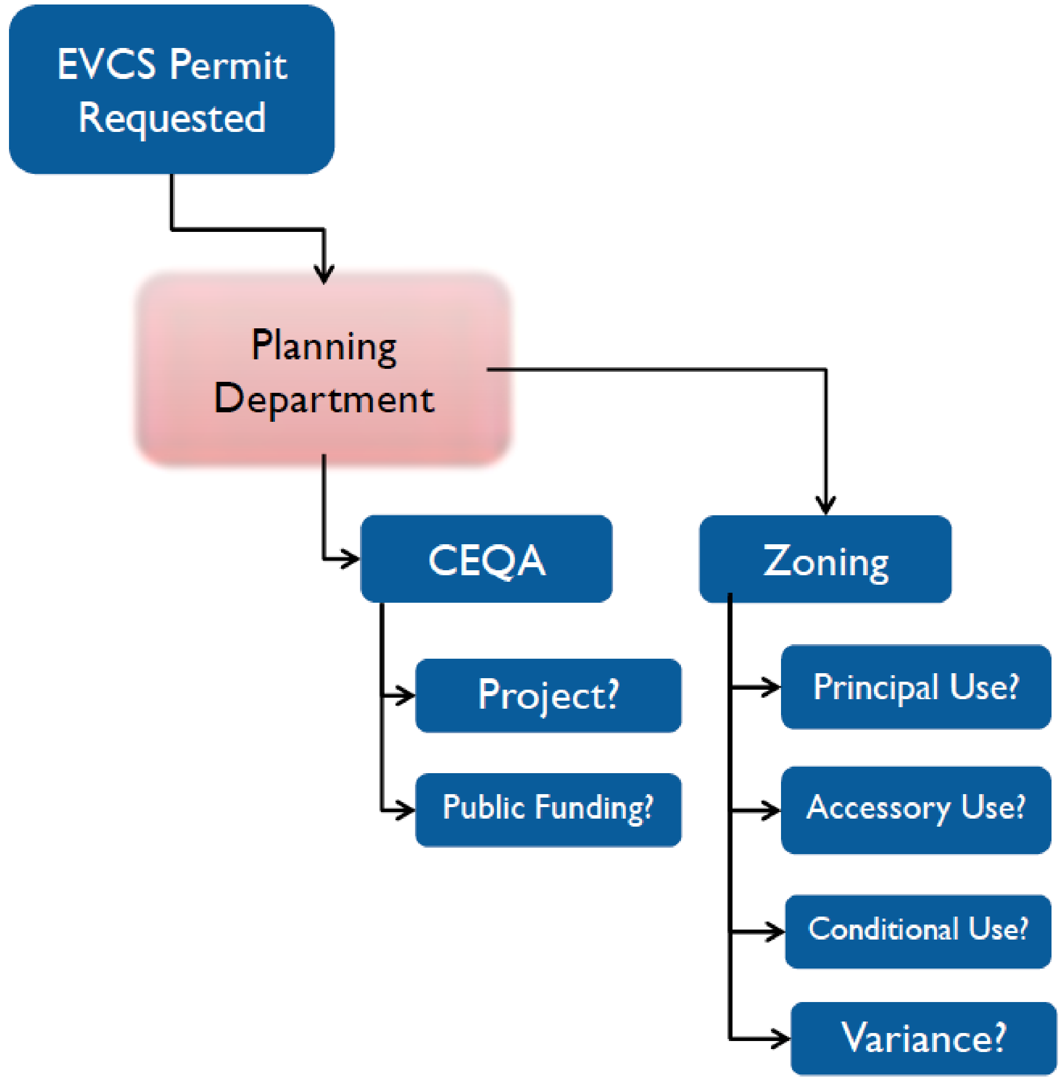

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

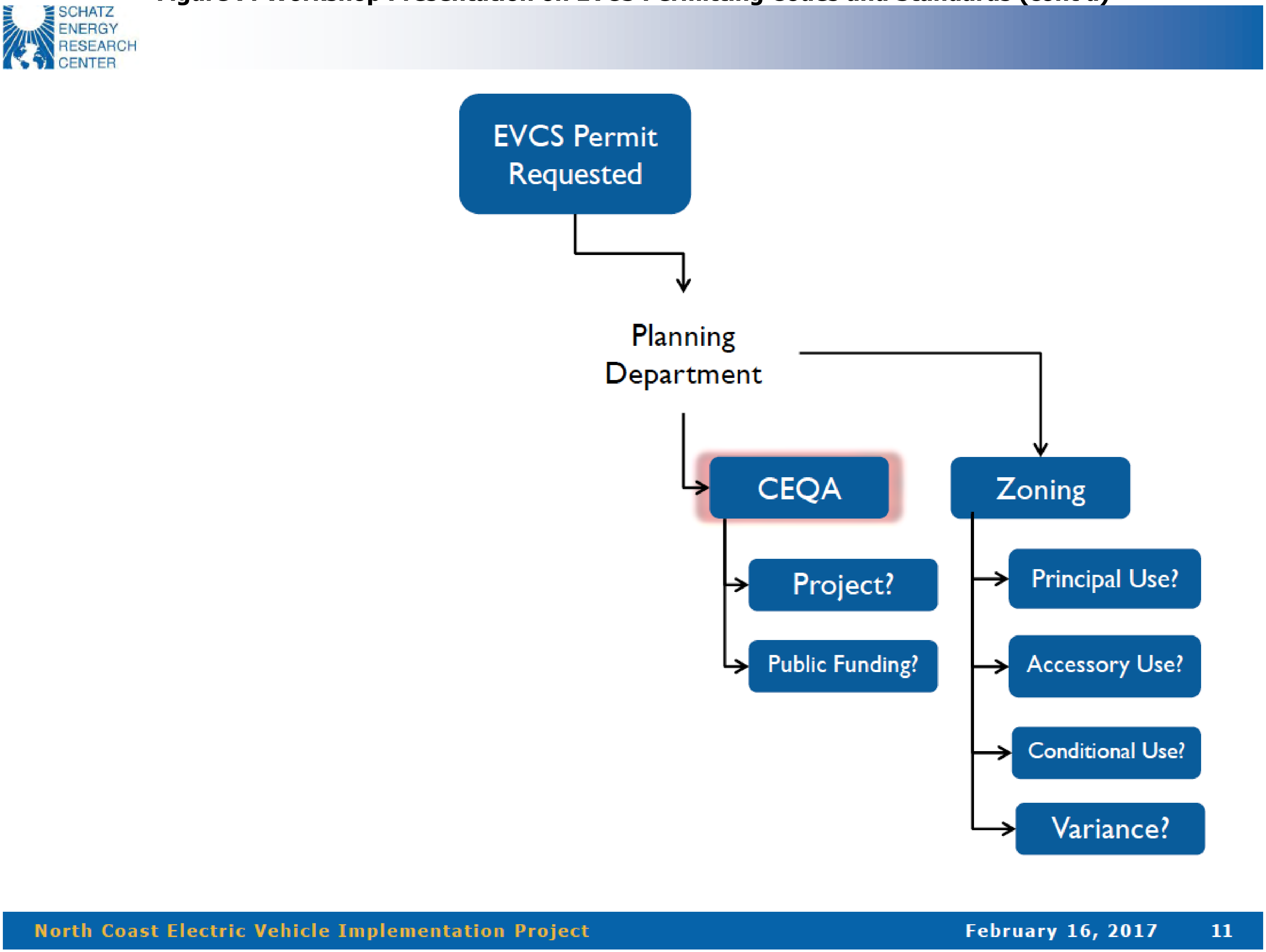

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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CEQA

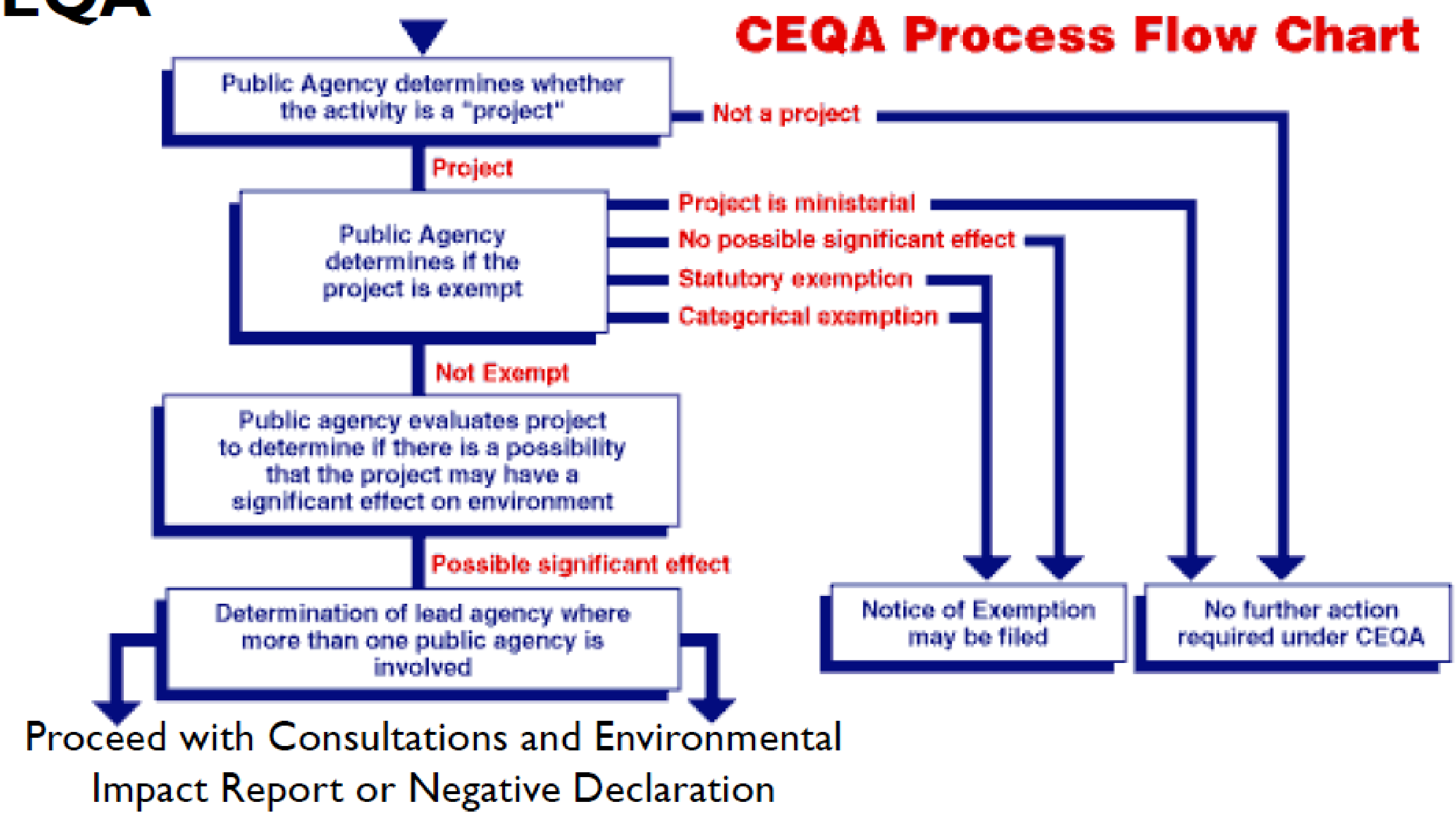

Image Source: http://resources.ca.gov/ceqa/flowchart/

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

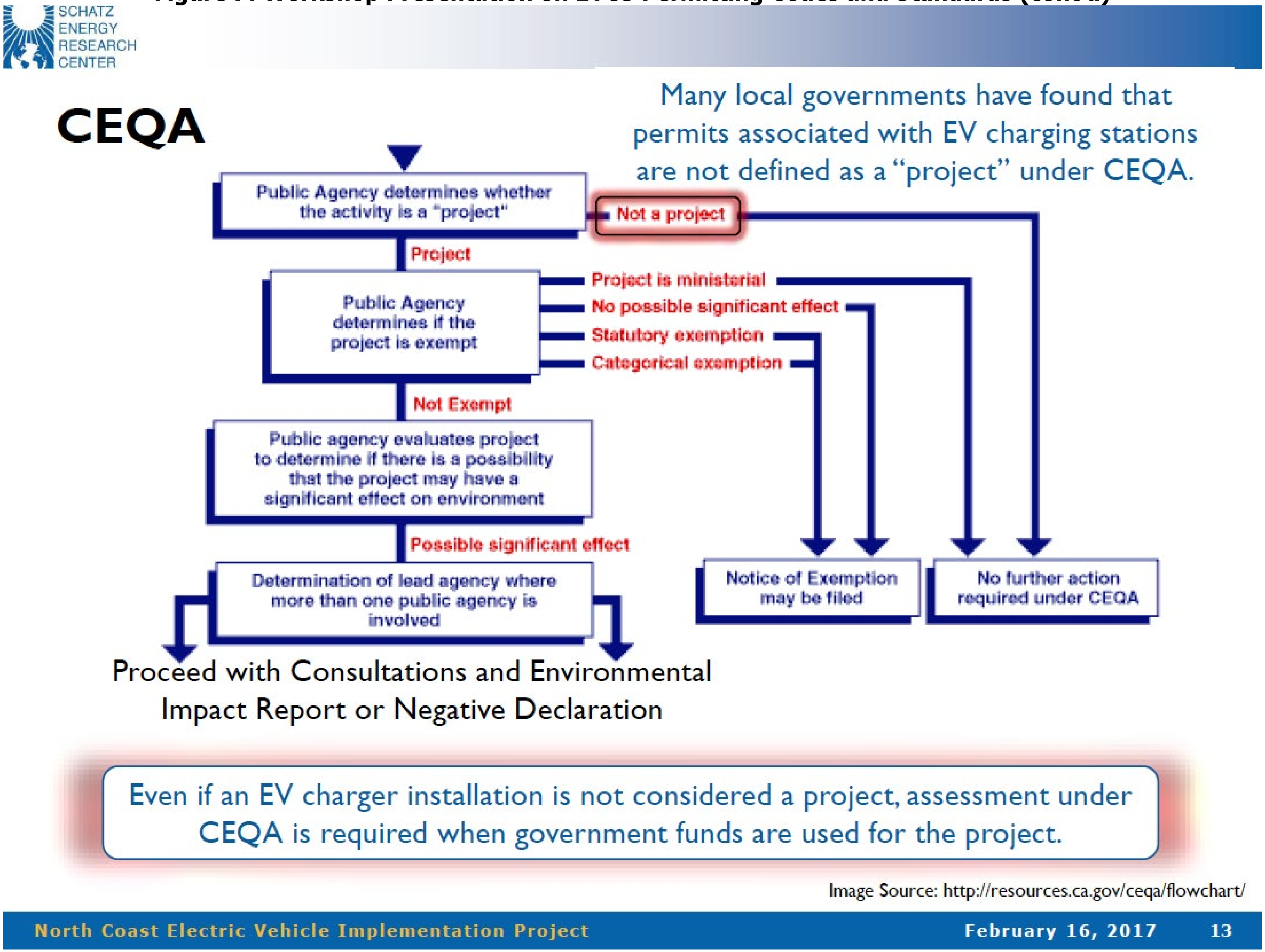

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

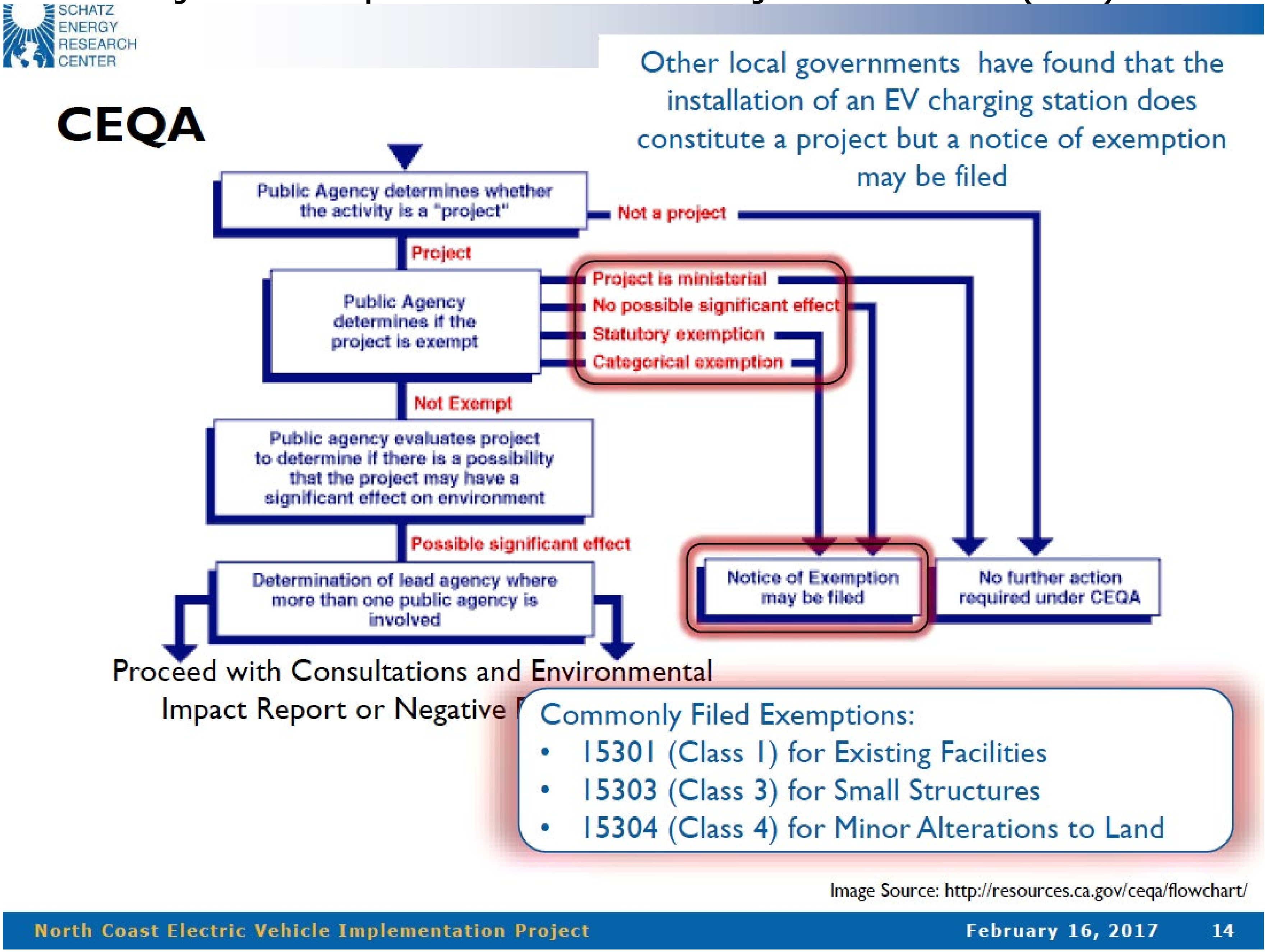

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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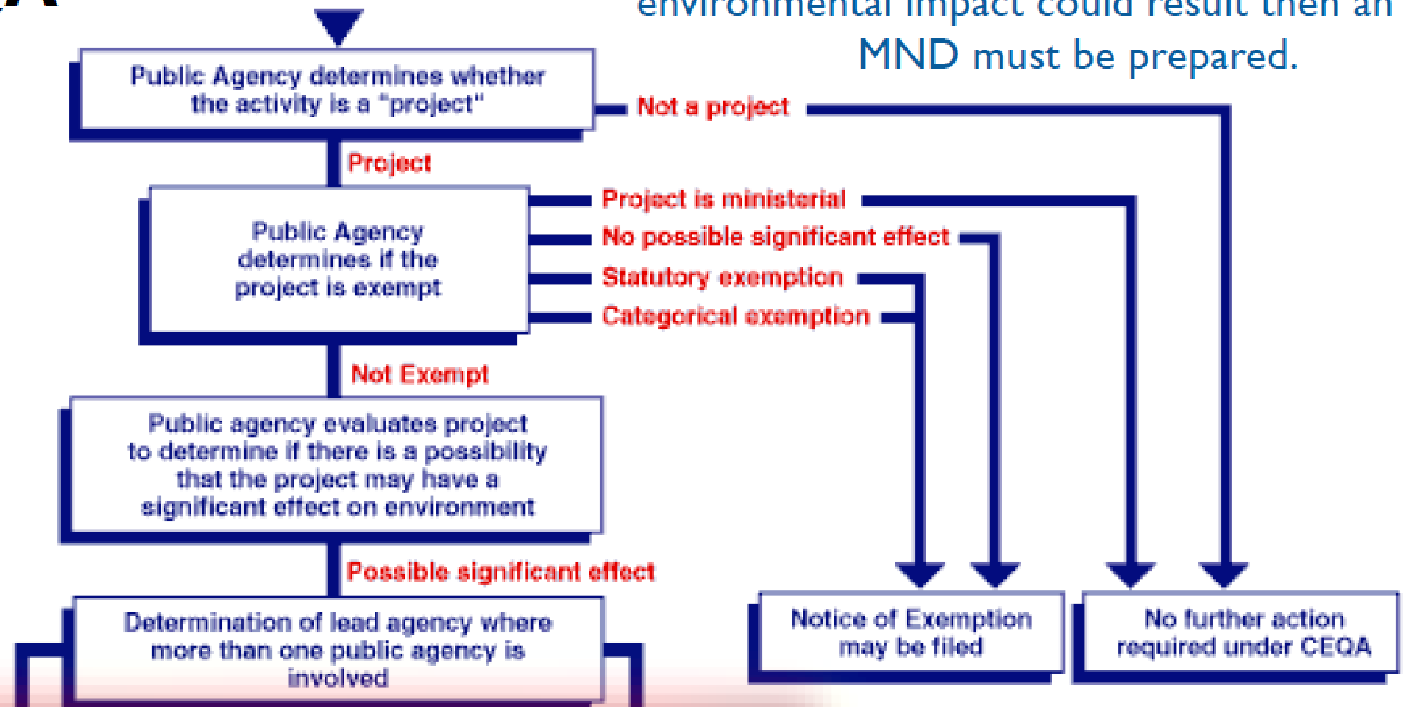
CEQA

If local agency determines that the project is not exempt and that there is a possibility a significant environmental impact could result then an EIR or MND must be prepared.



Proceed with Consultations and Environmental Impact Report or Negative Declaration

Inclusion of electric vehicles in General Plans and Climate Action Plans with programmatic EIRs will allow tiering here which will help streamline this process

Image Source: http://resources.ca.gov/ceqa/flowchart/

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

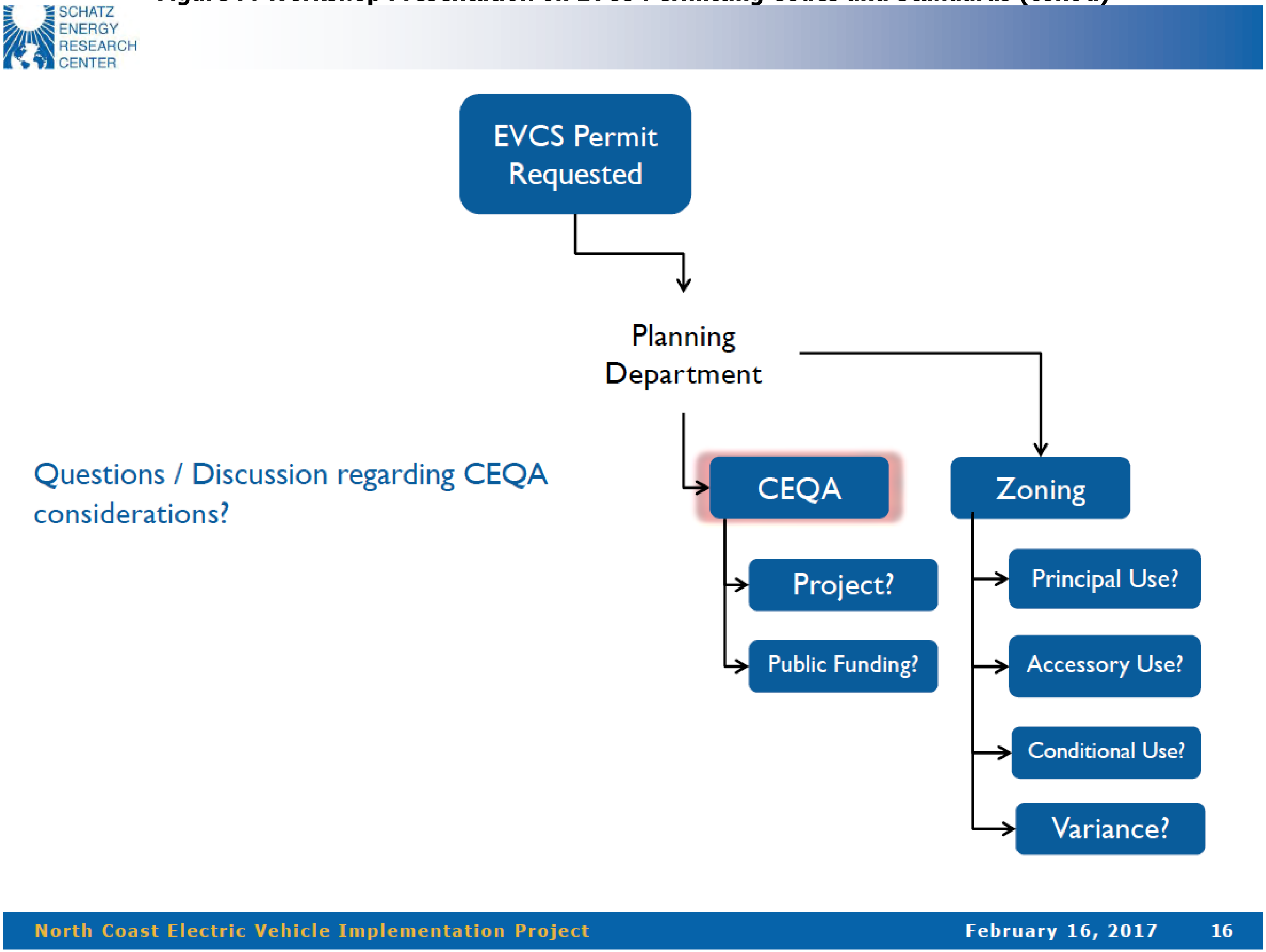

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

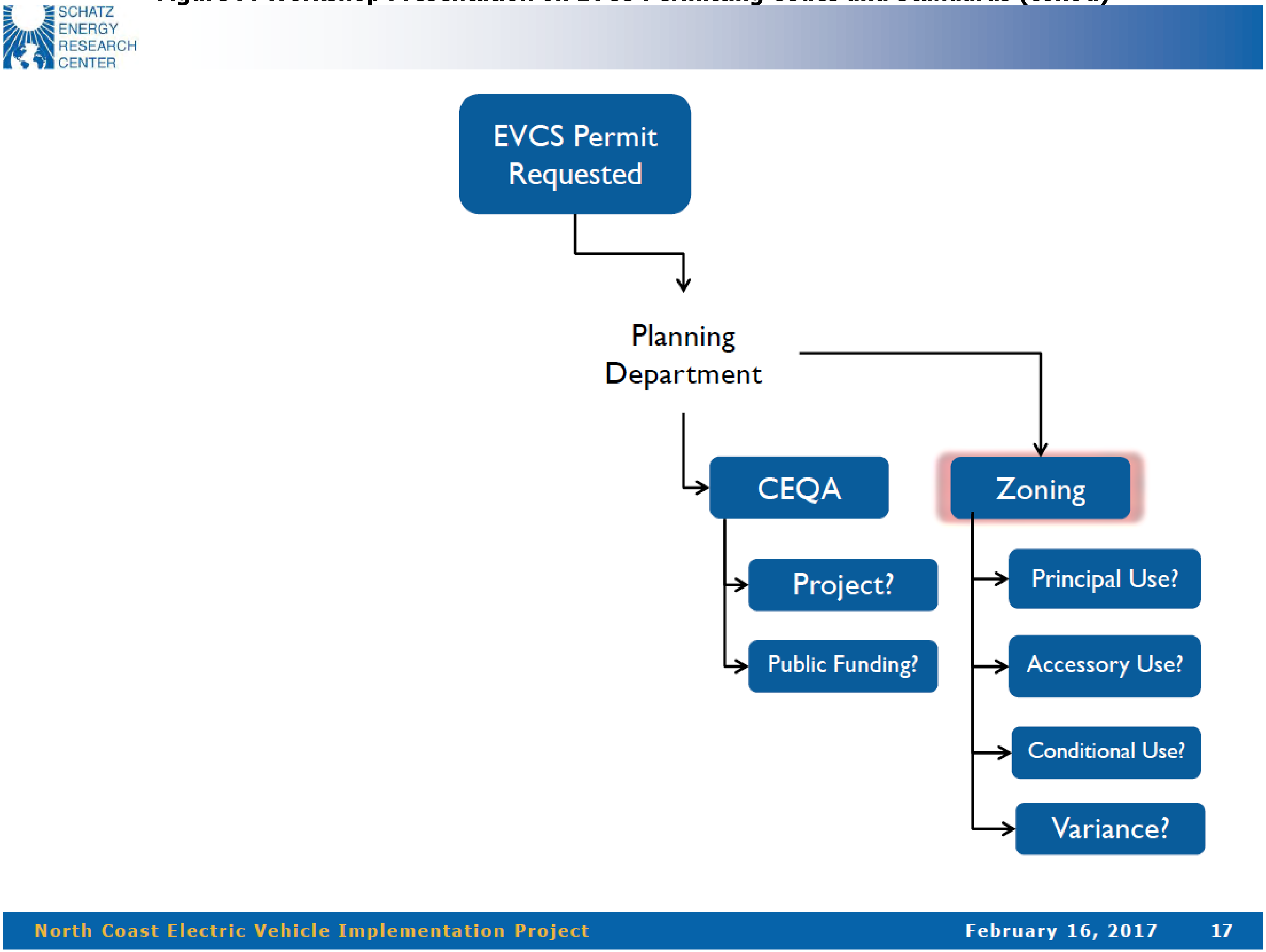

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

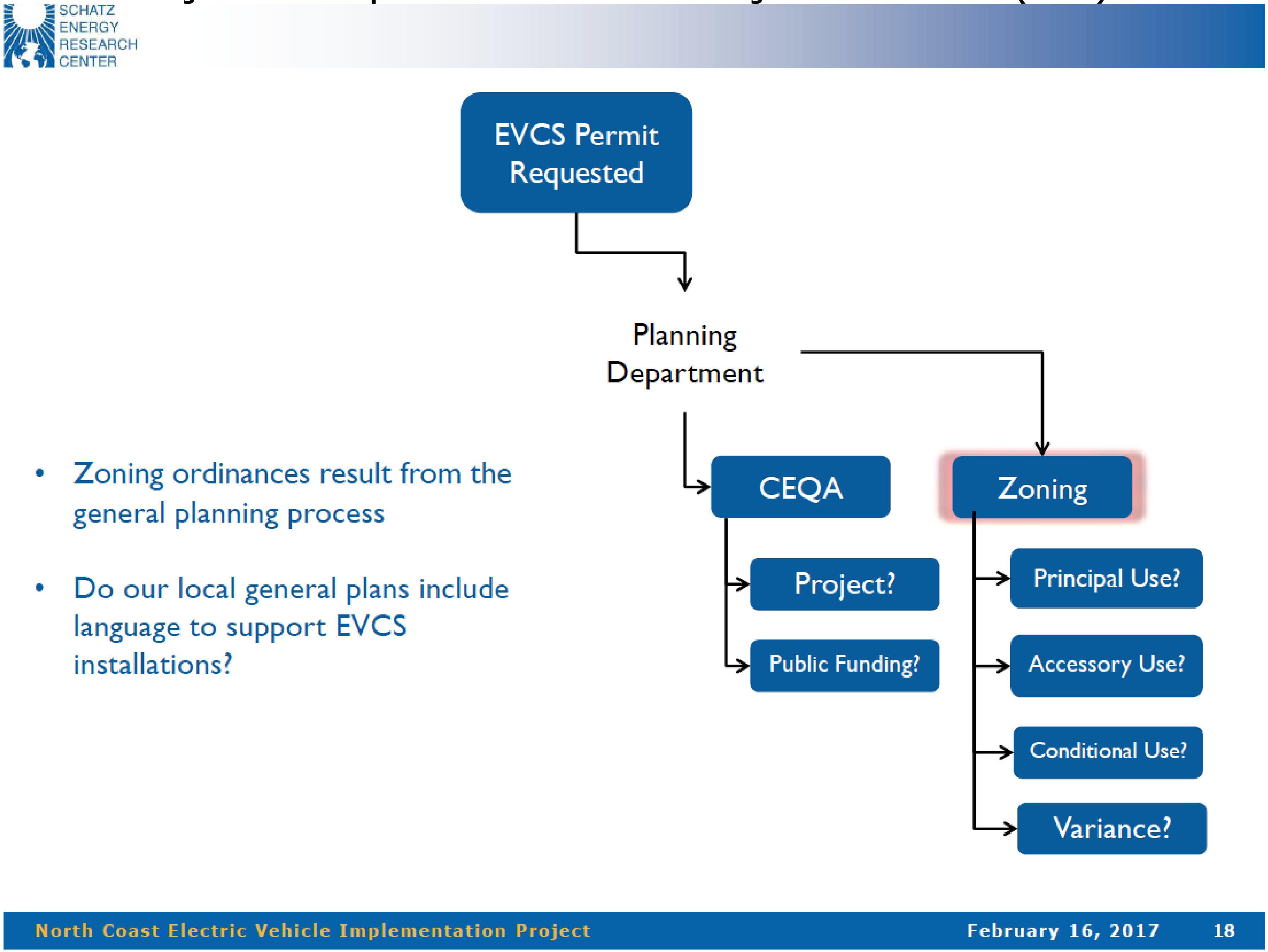

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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Details in your handout

Jurisdiction	EVs or AFVs mentioned in General Plan?
Del Norte County	No
Crescent City	No
Humboldt County	Yes
Arcata	Yes
Blue Lake	Yes: Un-adopted Update
Fortuna	Yes
Eureka	No (Update?)
Ferndale	No
Trinidad	No
Rio Dell	No
Trinity County	No

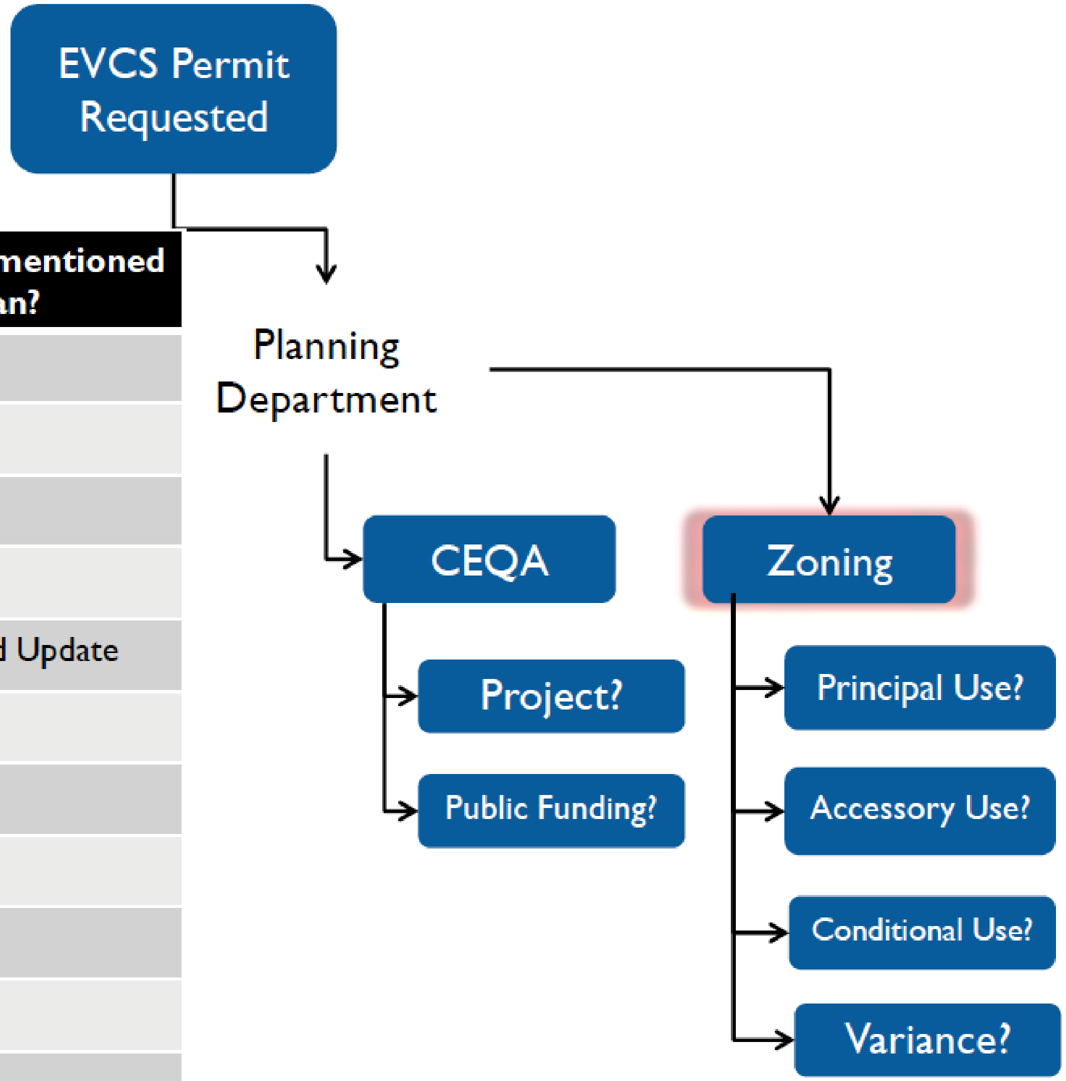

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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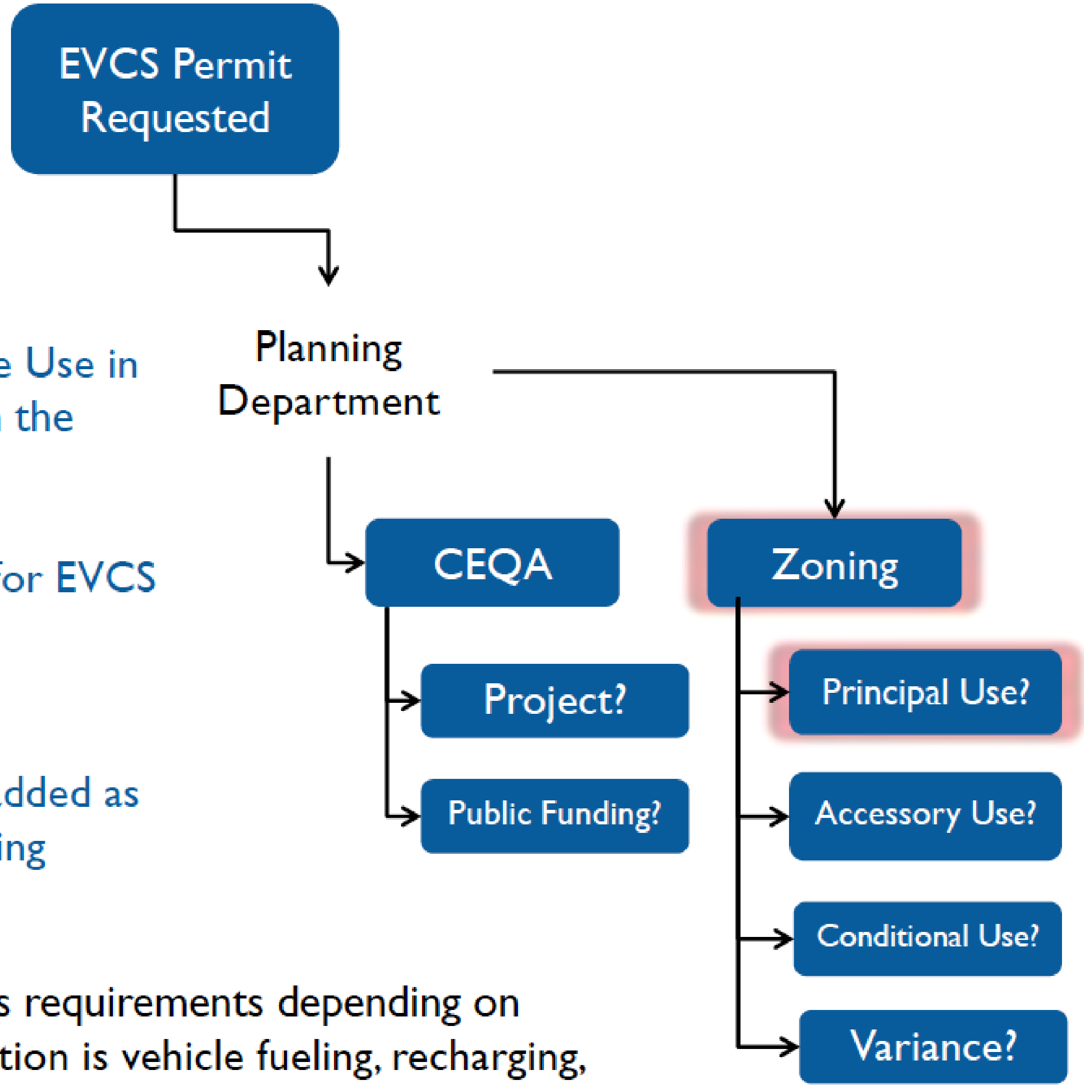

- EVCS is not listed as a Principle Use in any of the zoning ordinances in the North Coast Region
- Not surprising since the need for EVCS in the public space is a recent development
- EV charging stations could be added as a Principal Use for various zoning classifications

Note that 2016 CBC differentiates requirements depending on whether the facility's primary function is vehicle fueling, recharging, parking, or storage.

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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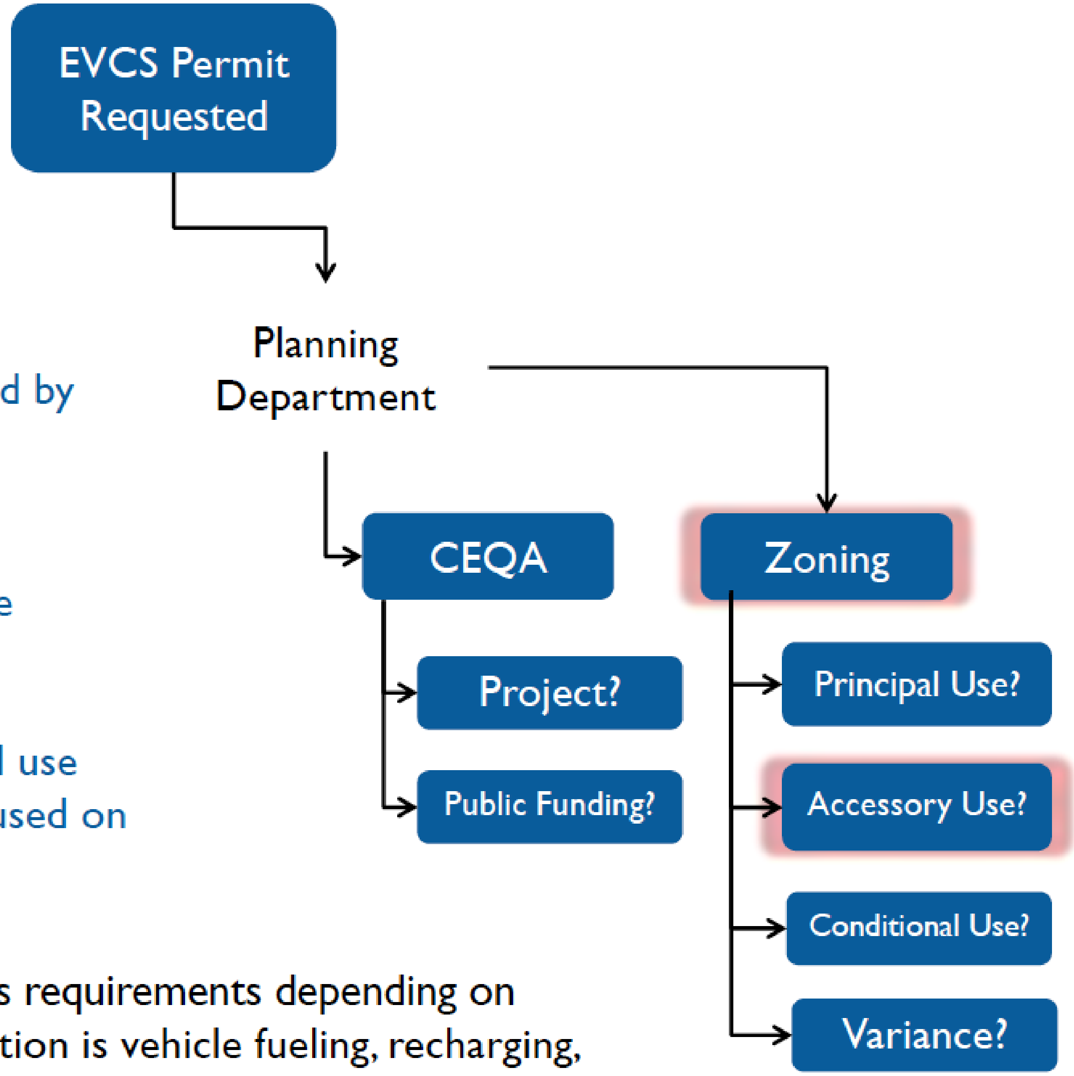

- EVCS are commonly considered by planning departments to be an accessory use.
- The accessory use supports the principal or conditional use.
- EVCS can support any principal use where motor vehicles may be used on the property

Note that 2016 CBC differentiates requirements depending on whether the facility's primary function is vehicle fueling, recharging, parking, or storage.

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

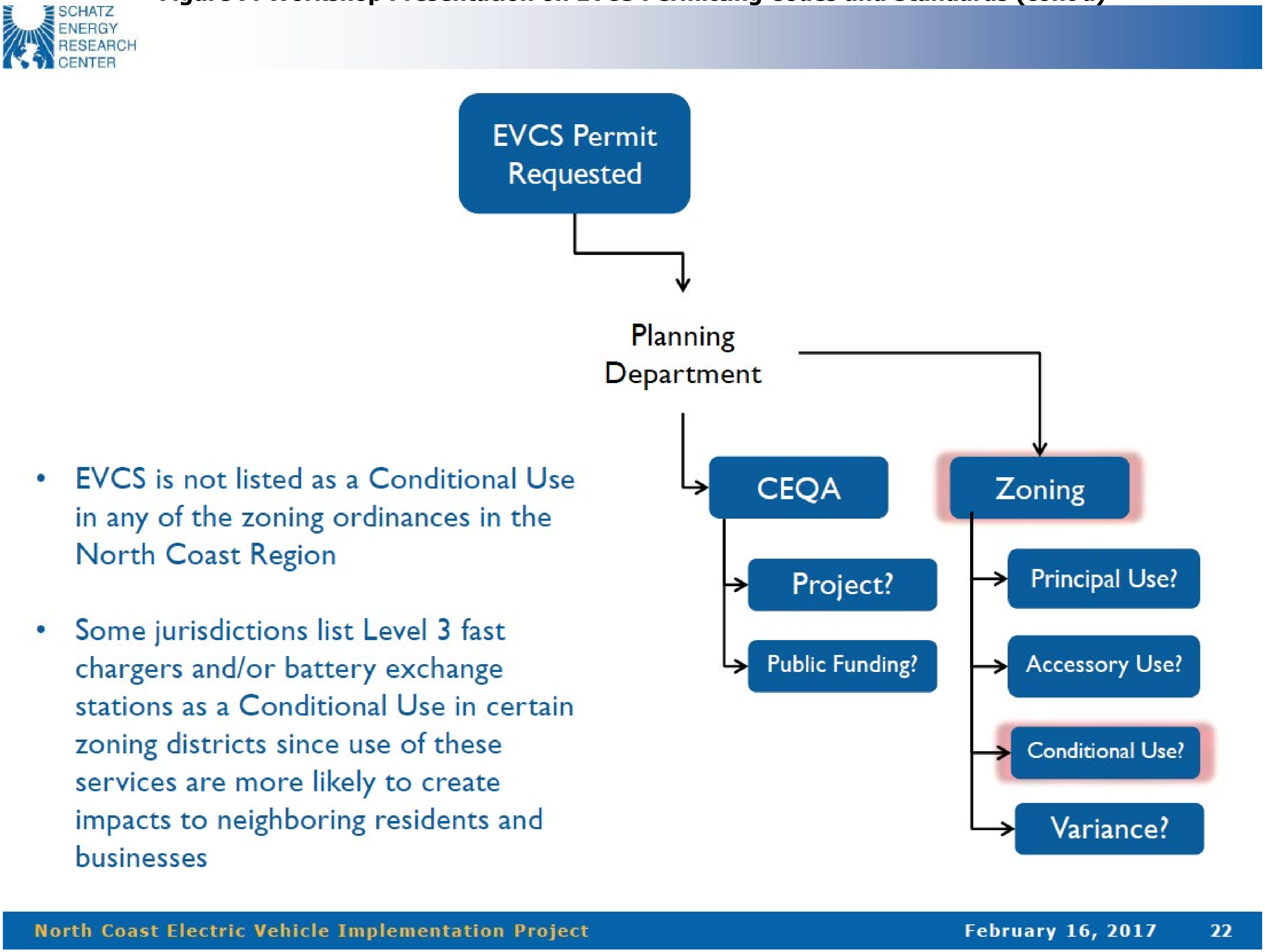

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

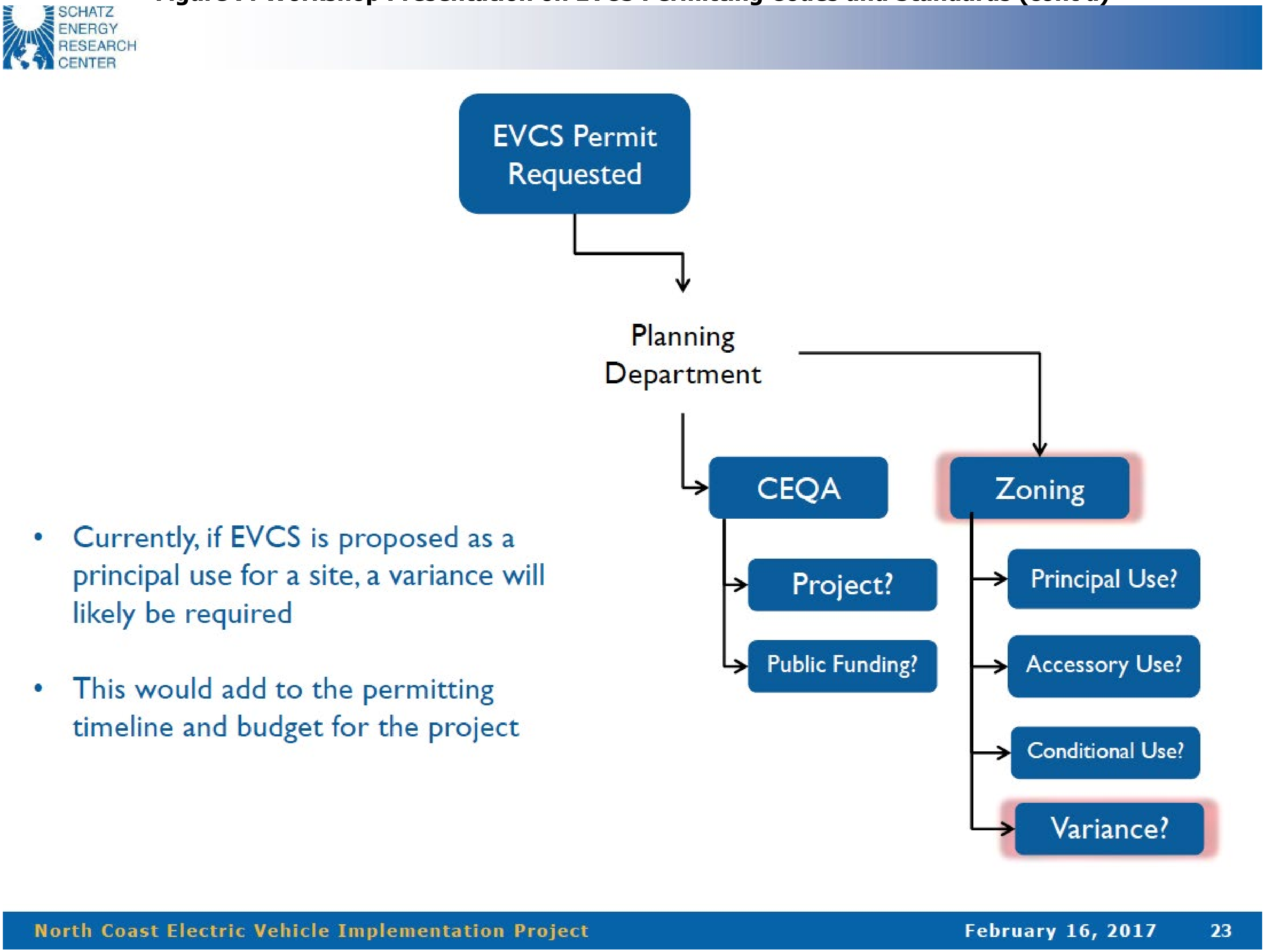

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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Recommendations to local planning departments for streamlining EVCS permitting processes

1. Include EV transportation and EVCS in General Plans and Climate Action Plans

Jurisdiction	Has a Climate Action Plan?
Humboldt County	Draft, un-adopted
Arcata	Yes
Blue Lake	Draft, un-adopted
Eureka	In Development
Trinidad	Draft, un-adopted

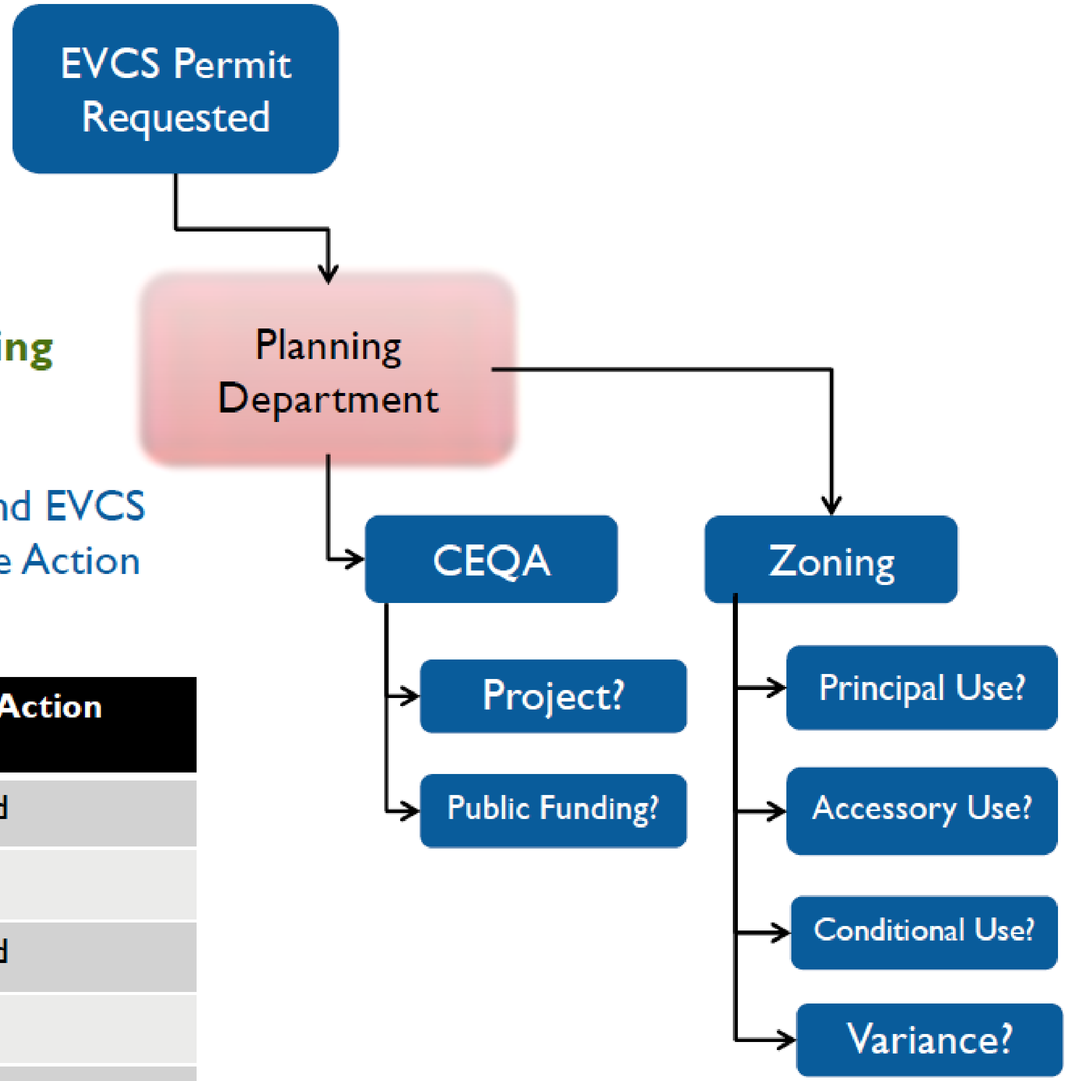

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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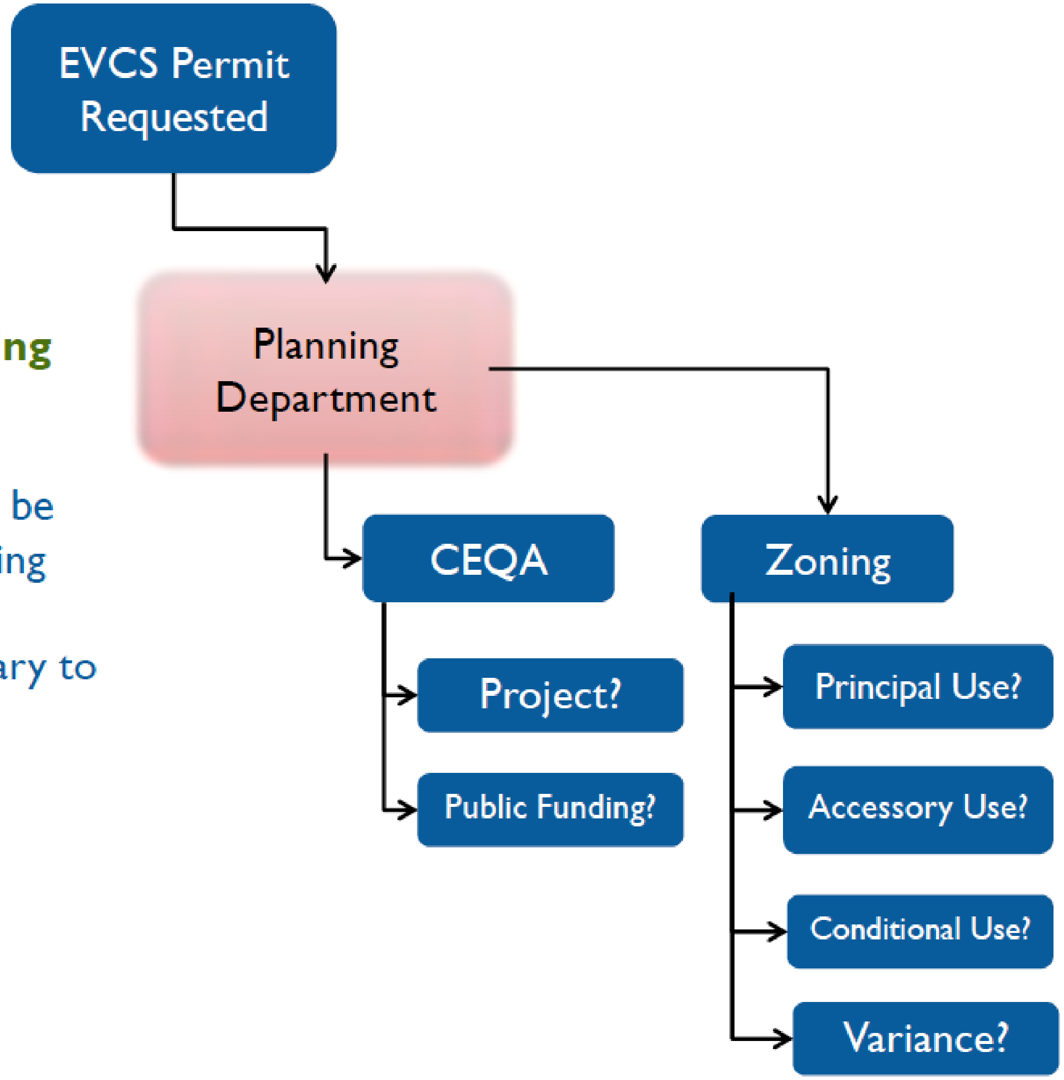
Recommendations to local planning departments for streamlining EVCS permitting processes

2. EV Charging Stations should be allowed across different zoning classifications because it is compatible and complimentary to many land uses



See example zoning ordinances in your handout

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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Recommendations to local planning departments for streamlining EVCS permitting processes

3. Consider EVCS installations qualifying for streamlined permitting process at Building Department as being either "not a project" or exempt from CEQA

4. Consider other EVCS installation projects as being exempt from CEQA on a case by case basis

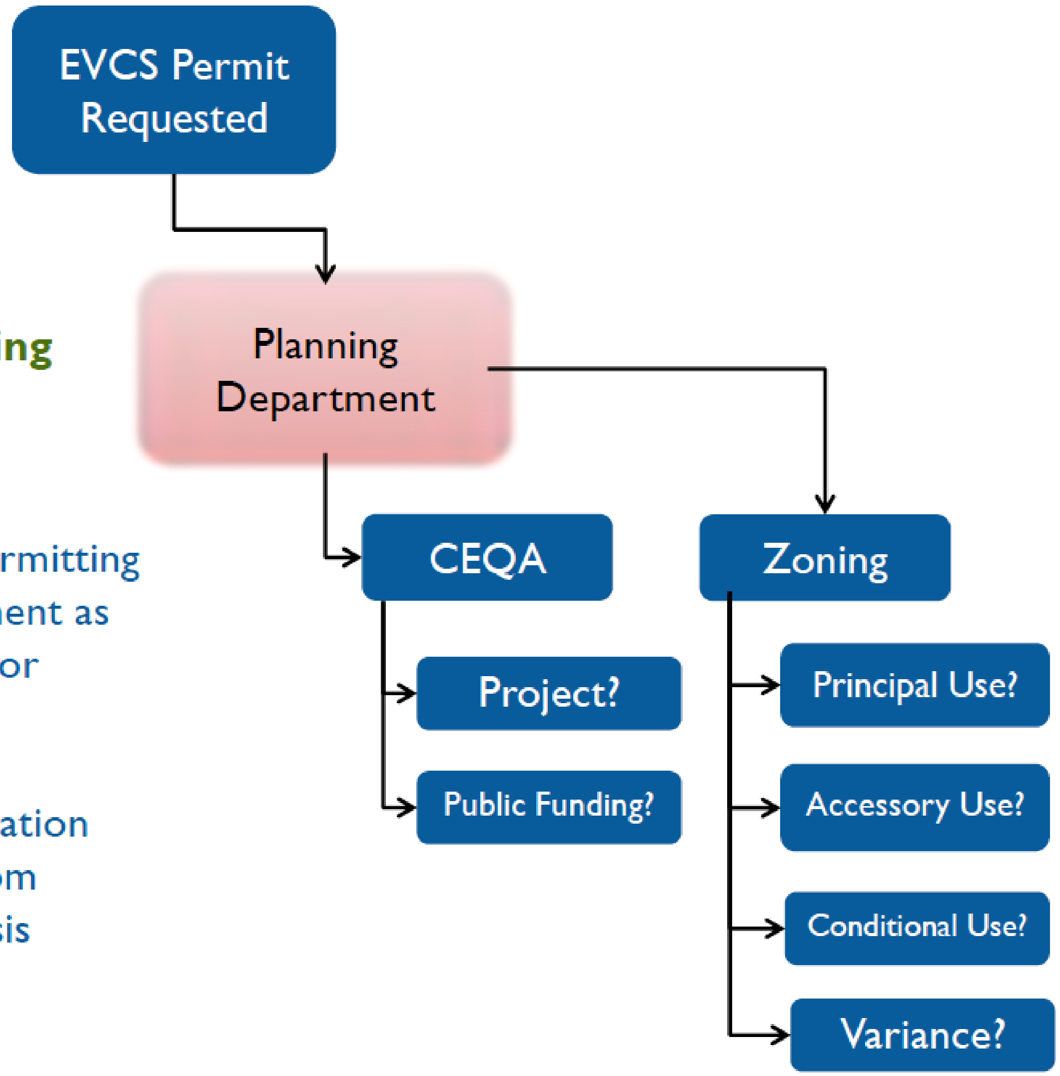

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

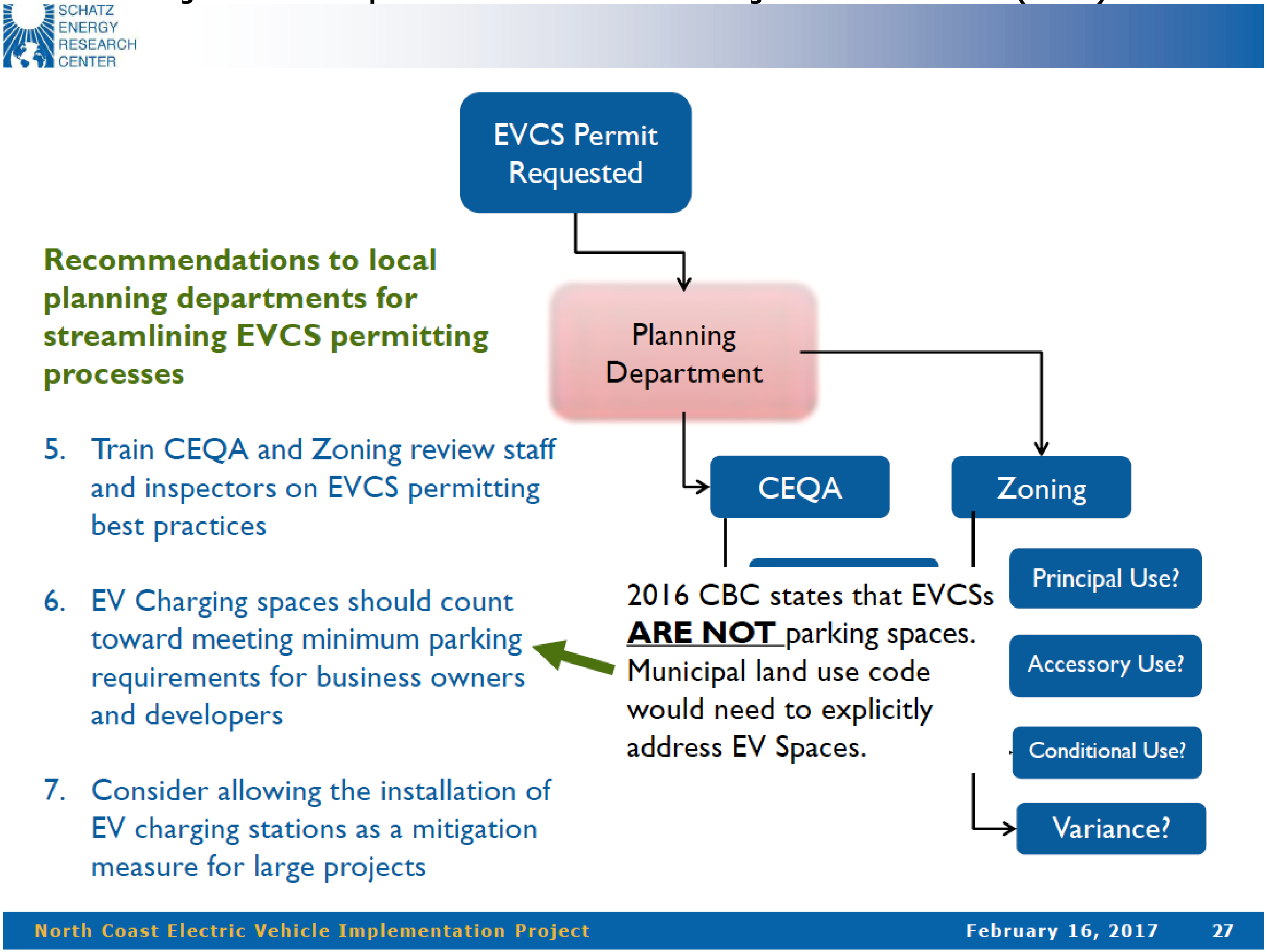

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

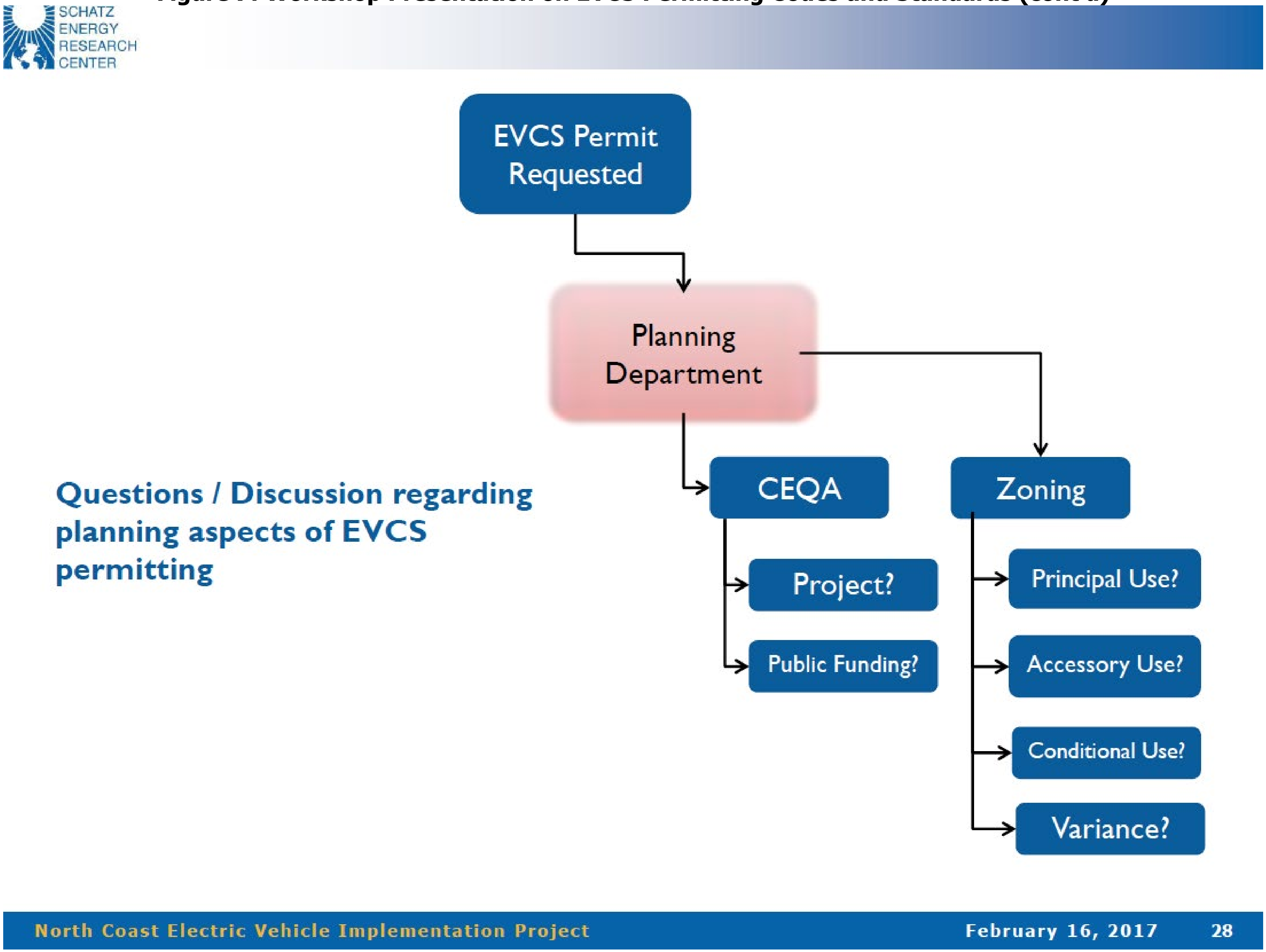

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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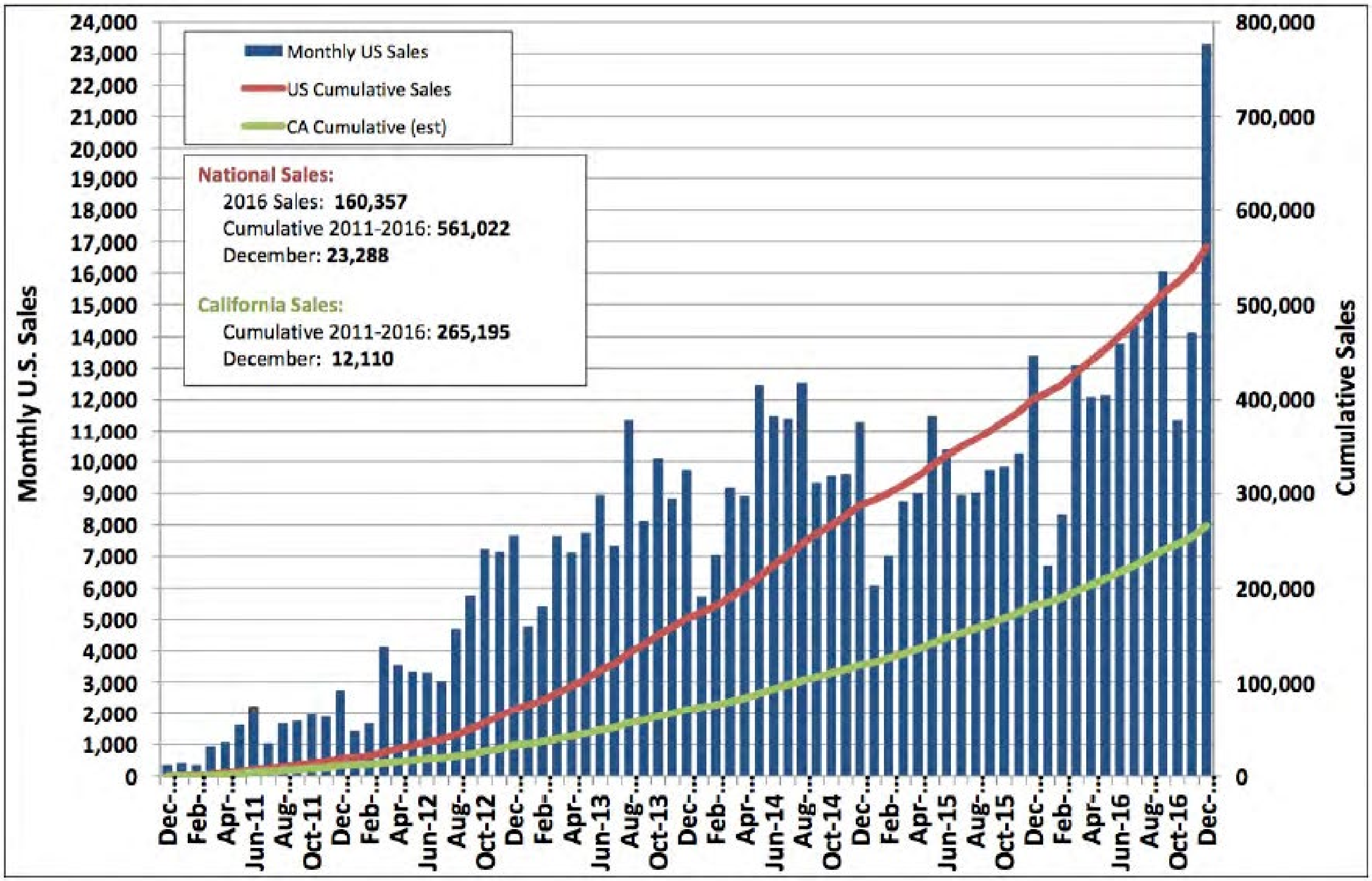
5 Minute Break

CALIFORNIA PLUG-IN ELECTRIC VEHICLE COLLABORATIVE



Note: Approximation assumes CA sales are 52% of national sales.
Reference: www.hybridcars.com

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

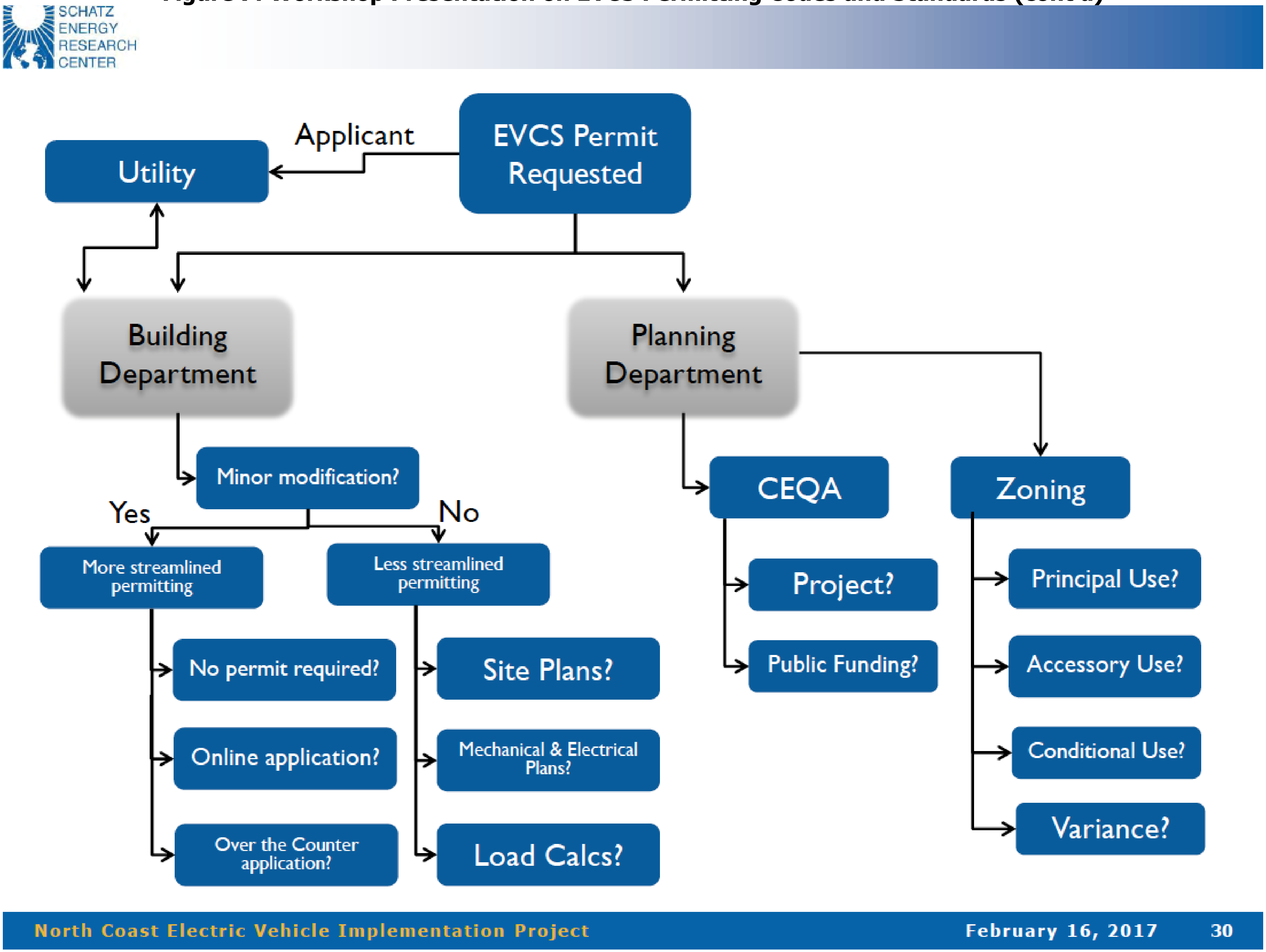

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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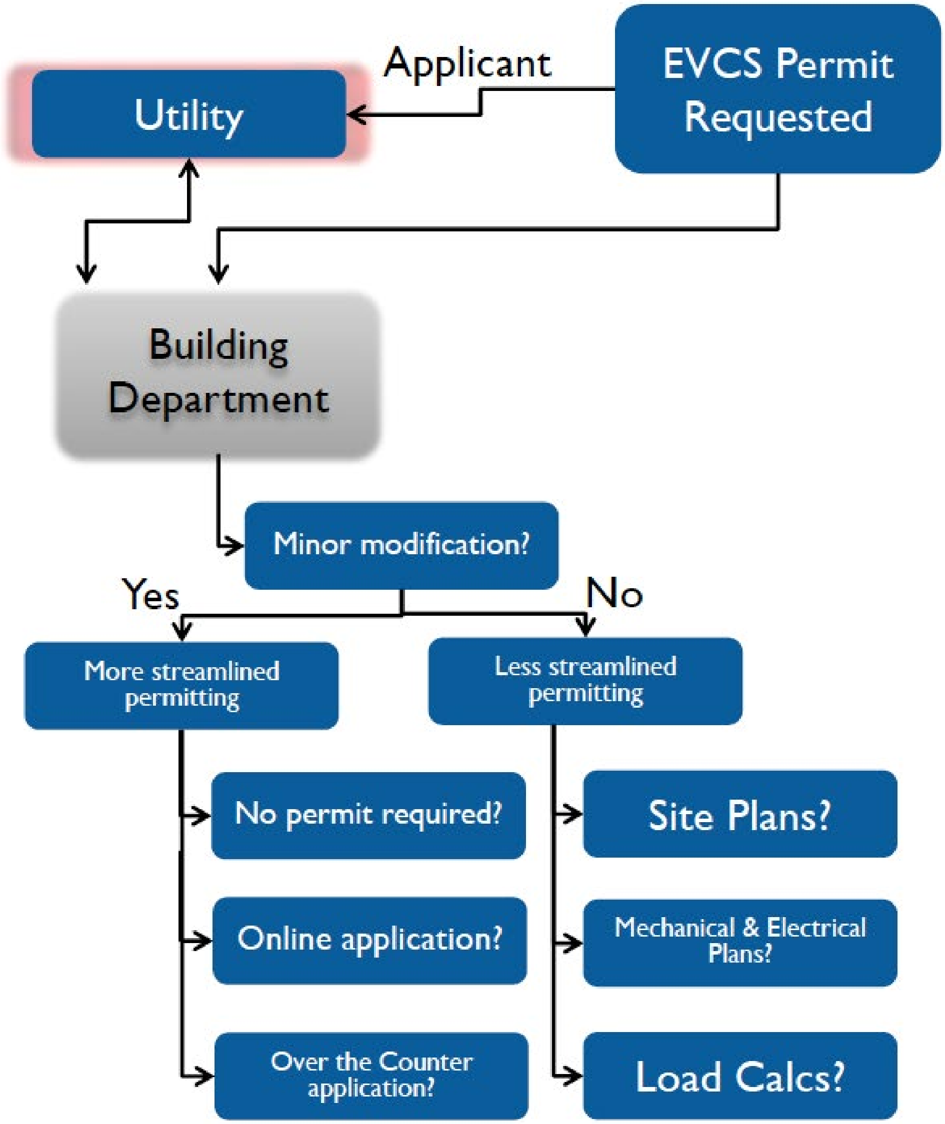

- Many utilities request that EV drivers notify them when they purchase or lease an EV.
- Utility is responsible for upgrading the site's electric service and their electrical system to support an EV charger if required.
- If a service upgrade is required the utility will be a partner in the EVCS installation, and permits from local jurisdictions will be dependent on the utility completing necessary upgrades
- If a service upgrade is not required, the utility will want to be aware of the additional load for network planning purposes

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

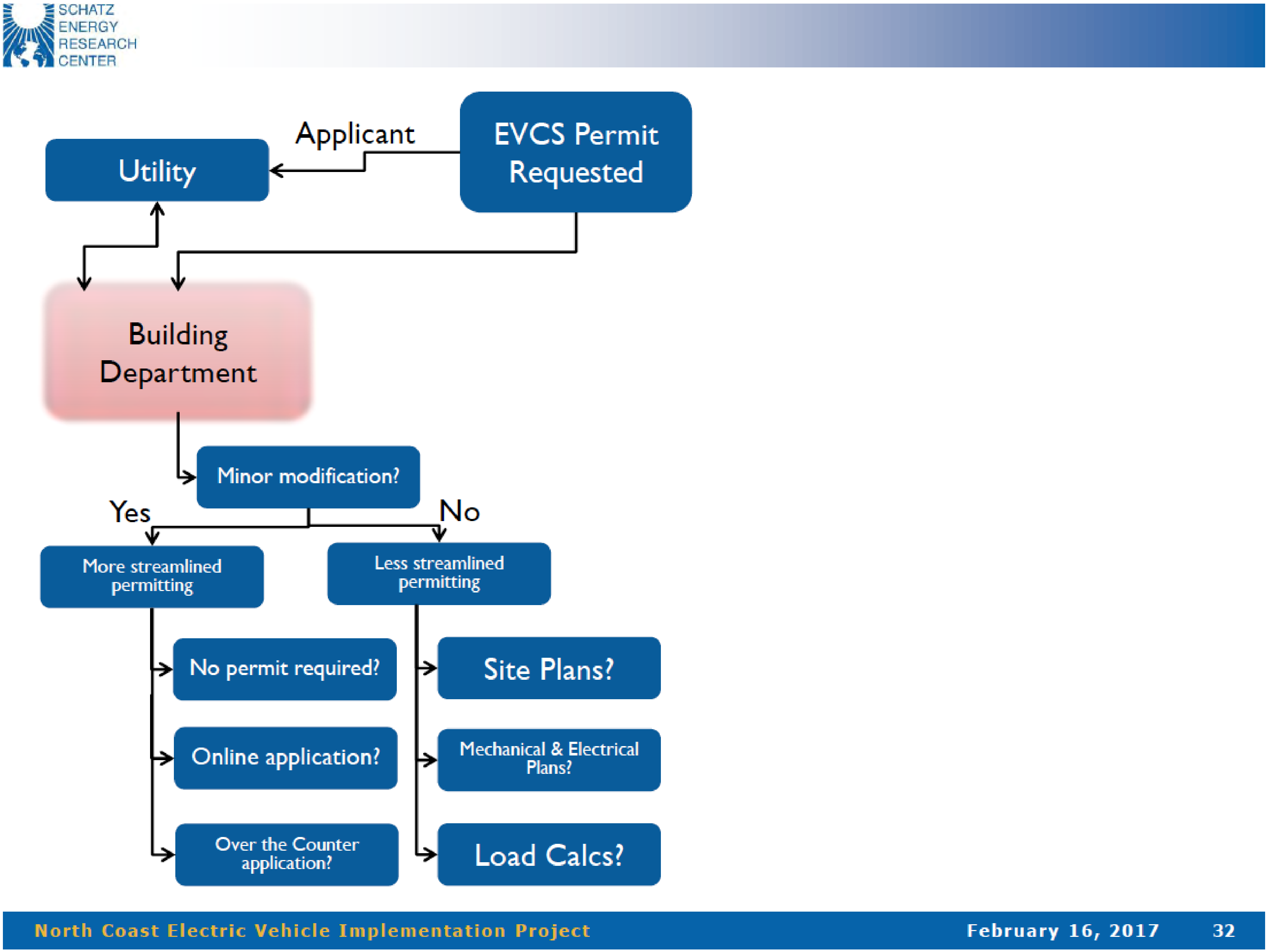

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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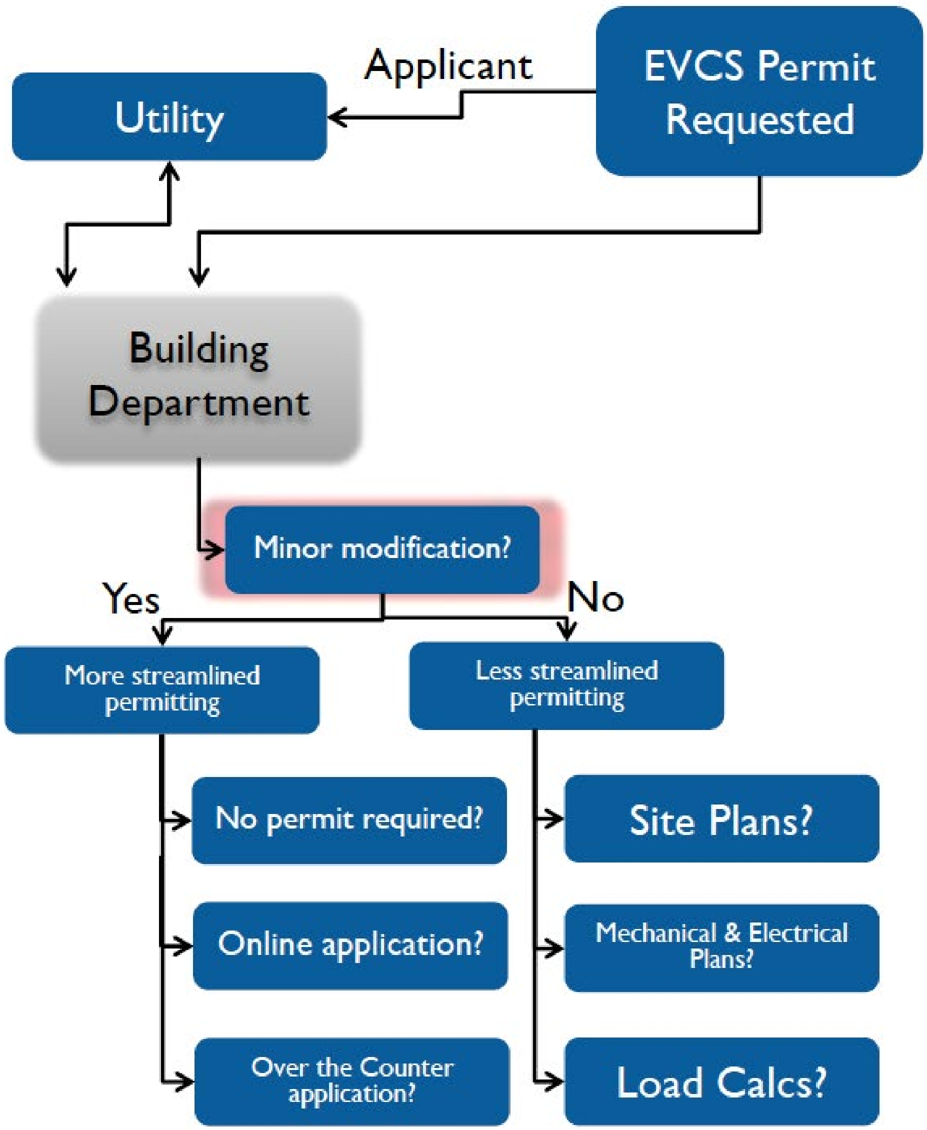

- Considering certain types of EVCS installations as a "Minor Modification" or "Minor Work" is one way to streamline the permitting process.
- The installation has to meet certain criteria. For example:
  - Level I or 2 charger
  - residential or private commercial
  - inside private garage
  - within a certain distance from service panel

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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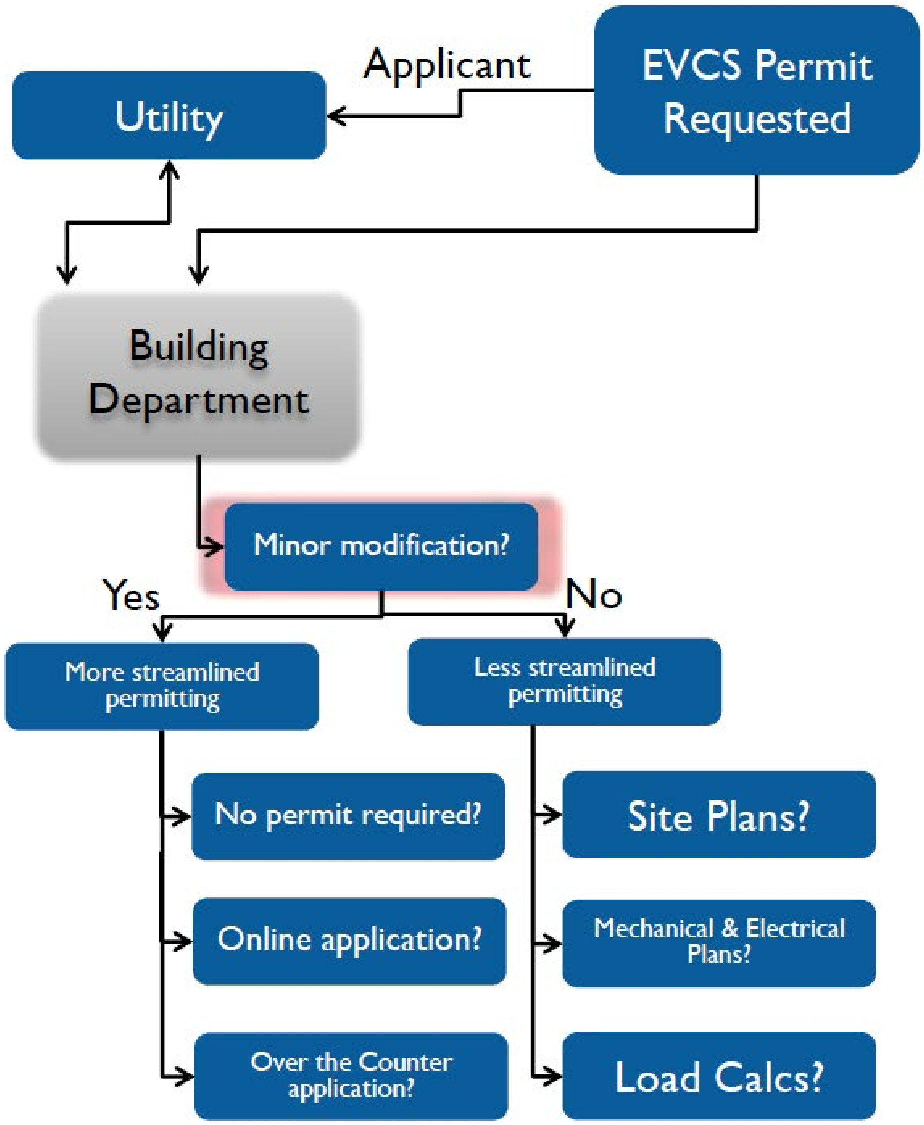

Examples:

- New Jersey has determined that installation of residential EVCS is considered "Minor Work."
  - Verbal notification to code enforcement agency required prior to starting installation
  - Permit application must be filed within five days of notification
- 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
  - Cost is about 10% of cost for regular permit
  - One tenth of minor installations get inspected

(Energetics Inc. 2013)

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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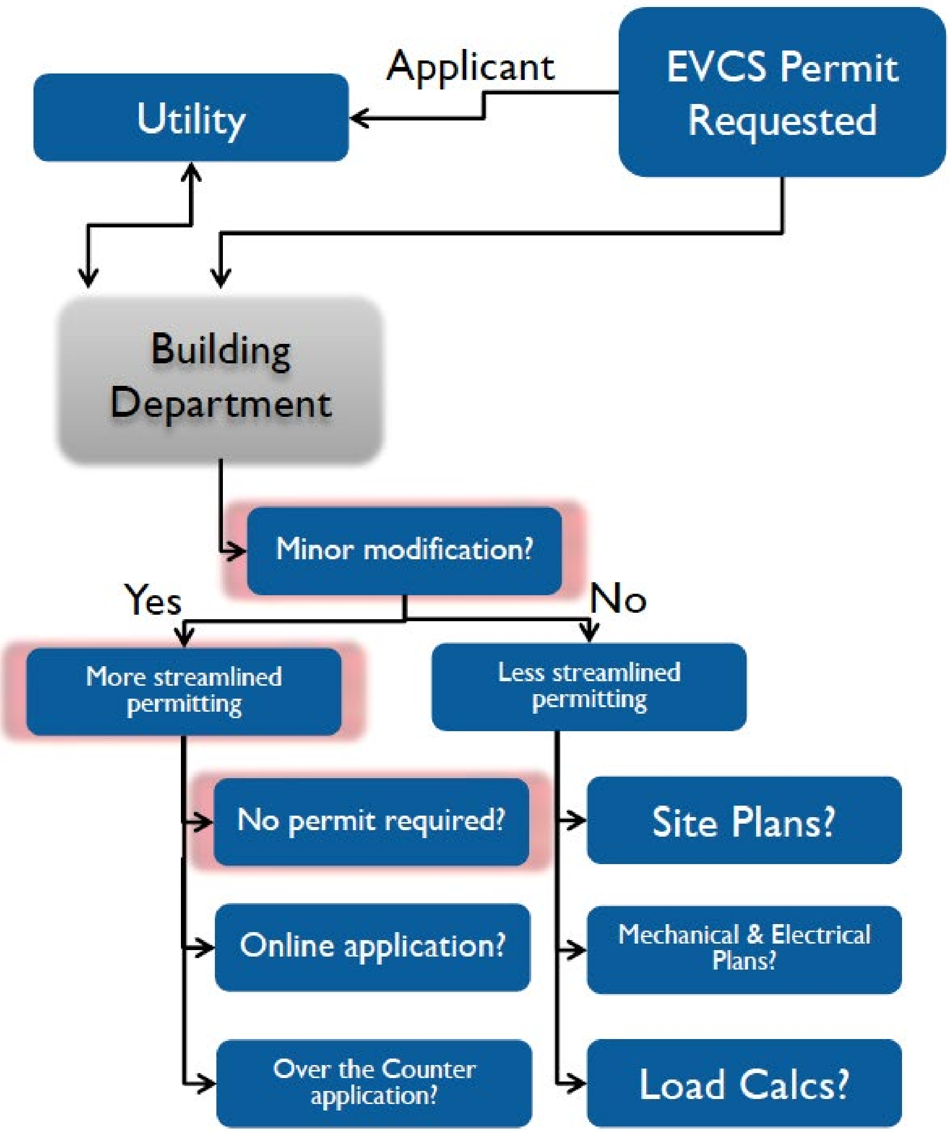

Really? No Permit Required?

- New Hampshire allows the homeowner to do the electrical work on single family homes without a permit.
- Not likely to be a permitting pathway locally

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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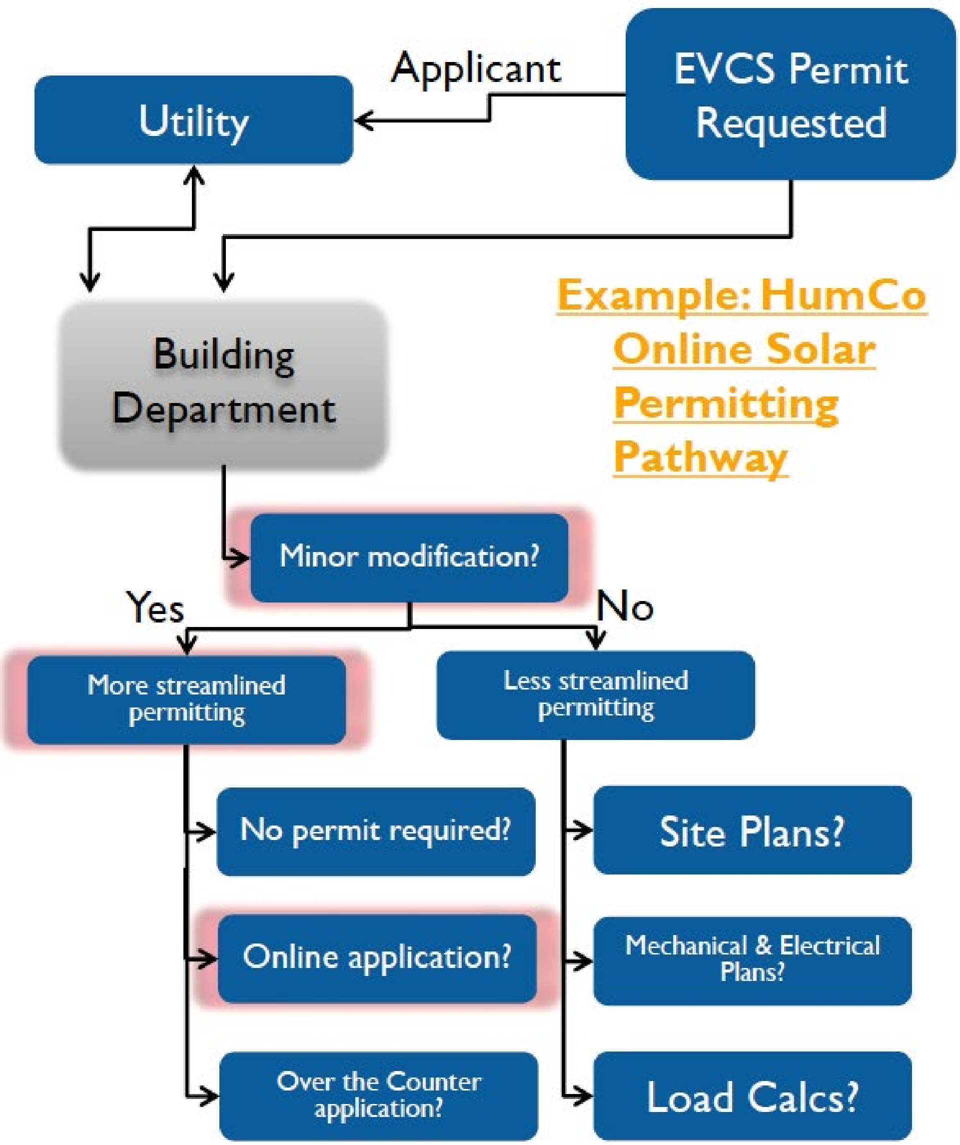

If there is no precedent to allow a typical residential or private commercial EVCS installation to be considered a "minor modification", online permitting pathways are still possible, especially for residential installations. Examples include:

- Houston and Los Angeles offer online express permitting. Online permits are issued automatically and instantaneously for standard EVCS and inspection occurs within 24 hours.
- In San Francisco electricians registered with the Department of Building Inspection can obtain permits for EVCS installations instantly online.
- Many other, mostly larger, jurisdictions are using online permitting processes to streamline EVCS permitting

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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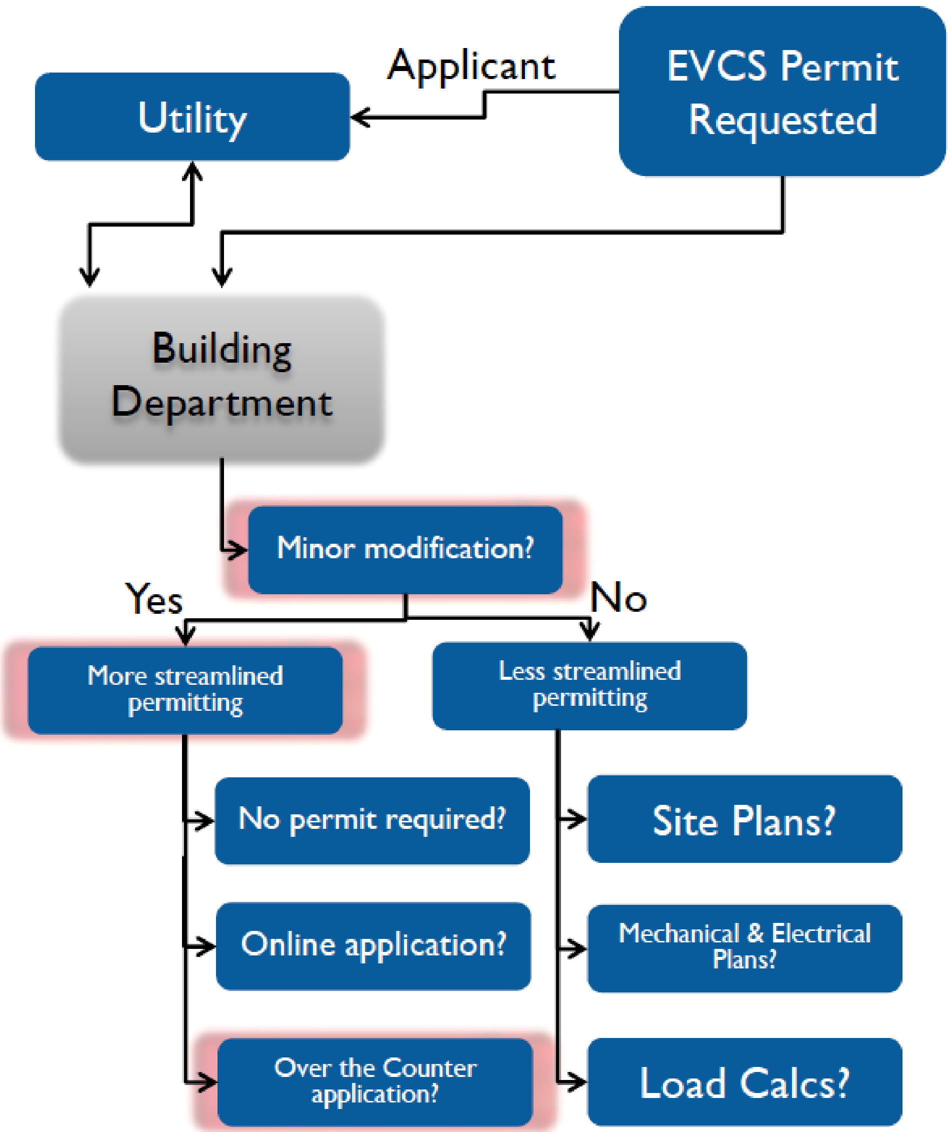

Examples of Over the Counter Permitting :

- Raleigh NC applied its existing "stand alone" permitting and inspection protocols to EVCS installations. The applicant is walked through the process at the counter by permitting personnel. Getting the permit takes about one hour and the inspection can be performed as early as the following day
- San Francisco Department of Building Inspection issues same-day over the counter permits for residential EVCS installations.
- Cities of Irvine, Mountain View, and Sacramento example permit forms in handout

(Energetics Inc. 2013)

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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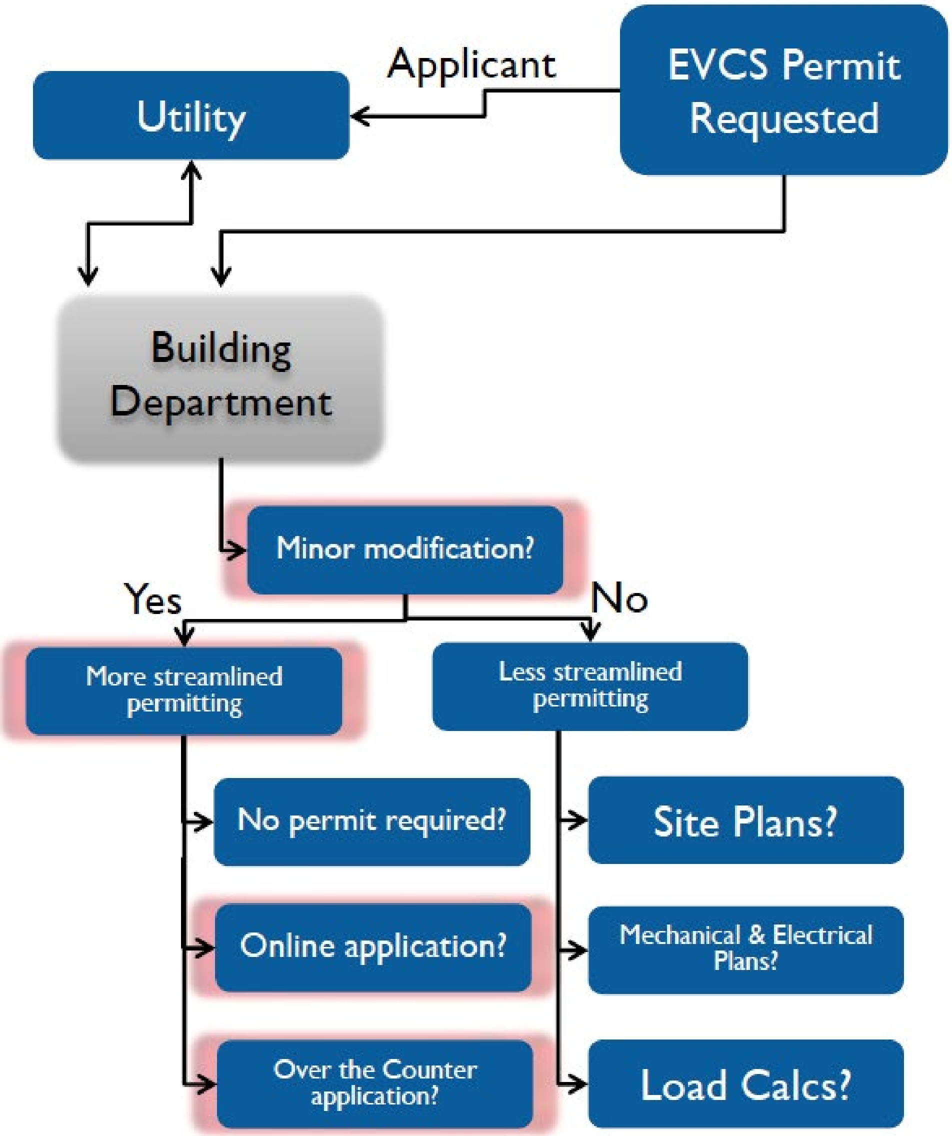

Recommendations:

- For typical residential EVCS installations, local jurisdictions could follow the a model similar to Irvine or San Francisco Bay Area jurisdictions to streamline permitting processes
- Potential need for increased reliance on the Standard of Care followed by local licensed electricians

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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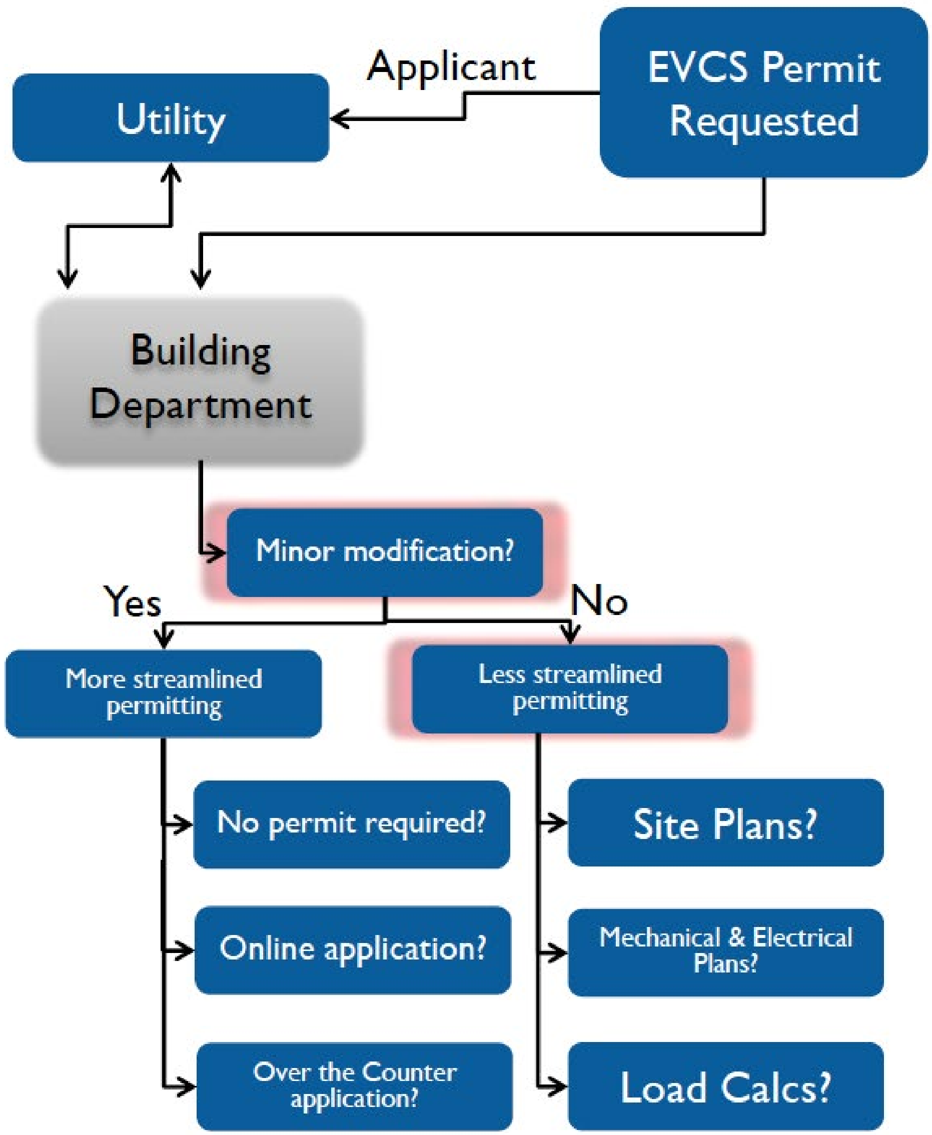

Less streamlined permitting pathways are typically used by jurisdictions initially for all installations

- Contractors and permitting staff are not familiar with the technology
- Widespread use of EV chargers was not anticipated until recently so local community plans don't include policies
- Permitting requirements for Level 2 and Level 3 may initially be similar even though Level 3 installations are more complex

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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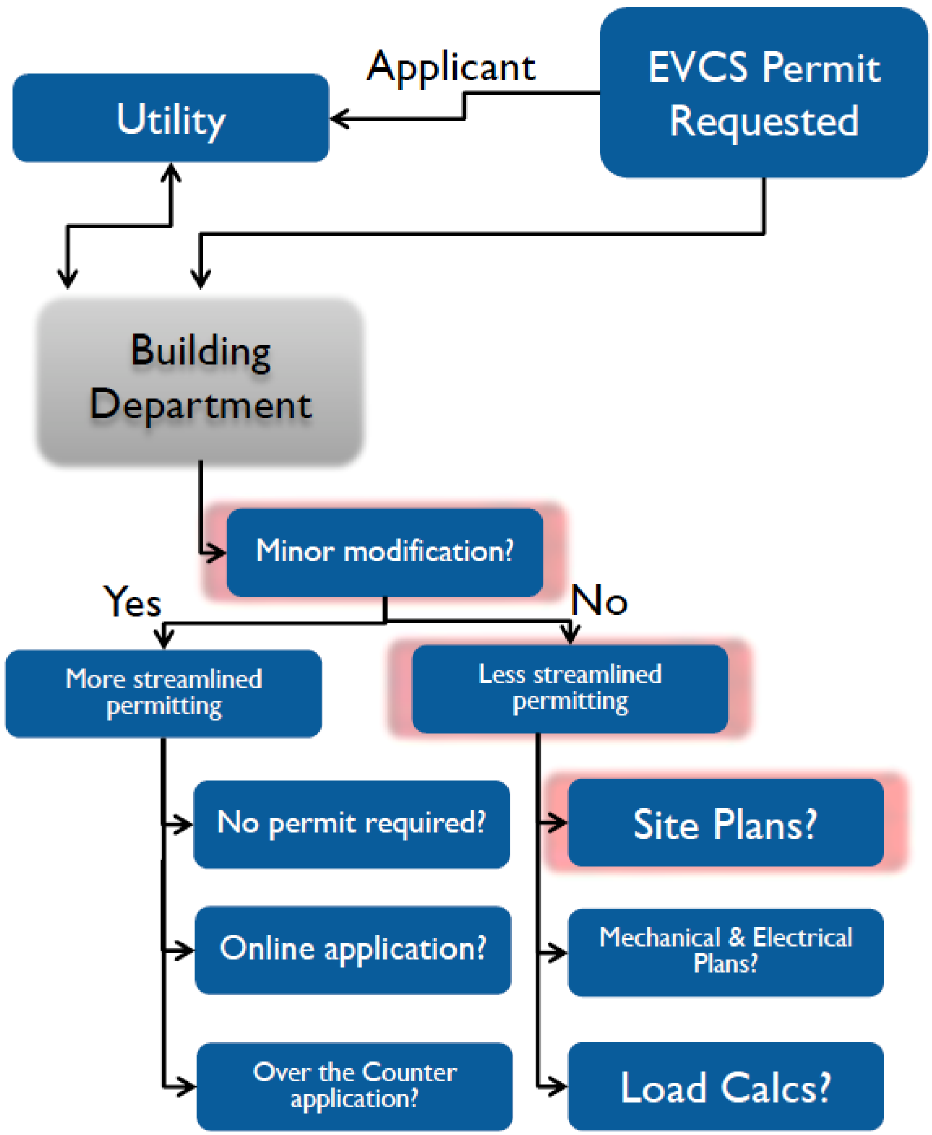

Site plans

- Residential and private commercial Level 2 located where public cannot access
  - Site plan sketch by owner or contractor (see City of Mountain View permit example in handout)
- Non-residential where public may access (Level 2 and Level 3)
  - Scaled drawing, plan and elevation views
  - Check for ADA compliance on non-residential installations
  - Check signage for compliance with state or local guidance
  - Check trenching and paving for compliance with local codes

See example site plans in handout

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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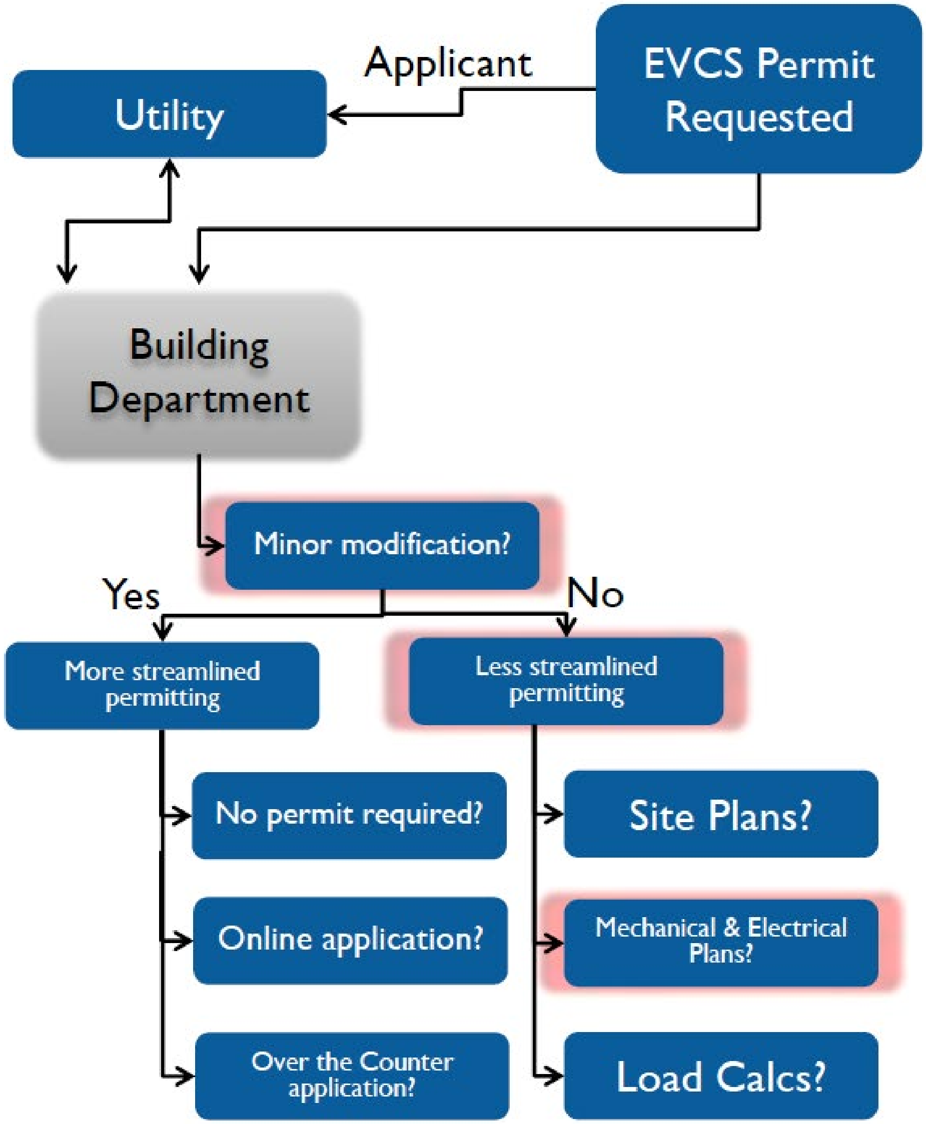
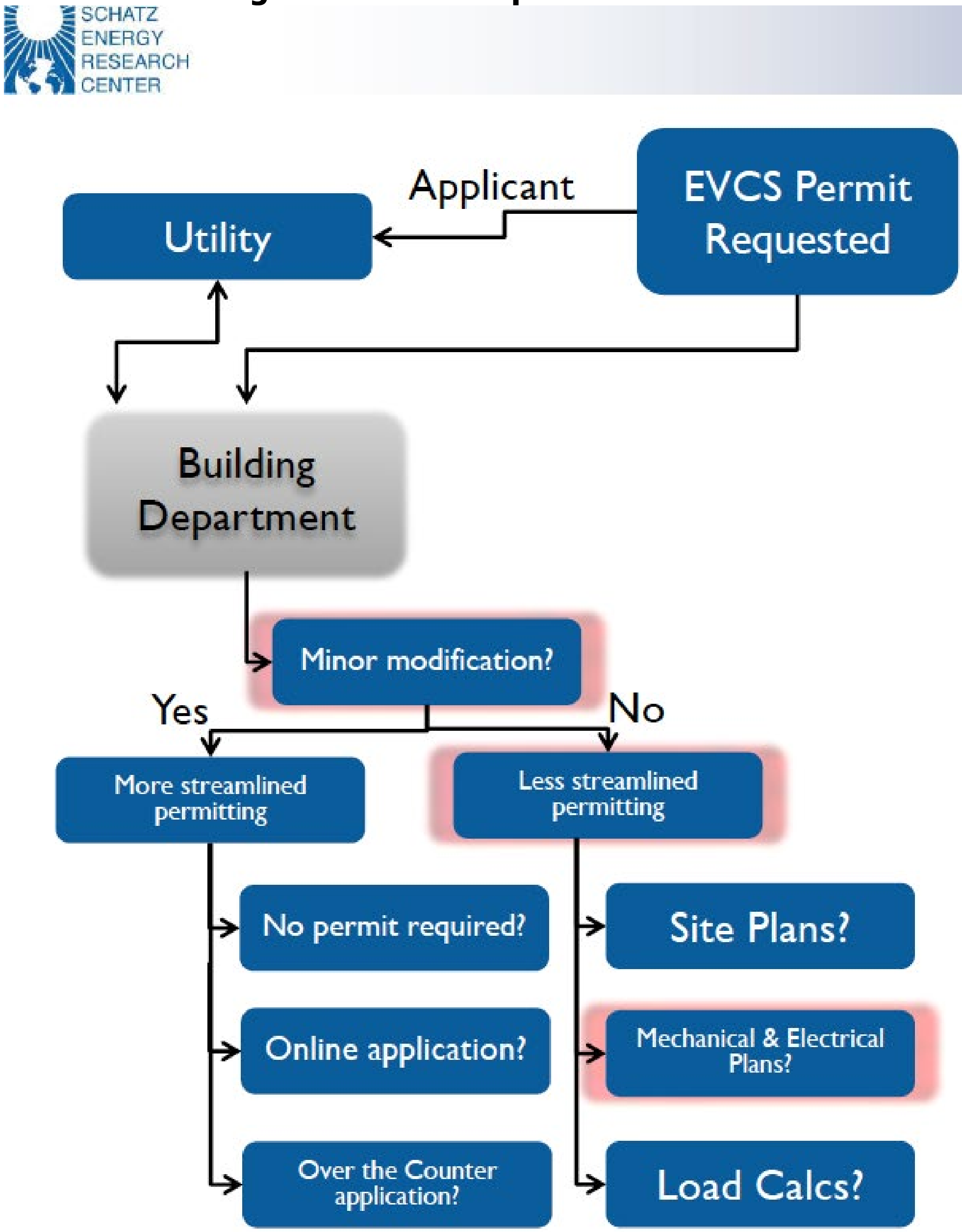


Do Not Need Mechanical Plans for EVCSs

~~Mechanical plans~~

- Only required where EVCS being installed is designed for charging batteries that require venting
  - NEC 625.15 and 625.29
- Modern EV Batteries are sealed and do not vent gases
- EV Chargers designed to charge modern batteries that do not vent will not charge batteries that do vent and visa versa.
  - Standard J1772 connector does not allow this.

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)



Electrical plans- Level 2 and Level 3 (AC and DC Charging)

- Coordinate with utility where service upgrades are required
- Single line diagram of main service to main panel
- Panel schedule showing existing loads and proposed branch circuit for EVCS
- Check wire and conduit size, grounding

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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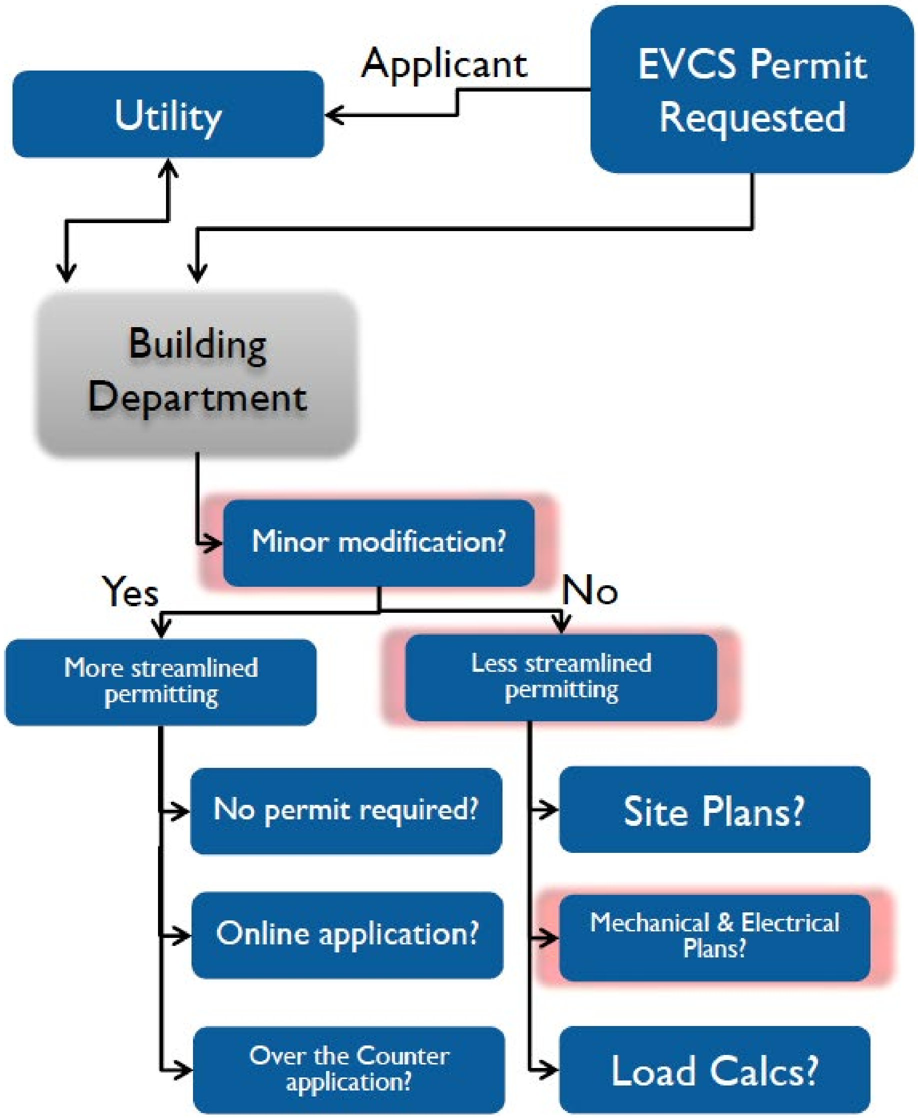

Electrical plans- Level 2 (AC Charging)

- Per NEC, EV Chargers are considered a continuous load
  - circuit must be sized to handle 125% of name plate
- SAE J1772 standard for Level 2 charge connector plug allows up to 80 amps at 240 volts per charging station (100 amp, 240 volt circuit is the highest power one would see for Level 2 chargers)
- Tesla is currently the only OEM vehicle that draws near the maximum for L2 (17.3kW, 72A continuous). Next highest is 10kW.
- Most existing Level 2 EV Chargers draw 30 - 40 amps at 240 volts with 40 - 50 amp breakers.

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

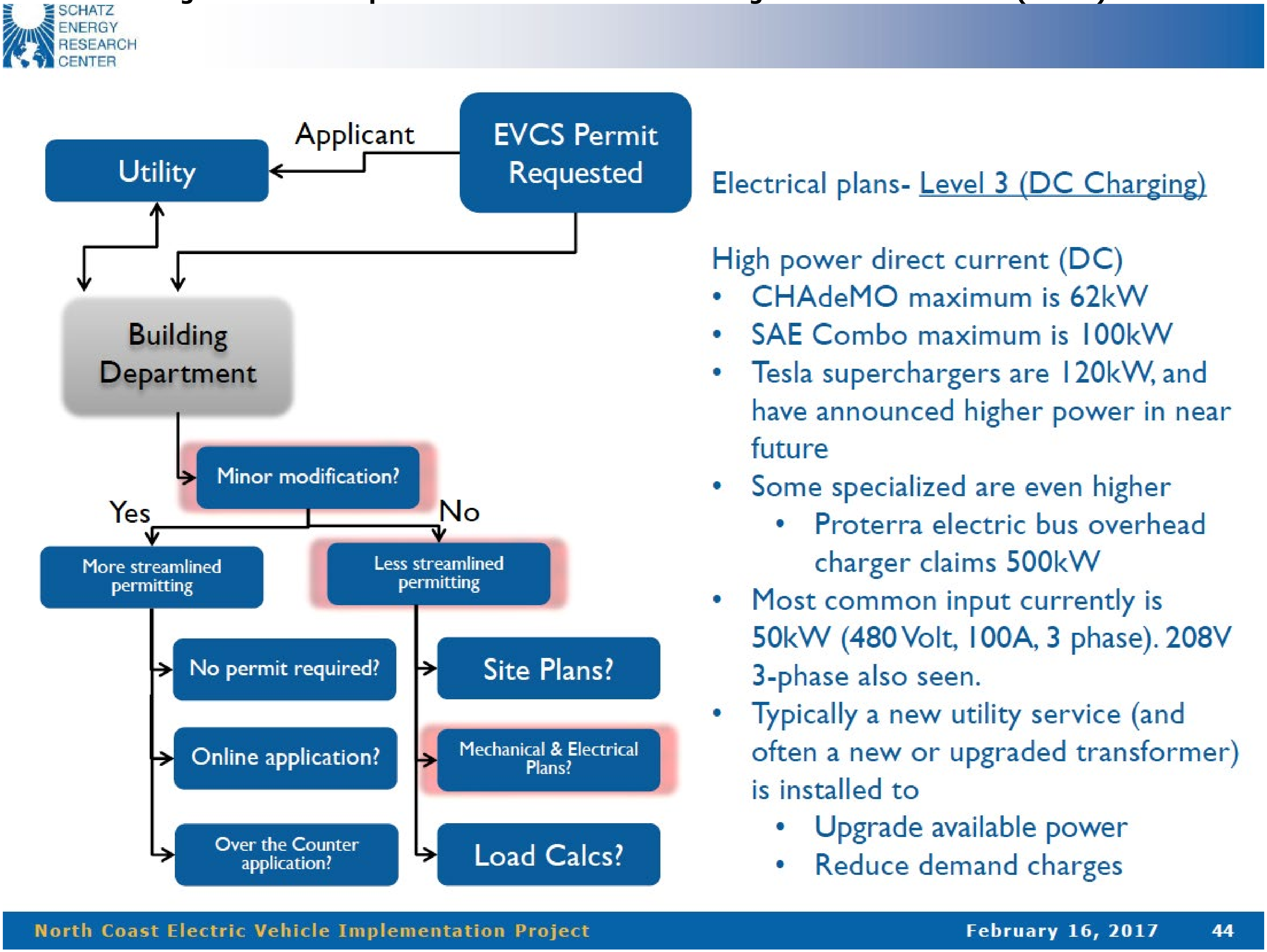

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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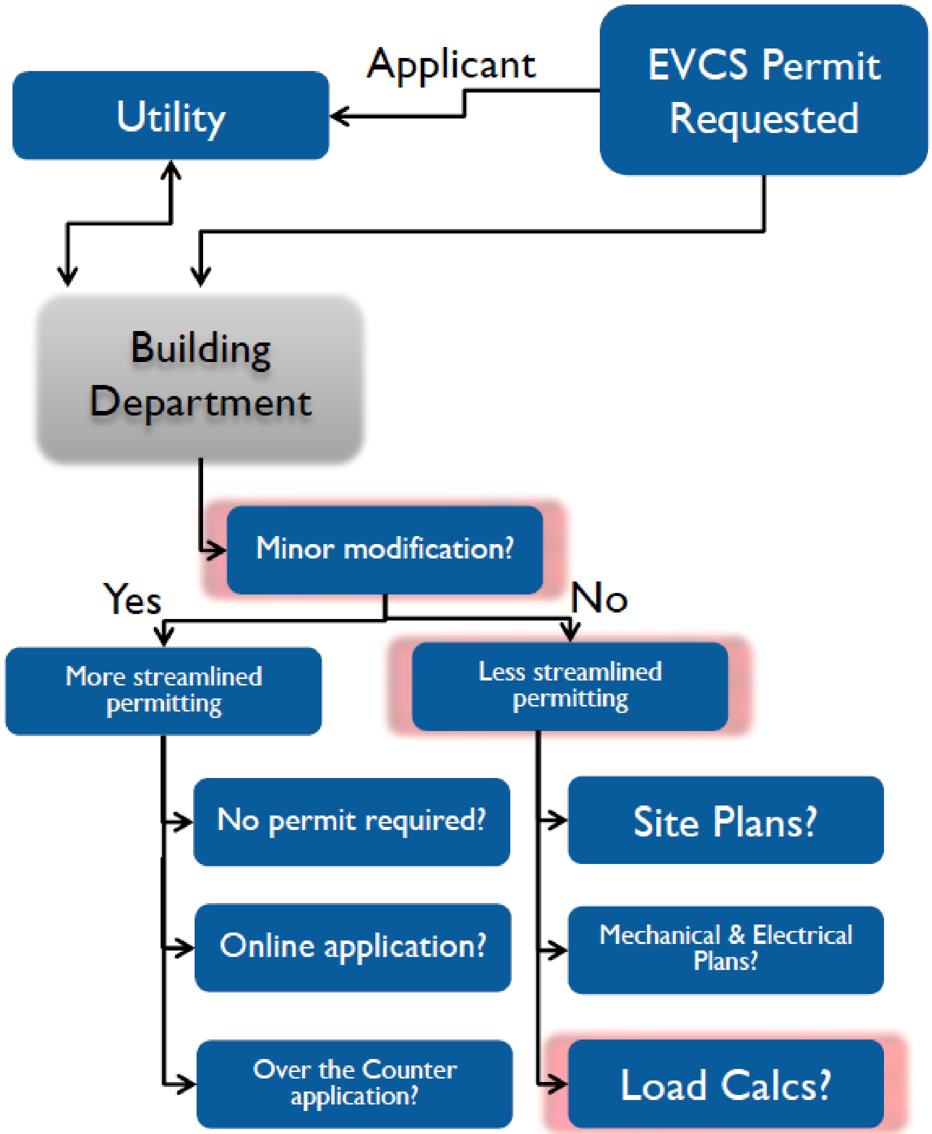

Electric Load Calculations

- Various Load Calculation methods have been developed. For example:
  - See permit examples in handout
- Standard Method of Part III Feeders and Service Load Calculations (Article 220 of the California Electrical Code)

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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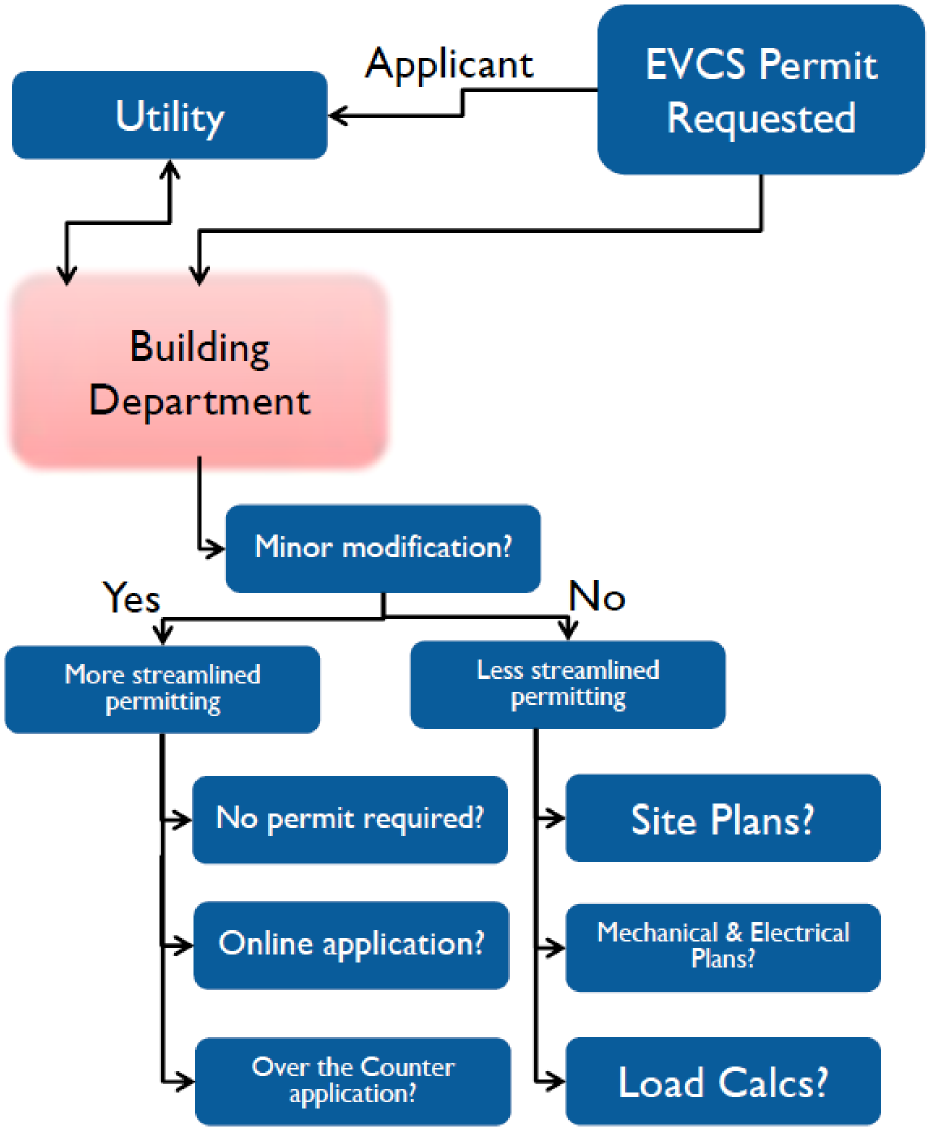

Recommendations to Streamline EVCS Permitting Process for Local Building Departments

1. Provide a mechanism for an expedited "minor modification" permit to allow streamlined process for simple EVCS installations that are not publically accessible where service upgrade is not required

2. Train permit review staff and inspectors on EVCS permitting best practices (see handout for example permitting and installation checklists)

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Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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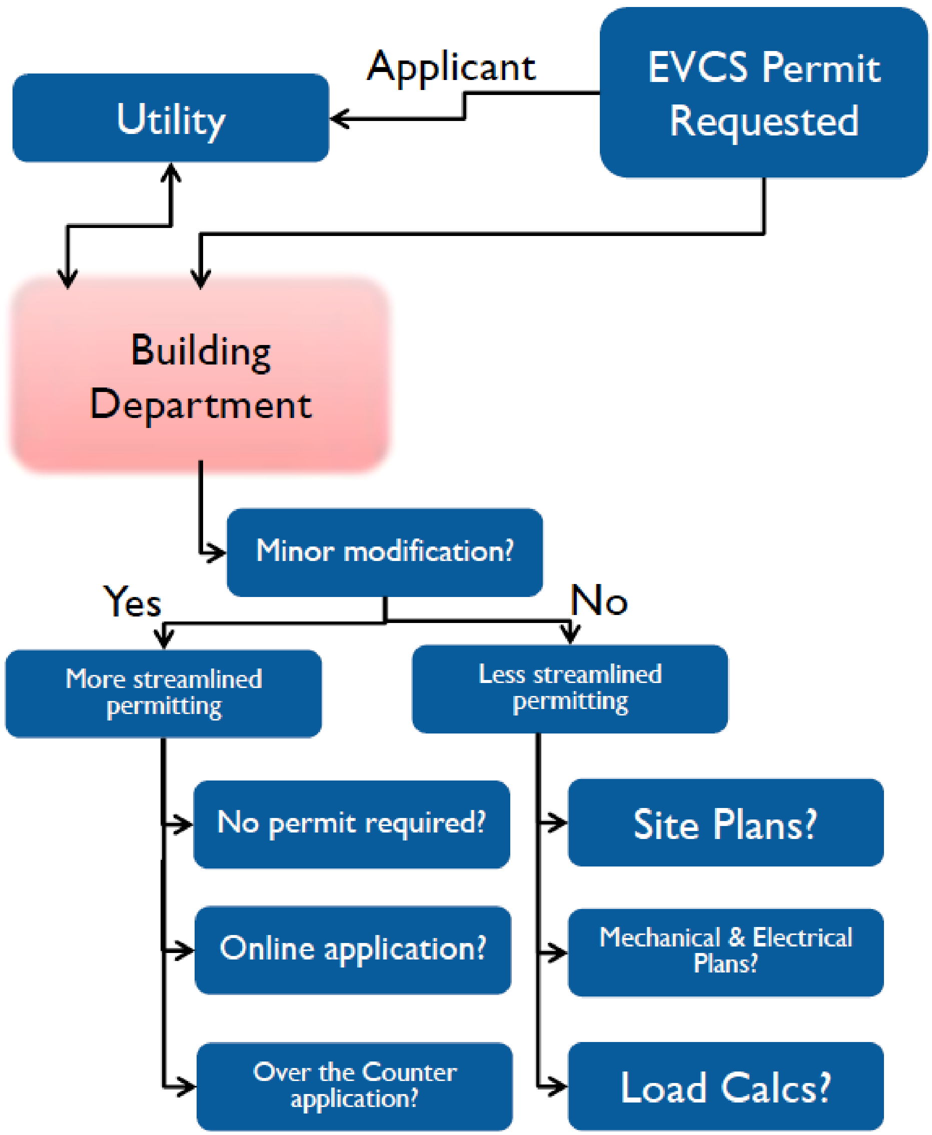

Recommendations to Streamline EVCS Permitting Process for Local Building Departments

3. Develop installation checklists specific for EVCS Installations (see examples in handout)
   - Streamlined process for simple installations
   - Clearly outline steps for all EVCS permit applications

4. Consider adopting voluntary parts of CalGreen

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

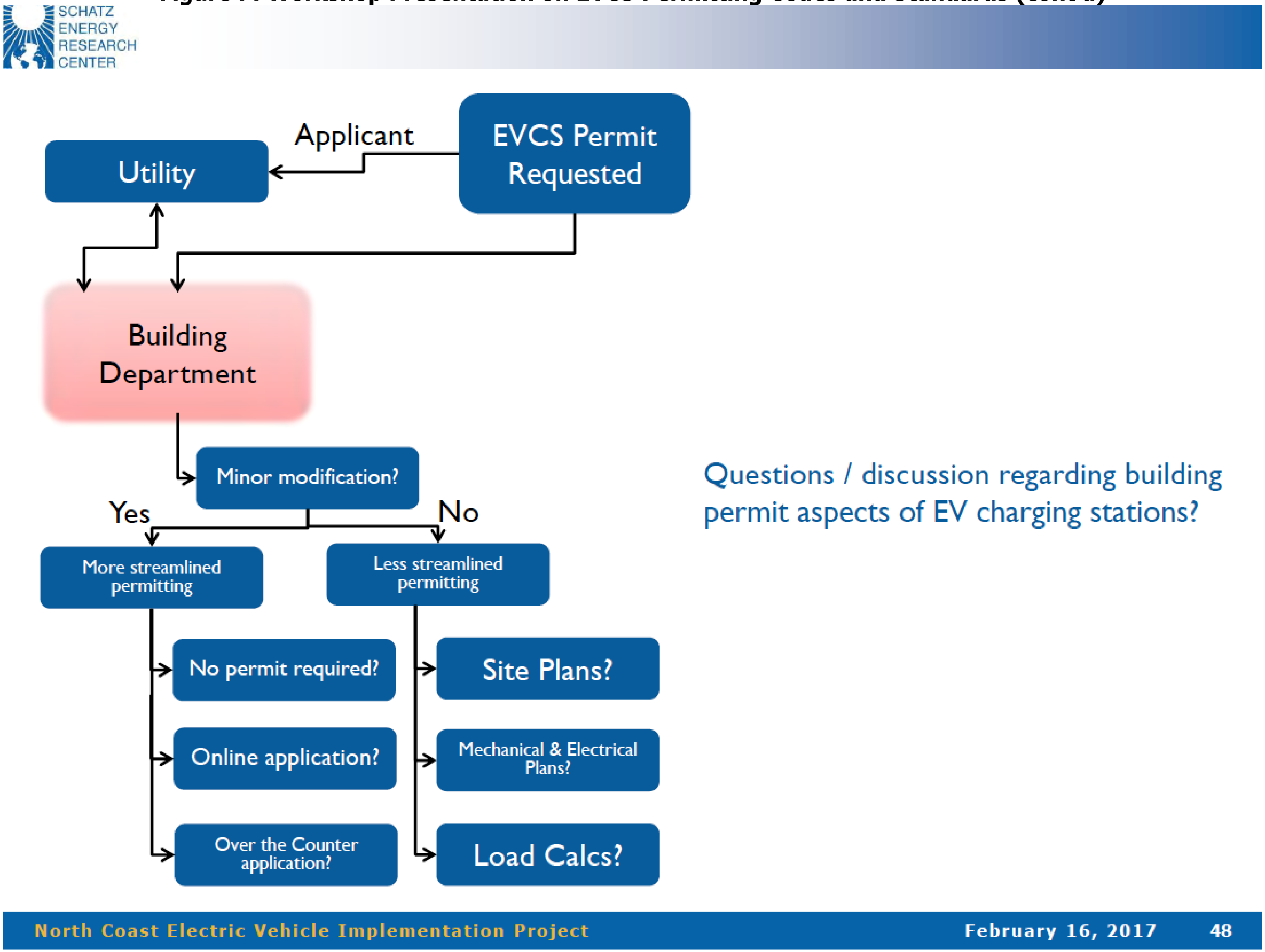

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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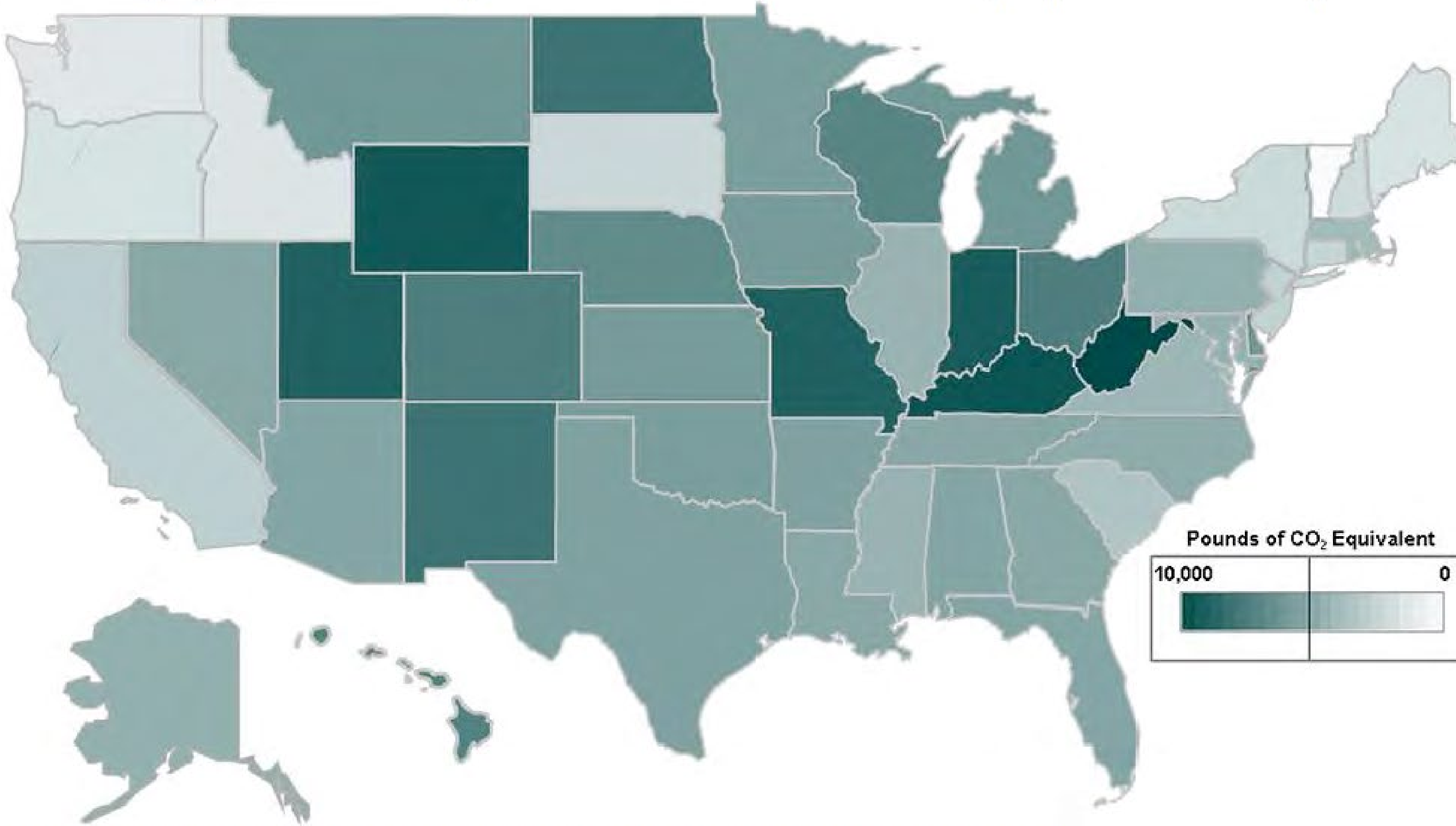
10 Minute Break

Annual well-to-wheel greenhouse gas emissions of an average electric vehicle by state.

- The average gasoline vehicle produces 11,435 pounds of CO_2 equivalent annually



Source: https://energy.gov/eere/vehicles/fact-950-november-7-2016-well-wheel-emissions-typical-ev-state-2015

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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ADA Accessibility: Section 11B-228

This applies to all public use and common use installations of EV chargers. Does not apply to an EV charger for use by a designated vehicle, such as public or private fleet vehicle (228.3.2).

Total Number of EVCS at a Facility[1]	Minimum Number (by type) of EVCS Required to Comply with Section 11B-812[1]		
	Van Accessible	Standard Accessible	Ambulatory
1 to 4	1	0	0
4 to 25	1 ♿	1	0
26 to 50	1 ♿	1	1
51 to 75	1 ♿	2 ♿	2
76 to 100	1 ♿	3 ♿	3
101 and over	1, plus 1 for each 300, or fraction thereof, over 100 ♿	3, plus 1 for each 60, or fraction thereof, over 100 ♿	3, plus 1 for each 50, or fraction thereof, over 100

Access California, presentation by Dennis Corelis, DSA. Slide 11. www.pevcollaborative.org/webinars

1. Where an EV charger can simultaneously charge more than one vehicle, the number of EVCS provided shall be considered equivalent to the number of electric vehicles that can be simultaneously charged.

See handout for summary of ADA requirements

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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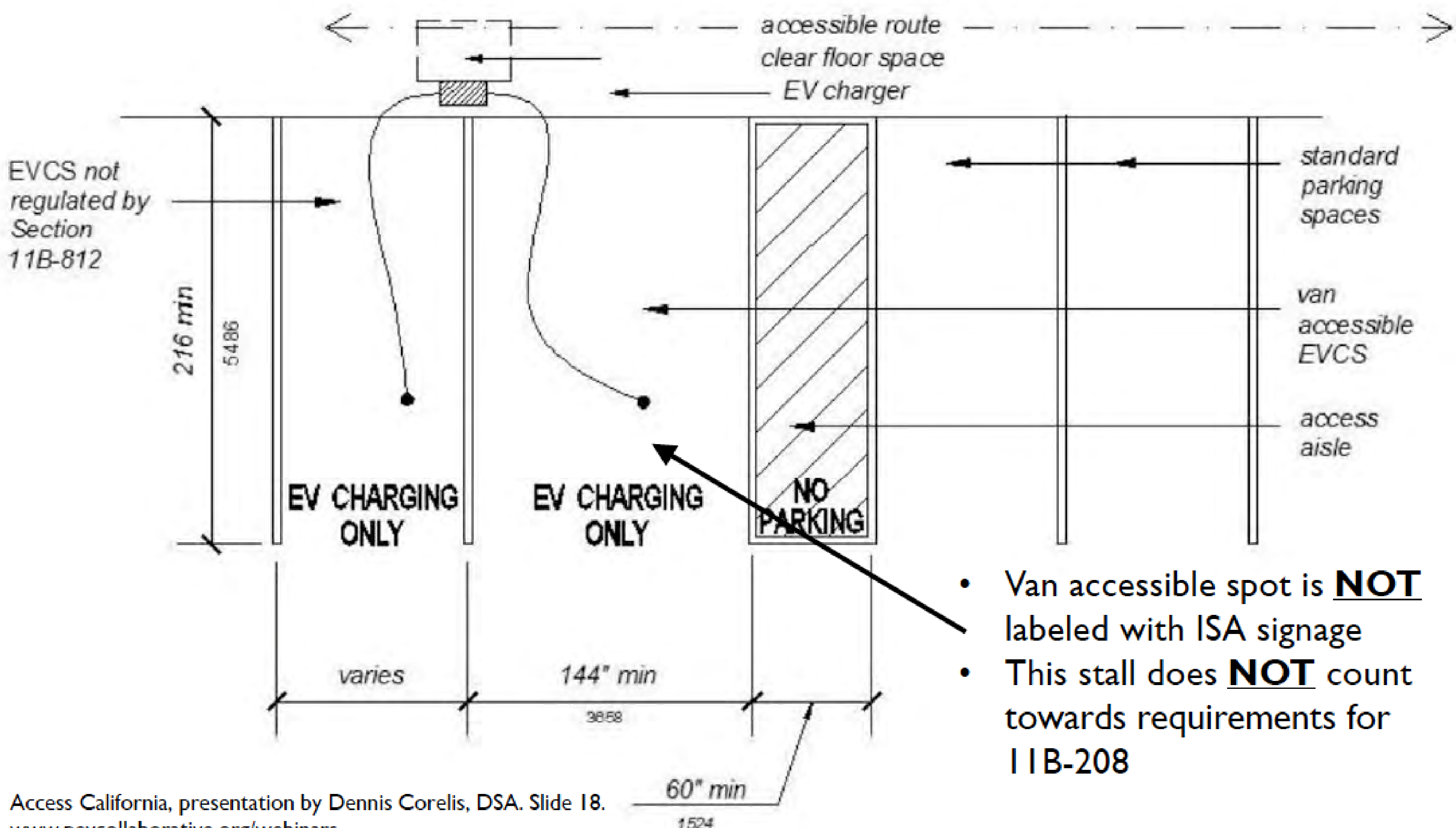
ADA Accessibility: Section 11B-812



- Van accessible spot is **NOT** labeled with ISA signage
- This stall does **NOT** count towards requirements for 11B-208

Access California, presentation by Dennis Corelis, DSA. Slide 18.
www.pevcollaborative.org/webinars

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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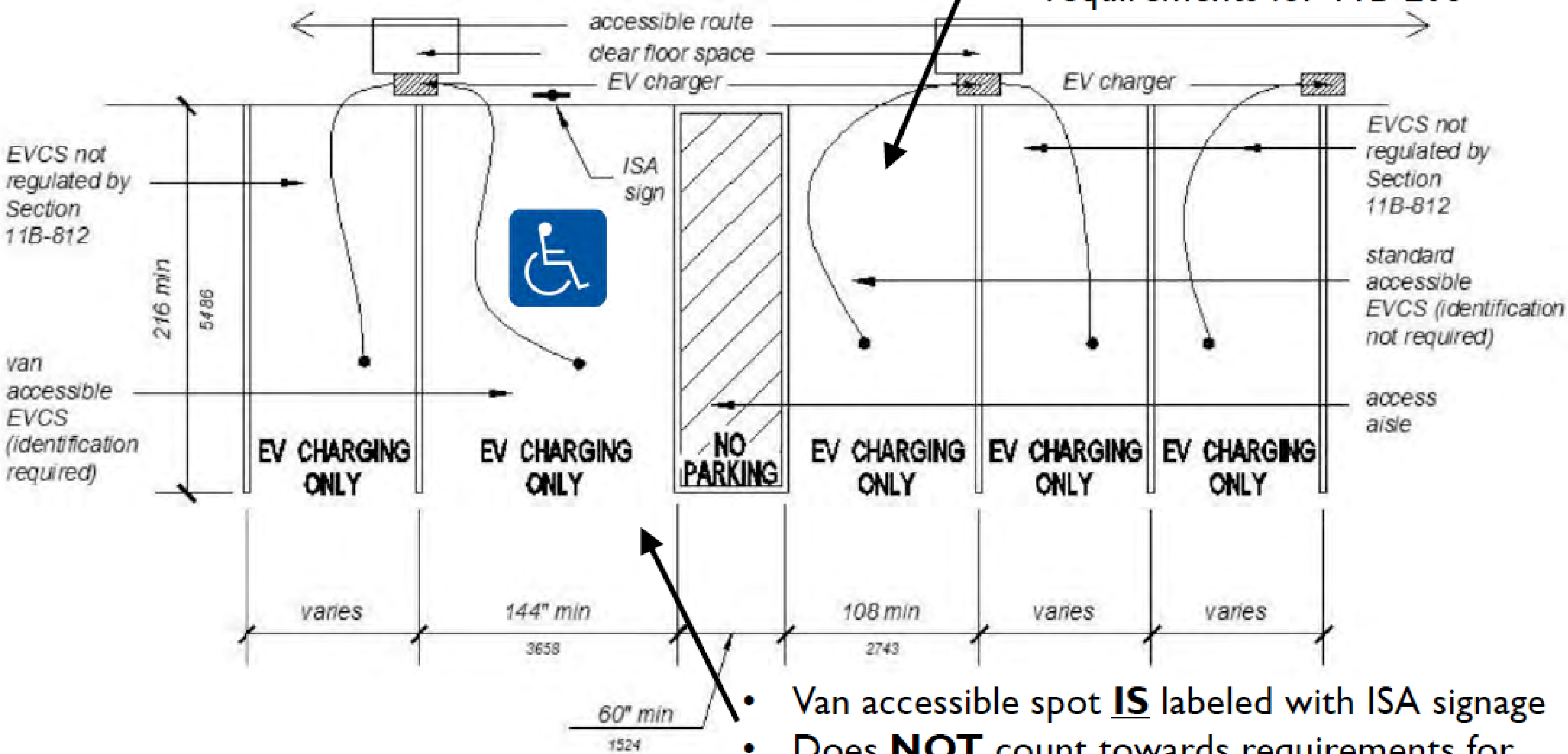
ADA Accessibility: Section 11B-812

- Standard accessible spot is **NOT** labeled with ISA signage
- Does **NOT** count towards requirements for 11B-208



- Van accessible spot **IS** labeled with ISA signage
- Does **NOT** count towards requirements for 11B-208
  - 208.1: EVCSs are **NOT** parking spaces

Access California, presentation by Dennis Corelis, DSA. Slide 21.
www.pevcollaborative.org/webinars

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

~~ADA Accessibility: Section 11B-707~~ And sensible basic access

Awesome art, but not a good install design

https://nextcity.org/images/made/SF_EVCharger_920_613_80.JPG

EV charging stations are point-of-sale devices, and regulated as such

- Clear floor space
- Unobstructed access to interface and plug
- ADA friendly display screens, payment systems, etc.
- Height and reach requirements for interface and plug

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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And sensible basic access

ADA Accessibility: Section 11B-707

Don't be fooled! Manual cord management doesn't work.
The ground will be spaghetti in no time.

https://chargedevs.com/wp-content/uploads/BWI-airport.jpg

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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And sensible basic access

ADA Accessibility: Section 11B-707

Clean install, good cord management

http://hanabi.autoweek.com/sites/default/files/styles/gen-932-524/public/P90216968_highRes_bmw-i3-94ah-dc-charg.jpg?itok=yvkhlqtf

One issue!
Not compliant with CEC 110.27(B): should have wheel stop(s) and/or bollard(s) protecting EV charger.

Good cord management

http://ww1.prweb.com/prfiles/2014/02/17/11592010/SemaConnect-Dual-Cable-Mgmt-System.jpg

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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And sensible basic access

ADA Accessibility: Section 11B-707

Excellent accessibility for a non-ADA spot; wheel stop blocks wheelchair access

http://www.plugincars.com/sites/default/files/ev-parking-620o.jpg

- Clear access around vehicle when parked for plugging cord into vehicle
- Wheel stop protects EV chargers, but would block wheelchair access

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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And sensible basic access

ADA Accessibility: Section 11B-707

Excellent accessibility for ADA and pedestrians; need cord management to keep cords off the ground.

http://www.evsellc.com/images/20141001_100920.jpg

- Clear access around vehicles and to EV chargers
- Wheel stops protect EV chargers
- No curb
- Need cord management to get cords off the ground

Replace wheel stops with a single bollard (to remove tripping hazard) and add cord management and this would be perfect!

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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Health and Safety Code Division 26, Part 5, Chapter 8.7 (Section 44268): EV Charging Stations Open Access Act

- ➢ Added by SB 454 in 2013
- ➢ Applies only to publically available parking spaces (defined by 44268(g), see handout) served by EV chargers

- EV charger user must not be required to pay a subscription fee or obtain membership in any club, association, or organization in order to use the EVCS.
  - Allowed to offer additional services for subscription or membership, but must allow non-subscribers and non-members to use.
- Must allow payment by credit card, mobile technology, or both without a subscription.

Think Gas Card / Card Lock

Optional

Subscription payment services

Mobile App   RFID card

Think Typical Payment At A Gas Pump

Required

True non-subscription payment

- On-site credit card reader
- RFID-based cell phone payment (i.e. PayPal, Apple Pay, Android Pay, etc.)
- Phone number to call to provide credit card information

Future Required

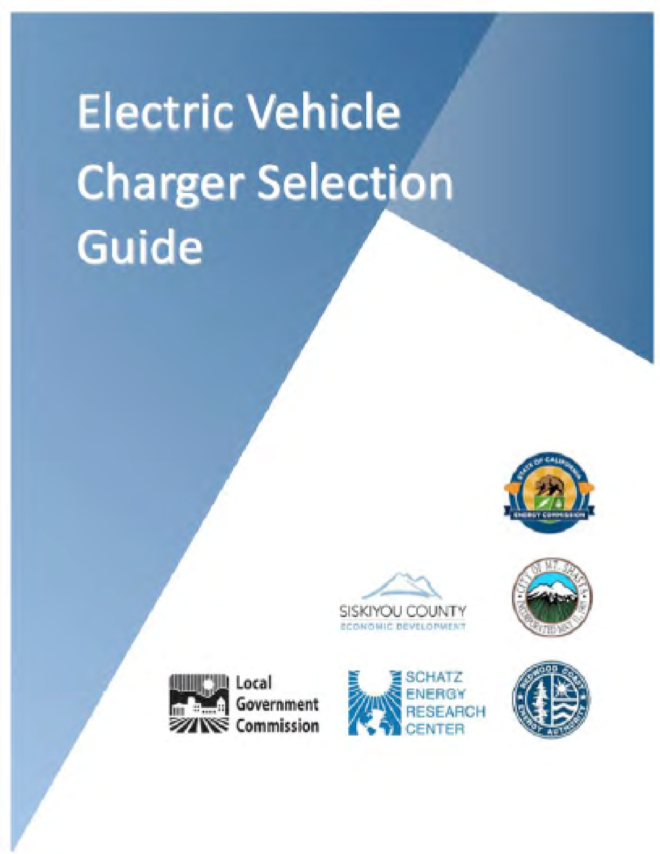
Interoperability Billing Standard

- Not yet established
- Subscription payment services are cross compatible

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

Health and Safety Code Division 26, Part 5, Chapter 8.7 (Section 44268): EV Charging Stations Open Access Act

- EV Charger Selection Guide: Can be used by permitting departments to verify that EV charger models proposed for public installation meet Health and Safety Code



- Available online at www.redwoodenergy.org
- Will be updated quarterly through the end of the year

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

Health and Safety Code Division 26, Part 5, Chapter 8.7 (Section 44268): EV Charging Stations Open Access Act

- Added by SB 454 in 2013
- Applies only to publically available parking spaces (defined by 44268(g), see handout) served by EV chargers

Cost To Charge Vehicle

ROEV Subscribers
$0.30/kWh

Non - ROEV Subscribers
$1.20/hr + $0.25 per charge event

- Total actual costs for use of EV charger, including "network roaming charges" for non-members, per event fees, etc., must be disclosed at the point of sale.

ELECTRICITY

9.6 kW

240 VAC / 40 Amps

CONDUCTIVE

- EV charger must comply with Code of Federal Regulations Title 16, Part 309
  - Power rating of EV charger must be conspicuously displayed in format defined by Part 309.20 and Appendix A to Part 309

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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Wayfinding Signage

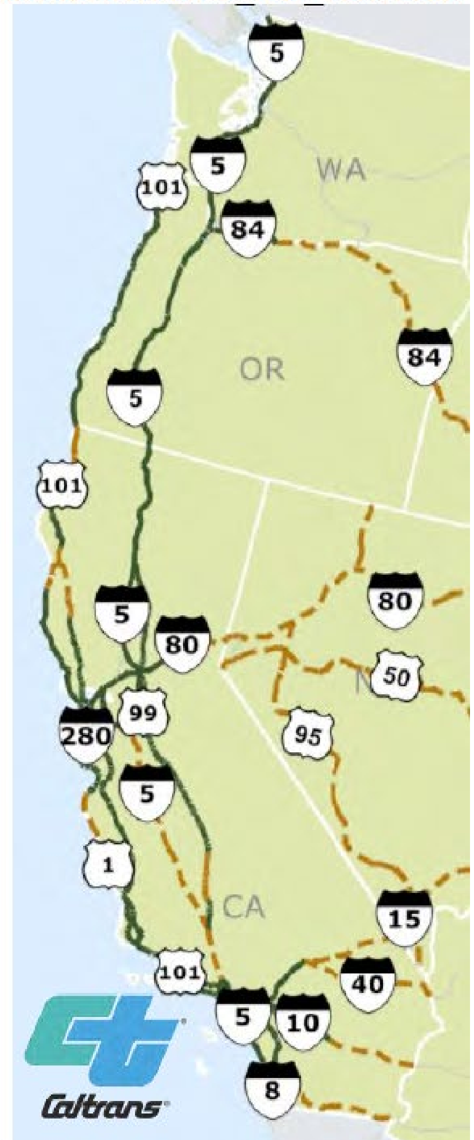
M5-1
M5-2, M6-1, M6-2, M6-3

G66-21C (CA)
G66-21B (CA)
Subject to FHWA interim approval IA-13.

http://www.westcoastgreenhighway.com/evsigns.htm

G66-22J (CA)
G66-22K (CA)

http://www.fhwa.dot.gov/environment/alternative_fuel_corridors/



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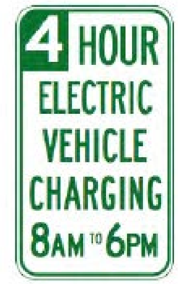
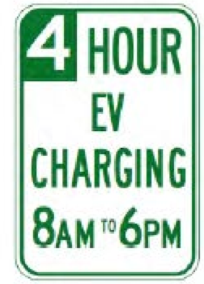
Station Signage

G66-21C (CA)
G66-21B (CA)
Subject to FHWA interim approval IA-13.

G66-21 (CA)



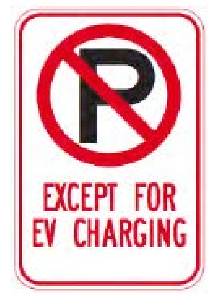
R114A (CA)



R114 (CA)

R112 (CA)

R113A (CA)



R113 (CA)

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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Codes and Standards - Overview

Organization	Code, Article, or Section	Description
NFPA	70	National Electric Code
NEC	625	Electric Vehicle Charging System
SAE	J1772	AC EVSE Connection
SAE	J1772 combo	AC and DC EVSE in one connection
TEPCO	CHAdeMO	DC EVSE Connection
DGS	CBC Chapter 11B	Accessibility requirements
CalGreen	Part 11	Mandatory & Voluntary Codes

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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Codes and Standards – 2016 CalGreen

Organization	Code, Article, or Section	Description
CalGreen (2016)	4.106.4 (new const. only)	Mandatory residential requirements • New single and duplex: All attached private garages are "EV Capable" • Multifamily: 3% of parking spaces ready to support future EV chargers.
	A4.106.8	Voluntary residential requirements
	5.106.5.3 (new const. only)	Mandatory commercial requirements • Table 5.106.5.3.3: # of required EV spaces per parking lot • "EV Capable"
	A5.106.5.3	Voluntary commercial requirements

"EV Capable" and "future support" = raceway and panel capacity with label for 240V 40A service per EV space.

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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Codes and Standards – Parking

- AB 475 authorizes local governments to require that cars located at EVCSs must be plugged into the EV Charger (see CA Vehicle Code 22511 in handout)
- SB 880 Outlines rights and responsibilities of Home Owners Associations to ensure that PEV drivers are not unreasonably prohibited from installing EVCS
- CalGreen includes information about required minimum parking spaces

New Commercial Construction: 5.106.5

Total # of Parking Spaces	EV Spaces	Clean Air Vehicle Spaces
0 - 9	0	0
10 - 25	1	1
26 - 50	2	3
51 - 75	4	6
76 - 100	5	8
101 - 150	7	11
151 - 200	10	16
201+	6%	8%

New Residential Construction: 4.106.4

Building Type	EV Spaces
Single Family / Duplex attached private garage	"EV Capable" raceway
Multi-family: 17 or more units	• 3% of parking spaces are EV spaces • 1 in 25 must be ADA van accessible • Adjacent to ADA spot OR located on accessible route.

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

Codes and Standards – Parking

Plug-In Electric Vehicle Parking Code Example

Snapshot: The California Vehicle Code (CVC) provides local governments the authority to place traffic control devices in their jurisdictions (including county highways) to guide, warn and regulate traffic as necessary to carry out the provisions of the CVC and local traffic ordinances. **Traffic Operations Policy Directive 13-01** includes several plug-in electrical vehicle signs and pavement markings for communities. Signs that restrict parking to PEVs, or limit the amount of time a vehicle can be parked, need to be added into local codes to become legally enforceable. The following example is adapted from the City of Santa Monica's **Municipal Code**.

Parking Code Templates

The local government of ____________, or designee, is authorized to designate parking spaces or stalls in an off-street parking facility owned and operated by ____________ or the Parking Authority of the ____________ for the exclusive purpose of charging and parking a vehicle that is connected for electric charging purposes.

When a sign provides notice that a parking space is a publicly designated electric vehicle charging station, no person shall park or stand any nonelectric vehicle in a designated electric vehicle charging station space. Further, no person shall park or stand an electric vehicle in a publicly designated electric vehicle charging station space when not electrically charging or parked beyond the days and hours designated on the regulatory signs posted. For purposes of this subsection, charging means an electric vehicle is parked at an electric vehicle charging station and is connected to the charging station equipment.

- Building code requires all EV Charging Stations to be labeled as "EV Charging Only"

See handout for code example

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

Codes and Standards – NEC 625

EVSE is considered a **continuous load** under NEC so the supply system to the equipment must be rated for 125% of the nameplate rating. Covers following construction equipment:

- Coupler, polarization, non-interchangeability, construction and installation, unintentional disconnection, grounding,
- Markings,
  - Ventilation
- Means of Coupling
  - Conductive or inductive
- Cords and cables
  - Power-Supply cord
  - Output cord to electric vehicle
- Overall Cord and Cable Length

- Interlock
- Automatic De-Energization of cable
- Personnel Protection System
- Overcurrent Protection
- Rating
- Disconnecting Means
- Electric Vehicle Supply Equipment Connection
- Interactive Systems
- Location
- Ventilation

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)

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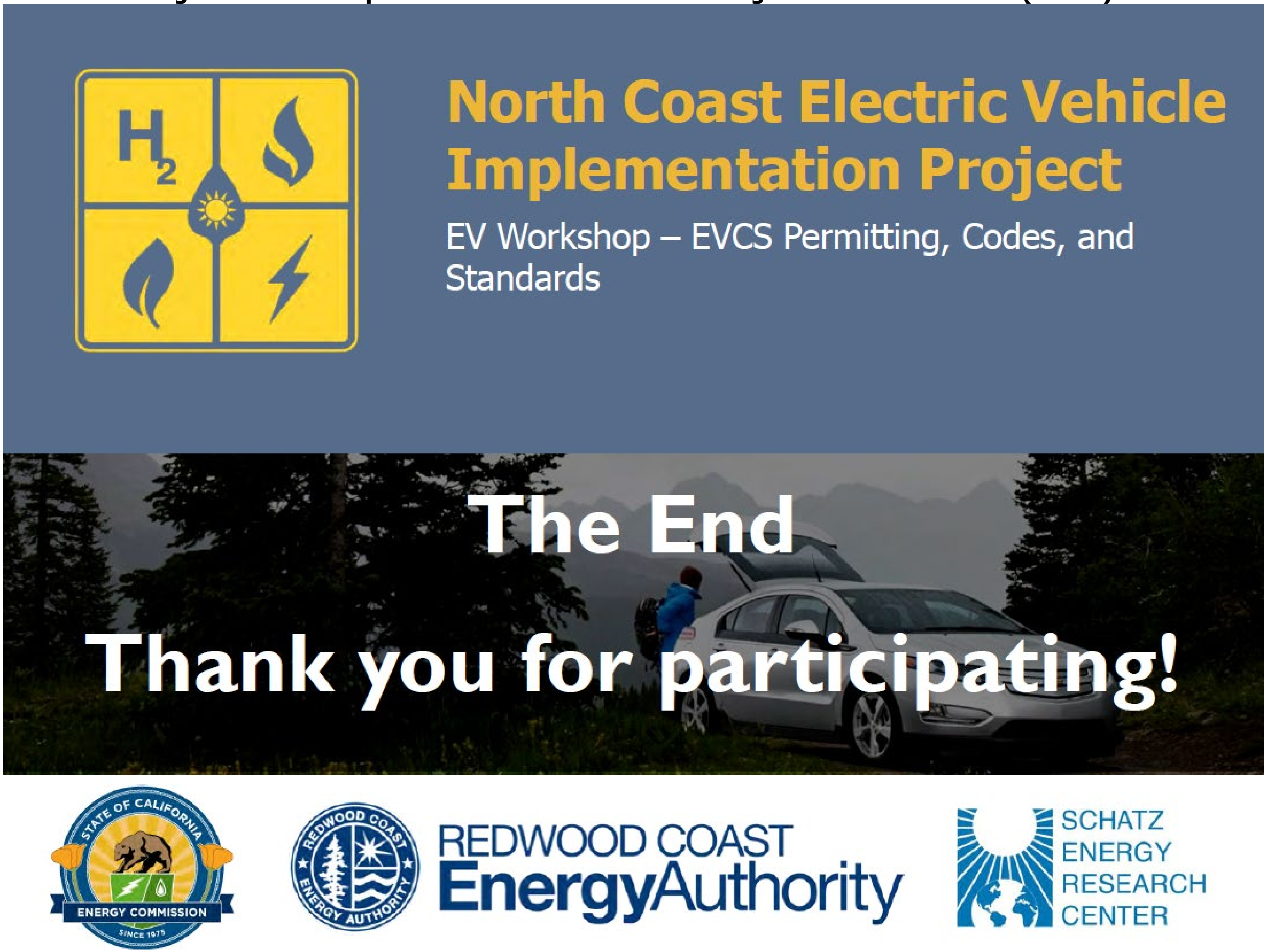
Codes and Standards – NEC 110 & 625 Key Points

Applicable Code	Description
NEC 110.28	The enclosure must be NEMA-rated
NEC 625.17	Cord length will reach vehicle's inlet without excessive slack and must be no more than 25' in length
NEC 625.29	Connector must be mounted at a height between 36" and 48" from the ground unless otherwise indicated by the manufacturer
NEC 110.26	The recommended space around electrical equipment is 30" wide, 3' deep and 6'6" high
NEC 110.27	Equipment operating above 50 volts must be protected against physical damage
NEC 625.23	For EVCS greater than 60 amperes, a separate disconnect is required and should be installed concurrently with conduit and visible from EVCS
NEC 625.21	Conductors should be sized to support 125% of the rated equipment load

http://energycenter.org/programs/pev-planning/san-diego

Figure 7: Workshop Presentation on EVCS Permitting Codes and Standards (cont'd)



Source: Redwood Coast Energy Authority

Appendix E:
EVCS Selection Guides

Figure 8 shows a guide for proper selection of electric vehicle charging stations.

Figure 8: EVCS Selection Guide

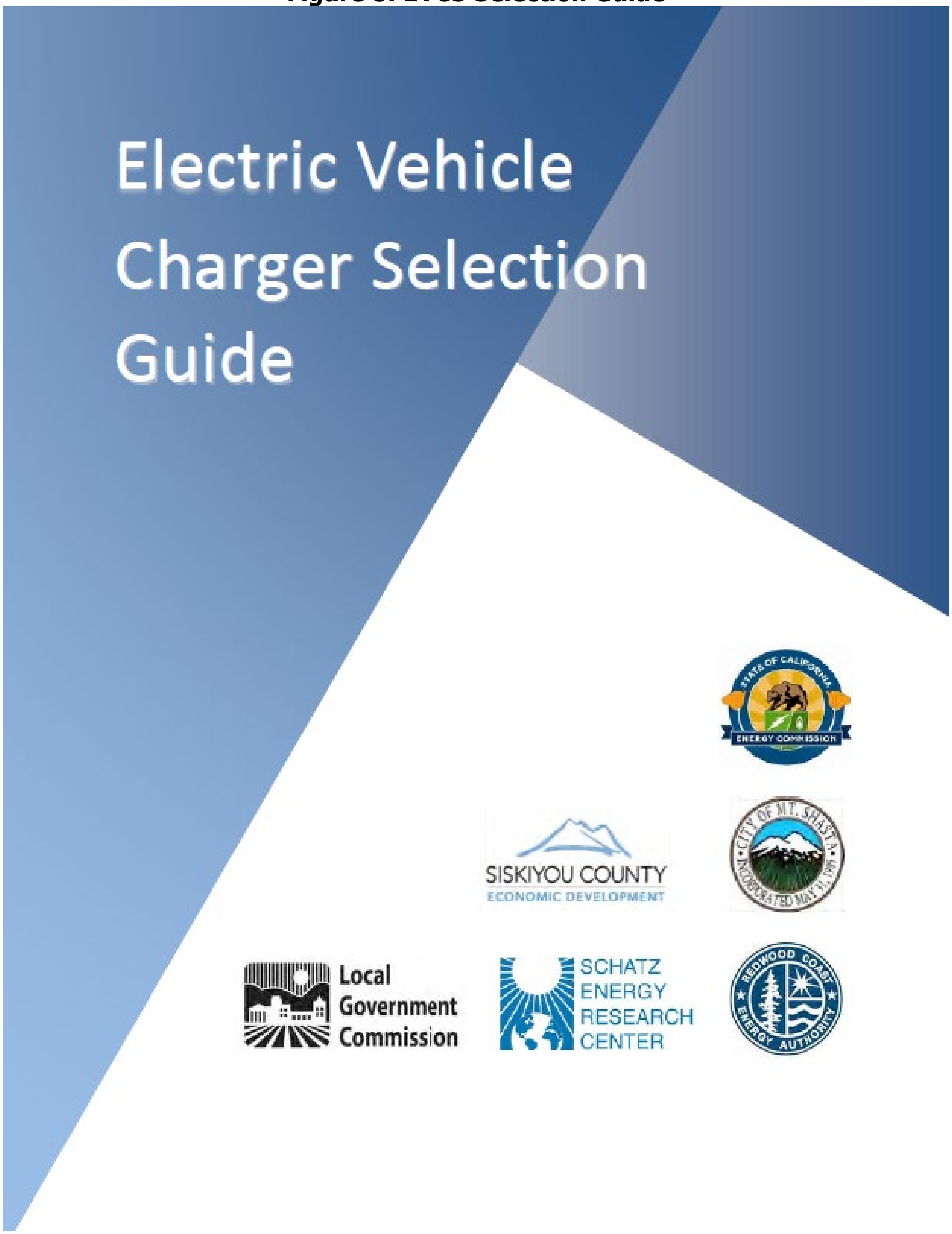


Figure 8: EVCS Selection Guide (cont'd)

1 Background

The Redwood Coast Energy Authority (RCEA) developed this guide as the result of an Electric Vehicle (EV) Readiness Implementation grant funded by the California Energy Commission (CEC). The goal of this guide is to help site hosts and others learn about, evaluate and compare the features of EV charging equipment (available as of November 2016) to assist them in selecting the best charger for their application.

In a prior project, RCEA conducted an Electric Vehicle Charger (EVC) selection process in partnership with the CEC's Alternative and Renewable Fuels and Vehicle Technology Program. The project team identified EV chargers available on the market and developed a rubric to objectively compare cost, performance and design metrics. The team then contacted manufacturers and obtained product information, evaluated criteria, and assessed available EV charger models.

The first section of this guide provides an overview of EVC equipment, how it works, and considerations in making a purchase. The next section includes a table of EVC features available from domestic manufacturers. To gather this information, RCEA sent out specification sheets of predetermined criteria to EVC manufacturers and requested an email response with completed specifications for current 208/240 V charger models. Additional information, including 480 V chargers, was collected using publicly available technical specifications. As funding allows, the table will be updated periodically to include new models and specifications as product offerings evolve.

1.1 Selecting an EVC: Making Choices

While there are many different chargers to choose from, answering a few questions about what you need in an EVC can make the decision easier:

1. What type of charging do you want to provide?
2. Do you want a networked charger or a stand-alone charger?
3. Do you wish to charge for access to an EVC? What costs are you willing to incur?

This section will provide some background information to help answer these questions, as well as providing some approximate costs associated with installing EVCs.

1.2 Types of EV Charging

Chargers are generally classified in terms of the power they can provide, designated as "levels":

- A Level 1 EVC uses a standard 120 volt outlet, usually taking between 8-20 hours to fully charge a PEV.

There are several names to describe equipment that charges electric vehicles. Most literature uses the term "Electric Vehicle Supply Equipment," or EVSE.

This guide uses "Electric Vehicle Charger," or EVC, as it describes the function more clearly: a device providing power to charge an electric vehicle.

See the end of this guide for a glossary of common electric vehicle charging terms.

Figure 8: EVCS Selection Guide (cont'd)

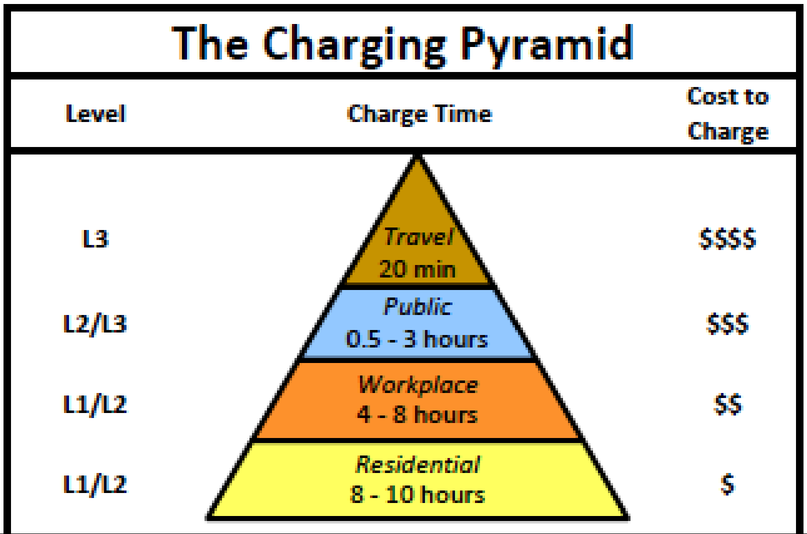
- A Level 2 EVC uses a 208/240 volt electric circuit, usually taking 4-8 hours to fully charge a PEV.
- A Level 3 EVC uses a 480 volt electric circuit, usually taking 20 minutes to reach 80% charge. Once at 80% charge, Level 3 chargers reduce power to supply the remaining charge in order to prevent damage to the battery.

The charge times will vary depending on the PEV and the battery capacity. More information is provided in the Glossary section of this guide. The different charging levels serve different consumer needs: fast chargers are best suited for long-distance trips where time is a premium, while slower chargers work best at locations where people will be parked for long periods. The charging pyramid (Figure 1) illustrates charging levels, their typical charge time, and approximate cost.

Chargers are also classified by the kind of connector on the charging cord. There are currently two competing standards: J1772, developed by SAE International, and CHAdeMO, developed by an organization of the same name. The connector inlets can be seen in Figure 2. Tesla also has a proprietary connector for their charging stations, exclusively available to Tesla drivers. In the US, CHAdeMO charging comprises the largest share of Level 3 stations, while J1772 is the main standard for Level 1 and Level 2 charging, with a smaller share of Level 3 charging.

It is important to note that not every car will be able to take advantage of an EVC's full power. While external charging devices are commonly called "chargers" (including in this guide), they merely provide an electric current – the actual "charger" managing energy flow into the battery is inside the electric vehicle, as shown in Figure 2. Different vehicles will have different charging rates depending on the internal charger; some will not support Level 3 charging, and other chargers (particularly in older vehicle models) will have charging rates below the standard Level 2 rate.

Figure 8: EVCS Selection Guide (cont'd)

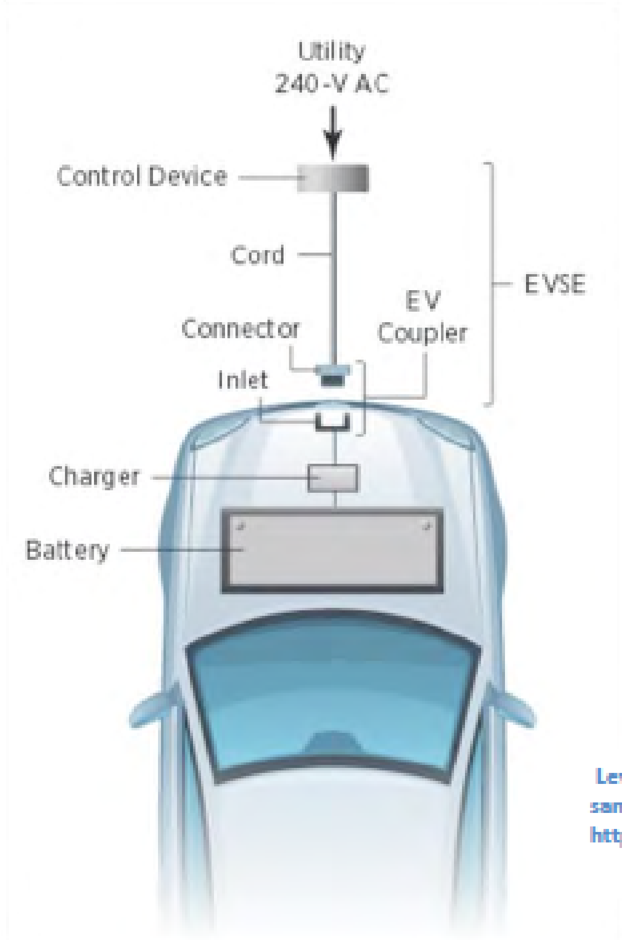


Level 1	Level 2	Level 3
		
• 120 Volts, 12-16 A • 2-5 miles of range per hour of charge • Plug in to any standard outlet	• 208/240 Volts, up to 80 Amps • 10-20 miles of range per hour of charge • Typical equipment cost $1,000 - $7,000	• 208-600 VDC, up to 200 A • 60-80 miles of range per hour of charge • Typical installed cost $20,000 - $100,000

Charging pyramid courtesy of: Zero-Emission Vehicles in California: COMMUNITY READINESS GUIDEBOOK, accessible at http://opr.ca.gov/docs/ZEV_Guidebook.pdf. Photo credits for Level 1, Level 2, and Level 3 are P1, P2, and P3, in section 6.1, respectively.

Figure 1: Comparison of charging levels, time, and typical installation cost

Figure 8: EVCS Selection Guide (cont'd)



CHAdeMO Level 3 receptacle (left) and Level 1 and Level 2 J1772 standard receptacle (right). Source used with permission from: http://www.afdc.energy.gov/pdfs/51227.pdf

Level 2 charging schematic. In this diagram, EVSE means the same as EVC. Source used with permission from: http://www.afdc.energy.gov/pdfs/51227.pdf

Figure 2: EVC schematic and connector inlet image

One of the largest factors in determining the type of charging to provide is cost. While maintenance and accessory costs can be significant (and will be explored in more detail in Section 1.4), equipment and installation are the largest cost components, and vary the most between different level chargers. Level 2 charging equipment, the most common for public charging, ranges from $1,000 to $7,000, depending on features. Incentives can help reduce the upfront cost; for example, the EV infrastructure tax credit for an EVC in 2016 is 30% up to $1,000 for consumers, and 30% up to $30,000 for businesses. Some states provide EVC and battery-only electric vehicle (BEV) incentives: Oregon has an EVC tax credit for 50% of the project cost up to $750. Other options include credits or incentives for organizations, alternative energy sources, and leased facilities.

Installation costs are highly variable: the type of site host, wiring, number of circuits and EVC units being installed, and trenching are all key factors unique to each installation. The cost for other components, such as EVC parking spot signs and wheel stops, will also vary depending on state requirements and shipping costs. Overall, the installation, maintenance, and equipment costs for a Level 2 station could range from $12,000 - $20,000. With more expensive equipment and more demanding electric service, Level 3 charging stations are typically at least 2-3 times the cost of a Level 2 station.

Figure 8: EVCS Selection Guide (cont'd)

1.3 Stand-Alone vs. Networked Chargers

A service network provides oversight and services to support a system of EVCs. Services are available to EV drivers as well as site hosts or network administrators, with different fee structures aimed at each. The simplest EVCs, frequently referred to as stand-alone or "dumb" chargers, do not have network access – they are essentially electrical outlets with circuitry to enable communication and safe charging with the vehicle, as outlined in Figure 3. Without network access, stand-alone chargers cannot process payment, and are generally reserved for residential or fleet applications.

An EVC network adds a variety of capabilities. For drivers, services may include payment options, station location and availability, and options such as reservations, messaging, and summary reports. Site host services include payment management, customer support, station status, data reporting, and typically access to a network "dashboard".

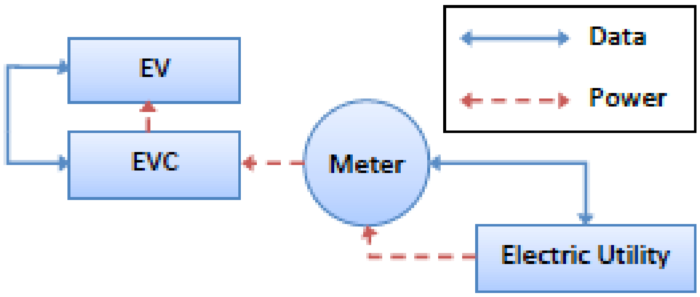


Figure 3: EVC Stand-alone ("dumb-charger") configuration

EVC selection is a balance between the preferred ownership model and realistic availability of services at the desired location. Stand-alone chargers have lower installation costs, simpler designs, and no recurring fees for features such as payment processing and cloud connectivity. They may also be the only viable option in locations with poor cell reception, or at low-use sites where network fees would likely exceed the cost of allowing free access. Conversely, networked EVCs allow for payment options, notification of charging station status, and provide remote diagnostic capabilities.

For those who wish to install a networked charger, service networks generally fall into two categories:

- Subscription access: users subscribe to the service network, which typically establishes an initial deposit and either manual or automatic deposits to keep a payment account active. Users then connect their vehicles and use a dedicated RFID card or smart phone app to initiate a charging session and have fees deducted from their account. These models may include a subscription fee, charging session fees, incremental fee based on the amount of electricity consumed, or some combination of fees.
- Open access: these service networks provide a dedicated subscription, but also accept universal payment methods such as credit cards. **In California, all publically available charging stations must be open access:** California Health and Safety Code Section 44268.2 states that public charging station customers "shall not be required to pay a subscription fee in order to use the station, and shall not be required to obtain membership in any club, association, or organization as a condition of using the station." The specification tables in Section 2 of this guide explicitly state which charging stations are open access.

Figure 8: EVCS Selection Guide (cont'd)

Networked chargers include several components beyond conventional charging hardware to enable the interchange of money and data, as well as data connections beyond the utility (Figure 4). These additional components/connections include:

- Communication: cell service or Internet connection to provide access to the cloud for data exchange.
- Network administrator: dedicated staff to routinely monitor station status, issue repair requests, track station usage, and maintain onsite hardware and software.
- Manufacturer or Network Service Center: central hub or operations center for all networked charging stations to provide customer support, manage data communication and reporting, monitor station status, and perform remote diagnosis and system updates.
- Transaction processor: Third-party group to manage financial transactions between EVC customers and financial institutions.
- Bank: financial institution that manages customer funds and releases payment for charging sessions and subscription account deposits.

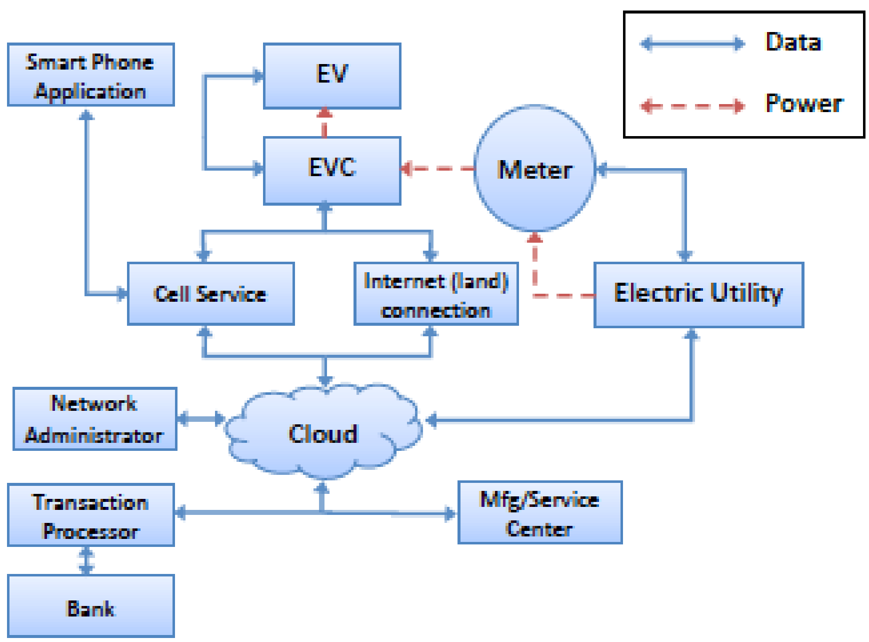


Figure 4: EVC Network with payment capability

Networks also provide a variety of customer dashboards for site hosts to monitor their site and obtain information about station status, usage patterns, revenue, greenhouse gas savings, and other details, as illustrated in Figure 5.

Figure 8: EVCS Selection Guide (cont'd)

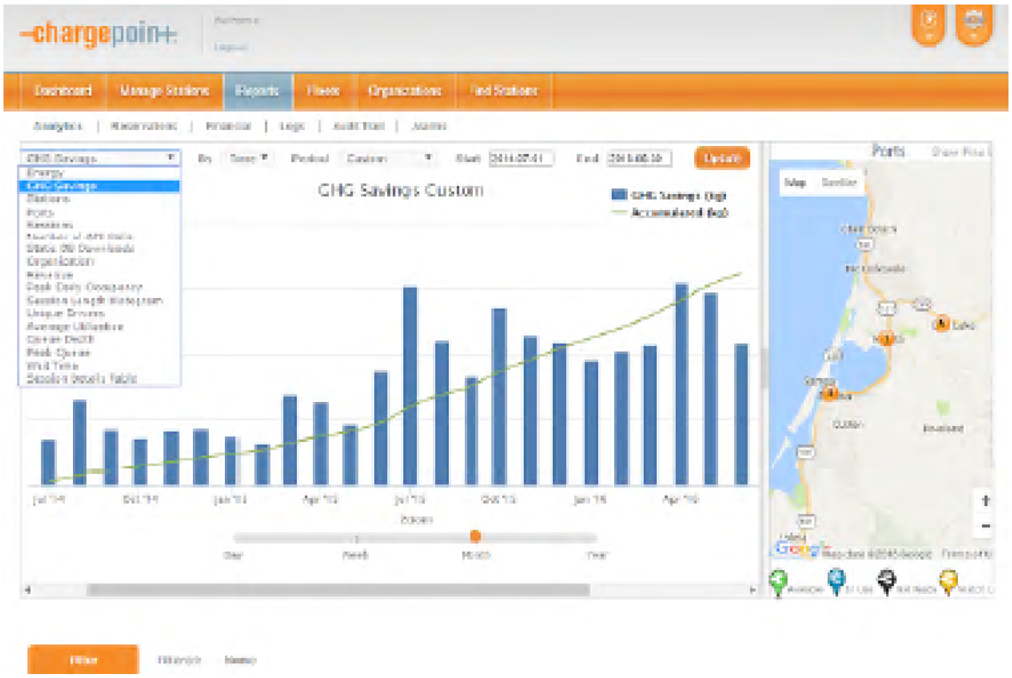


Figure 5: Example of a network dashboard

To reduce inconvenience for drivers, various manufacturers are working to create ways to allow drivers to use a single service to access other "out of network" EVCs. One such system is called the Open Charge Point Protocol (OCPP). When it is fully implemented, it is expected to operate similarly to the way that banks provide access to each other's customers with automatic teller machines (ATMs).

From a site host point of view, unless it is a workplace installation or similar ownership model, a charging station is primarily operated through a network management team and associated software. Most EVCs are connected by default to a service network by manufacturers to support their own diagnostic and customer support requirements. The site offerings and user experience will vary depending on location, cell or network access, and more. There are also cases in which the service network and site host both manage and maintain the charging station network.

1.4 Owner and Customer Payment

For many, the most important criterion in selecting an EVC is cost. While the equipment costs are generally straightforward, ongoing operational costs can be more complicated. Depending on the complexity of the network and business model, site owners may face multiple fees for different network components. For example, a location may include a monthly cell service fee, monthly utility meter fee, electric bill, and service network subscription. Some networks may bundle these fees into a per-charging session fee, either as a flat rate or as a portion of the total session cost. While not every charger will have the same fees, any installation will incur some of the costs below:

Figure 8: EVCS Selection Guide (cont'd)

Energy price

All chargers will require the station owner to purchase energy. This includes both the per-kWh charge for electricity directly used by the charger, and potential demand charges if the charger increases your peak demand.

High-cost scenario: The lowest power chargers draw approximately 2 kW of power – unlikely to increase a demand charge, but could potentially use 48 kWh (about 2 full vehicle charges) per day. DC fast chargers require 50 kW of power, potentially using 1200 kWh (about 48 full vehicle charges) and are more likely to incur demand charges.

Networking fees

If you wish to purchase a smart charger, most will require subscription fees to access the network. Network subscriptions are typically on an annual or multi-year basis.

High-cost scenario: While prices will vary depending on the network, typical charges are between $250-300/charging port/year. A bank of 5 dual-port chargers would cost approximately $3,000/ year.

Credit card processing fees

While most charger networks include a network-only payment card free of fees, most smart chargers will still accept credit cards (and the subsequent processing fees) in order to be accessible to the largest portion of the market. Some networks will handle all financial transaction for you, paying the processing fees themselves – and generally offsetting the cost in the network fee structure. If the network does not cover processing fees, you will be responsible – such fees are typically a small percentage of the total transaction value.

High-cost scenario: Profits from charger transactions will be a few percentage points less

Maintenance costs

Though actual charger upkeep can be minimal depending on the complexity of the equipment, repairing broken chargers could prove costly if not under warranty. For most, the warranty price will be the majority of the maintenance cost. Warranty pricing will differ based on the equipment and terms of coverage - some provide renewable warranties, others are fixed-term. Some manufacturers will include the warranty price in the equipment cost.

High-cost scenario: Annual extended warranties for DC fast chargers can cost over $800/charger/year. Less powerful chargers may have a fixed length warranty for half as much, but will leave you responsible for repair charges after the term is over.

For those looking to generate revenue from an EVC, most networks allow site owners to set their own pricing scales. Pricing is typically based on the amount of energy charged (similar to a utility bill), the time spent using the charger (similar to a parking meter), or as a flat per-charging-session fee. The fee structure you choose will have consequences for the driver. For example, a flat per-session fee will benefit those who can charge the most energy per session – either with longer charge sessions or with fast charger capability. Time-based fees benefit those who charge at a fast rate. Service networks may also support custom pricing strategies, such as including a time-based "parking meter" rates in addition to the charging fees to encourage people to move their vehicles once charging is complete. Customer payment typically involves using an RFID card obtained through registering with a network, or a credit card.

2 EV Charger Specifications

Once you've determined your specific EVC needs, you need to investigate the available options. Based on the EVC selection process finalized by RCEA and the CEC's Alternative and Renewable Fuels and Vehicle Technology Program for a previous grant, the most important criteria to consider are:

1. Theft deterrence features
2. Credit card reader type
3. Commercial maturity
4. Standard warranty length
5. Highest rating (in kW) available per plug
6. Dual plug with high power capability option

Prioritization of equipment features will also differ from site host to site host, and these criteria are not the only important criteria. The specifications table in Section 2.1 of this guide breaks down different categories based on Hardware (electrical and mechanical), Management Software, Payment System, and Manufacturer Information:

- Hardware - Electrical
    - *Number Charging Ports/Type*: The number of EVs that can charge simultaneously, and the connector type (e.g. J1772, CHAdeMO, see Figure 2 for examples).
    - *Input Power*: Power circuit required to support the charger.
    - *Output Power*: Maximum power deliverable to an electric vehicle. Given as a kW rating, and as an estimated miles of range added per hour of charging time.
    - *Cross Vendor Software Compatibility*: Can this charger use other manufacturer's software?
    - *Operating Conditions*: Temperature and humidity operating limits.[1]
- Hardware - Mechanical
    - *Mounting*: Either pedestal or wall.

[1] Not usually an issue outside of extreme climates.

Figure 8: EVCS Selection Guide (cont'd)

        - *Pedestal*: Hard-wired to a permanent pole or box. Typically mounted on a sidewalk or a concrete base.
        - *Wall*: Either hard-wired or temporarily wired to an existing wall. Typically includes a mounting plate.
    - *Cable*: Cable management strategy (e.g. coil, retractable, etc.).
    - *Number of Charging Ports/Type*: The number of EVs that can charge simultaneously, and the connector type (e.g. J1772, CHAdeMO).
    - *Theft*: Systems available to prevent theft or vandalism.
    - *Power Input Ratings*: Power circuit required to support charger.
    - *Operating Conditions*: Temperature and humidity operating limits.

- Management software:

    - *Network capable*: Can utilize networked management software.
    - *Remote management*: Can charger information and settings be accessed remotely?
    - *Cross Vendor Hardware Compatibility*: Can other chargers use this software?
    - *Network protocol*: Protocol for communication between EVC site host and an EVC network.
    - *Demand Response Capability*: Ability to adjust power output in response to grid demand.
    - *Data reporting*: Available data generated by charger.

- Payment System:

    - *Open Access*: Can any customer charge (yes) or is a service subscription required (no)?
    - *Customer payment*: Possible customer payment methods.
    - *Price Setting Option*: Potential fee structures the owner can set.
    - *Owner payment*: Expected network and maintenance fees paid by station owner.

- Manufacturer/Certification Information:

    - *Listings*: Product testing certifications (e.g. UL, ETL, etc.).
    - *Accessibility Features*: Device features intended to increase access for handicapped users.
    - *First Entry to EVSE Market*: Date of first product the manufacturer released to the EVSE market.
    - *Installation Rating*: Product installation certifications (e.g. NEMA).

Figure 8: EVCS Selection Guide (cont'd)

2.1 EVC Specification Tables

These tables give an overview of the various charging station equipment available as of November, 2016. Exact pricing and warranty will differ depending on the exact submodel and accessories included. While we have made every effort to ensure the information in these tables is accurate, they should not be considered a final authority on EVC specifications. For pricing and other detailed information, contact a sales representative. For images of the chargers, see Section 6.

Hardware - Electrical							
Manufacturer	Model	# Charging Ports/Type	Input Power	Output Power		Cross Vendor Software Compatibility	Operating conditions
				kW	miles range / hrs charging		
Level 2 EVC							
AeroVironment	TurboDock	1/J1772	208/240VAC; 16A	3.8 kW	13 miles range/hour	N/A	-40°F to 122°F
Blink	PE-30Kice	1/J1772	208/240VAC; 30A	7.2 kW	24 miles range/hour	No	-22°F to 122°F
BTC Power	Chargion	1-2/J1772	208/240VAC; 16A, 30A, 40A options	3.3 – 9.6 kW	11-32 miles range/hour	Greenlots SKY/OCPP compliant	-22°F to 122°F 90% RH non-condensing
ChargePoint	CT4000	1-2/J1772	208/240VAC; 40A circuit	7.2 kW (max)	24 miles range/hour	No	-22°F to 122°F 95% RH non-condensing
Clipper Creek	LCS / HCS / CS	1/J1772	208/240 VAC	2.88 – 19.2 kW	9.6-64 miles range/hour	CS models can use Liberty Plugins control system	Unknown
Efacec	Public	2/J1772	208/240 VAC 30 A / each output	7.2 kW	24 miles range/hour	Greenlots SKY OCPPv1.2, 1.5 and 1.6 compliant	-13°F to 122°F or -31°F to 122°F
EV Box	BusinessLine	1-2/J1772	1- or 3-phase, 230V – 400V, 16A and 32A	3.7 – 22 kW	12-73 miles range/hour	Greenlots SKY OCPPv1.2, 1.5 and 1.6 compliant	-22°F to 122°F 95% RH non-condensing
EVoCharge	30A EVoReel EVSE/iEVSE	1-2/J1772	208/240VAC; 40A	7.2 kW	24 miles range/hour	Customer can configure with any OCPP network	-22°F to 122°F 95% RH non-condensing
EVSE LLC	AutoCoil	1-2/J1772	208/240VAC; 30A	7.2 kW	24 miles range/hour	Greenlots SKY/OCPP compliant	-22°F to 122°F 95% RH non-condensing
GE	Durastation	1-2/J1772	208/240VAC; 40A	7.2 kW	24 miles range/hour	Not Specified	-22°F to 122°F 95% RH non-condensing
Juice Bar	Mini Bar	1-2/J1772, 1-2/120V connections	208/240VAC; 40A	7.2 kW	24 miles range/hour	Uses Greenlots SKY software	-22°F to 122°F
Millbank	PowerGen	1/J1772	208/240VAC	7.2 kW	24 miles range/hour	N/A	-22°F to 122°F
OPConnect	Mark II	1-2/J1772	208/240VAC; 30A per port	7.2 kW	24 miles range/hour	Yes	-22°F to 140°F 95% RH non-condensing
Schneider	EVlink Level 2	1-2/J1772	208/240VAC, 40A, 2 Pole Circuit Breaker	7.2 kW	24 miles range/hour	Chargepoint network (Level 2)/ Greenlots (DC Fast)	-22°F to 122°F 95% RH non-condensing

Figure 8: EVCS Selection Guide (cont'd)

Hardware – Electrical, continued							
Manufacturer	Model	# Charging Ports/Type	Input Power	Output Power		Cross Vendor Software Compatibility	Operating conditions
				kW	miles range / hrs charging		
Level 2 EVC							
SemaConnect	ChargePro™	1/J1772	208/240VAC; 30A	7.2 kW	24 miles range/hour	No	-22°F to 122°F 95% RH non-condensing
Shorepower Technologies	ePump	1-4/J1772	240VAC per connection port; up to 30A	7.2 kW	24 miles range/hour	Not Specified	-4°F to 140°F
Siemens	VersiCharge	1/J1772	208/240VAC; 40A circuit	1.8 – 7.2 kW	6-24 miles range/hour	Greenlots SKY OCPPv1.2, 1.5 and 1.6 compliant	-22°F to 122°F 95% RH non-condensing
Level 3 EVC							
ChargePoint	CPE200	1/CHAdeMO + 1/SAE CCS	480 VAC, 63A	50 kW	167 miles range/hour	No	-35°F to 120°F 95% RH non-condensing
EV Box	BusinessLine	1-2/J1772	3-phase, 400V, 32A	3.7 – 22 kW	12-73 miles range/hour	Greenlots SKY OCPPv1.2, 1.5 and 1.6 compliant	-22°F to 122°F 95% RH non-condensing
Schneider	EVlink DC Fast	1/CHAdeMO or 1/CHAdeMO + 1/SAE CCS	480VAC, 79A	50 kW max	167 miles range/hour	Chargepoint network (Level 2)/ Greenlots (DC Fast)	-22°F to 122°F 95% RH non-condensing

* - based on 30 kWh/100 mile fuel efficiency for standard 2016 Nissan Leaf, as reported at www.fueleconomy.gov. Reflects optimal driving conditions.

Figure 8: EVCS Selection Guide (cont'd)

Hardware - Mechanical							
Manufacturer	**Model**	**Mounting**	**Cable Management**	**# Charging Ports/Type**	**Theft Deterrence**	**Power Rating input(s)**	**Operating conditions**
Level 2 EVC							
AeroVironment	TuboDock	Wall or Pedestal	Coil Rack	1/J1772	Not specified	208/240VAC; 16A	-40°F to 122°F
Blink	PE-30Kice	Wall or Pedestal	Coil Rack	1/J1772	Not specified	208/240VAC; 30A	-22°F to 122°F
BTC Power	Chargion	Wall or Pedestal	Coil Rack or Cord Retractor	1-2/J1772	Not specified	208/240VAC; 16A, 30A, 40A options	-22°F to 122°F 90% RH non-condensing
ChargePoint (charger by Leviton)	CT4000	Wall or Pedestal	Cable Hanger	1-2/J1772	Locking charger holster	208/240VAC; 40A circuit	-22°F to 122°F 95% RH non-condensing
Clipper Creek	LCS / HCS / CS	Wall or Pedestal	Cable Wrap	1/J1772	Lockable connector, HCS allows key-based access	208/240 VAC	Unknown
Efacec	Public	Wall or Pedestal	Coil Rack	2/J1772	Bolted to wall or pole mount	208/240 Vac 30 A / each output	-13°F to 122°F or -31°F to 122°F
EV Box	BusinessLine	Wall or Pedestal	Cable Hanger	1-2/J1772	Bolted to wall or pole mount	1-phase, 230V, 16A	-22°F to 122°F 95% RH non-condensing
EVoCharge	30A EVoReel EVSE/iEVSE	Wall or Pedestal	Retractable Reel with auto-rewind & lock features. Wall or Ceiling Mounted.	1-2/J1772	Tamper proof mounting fasteners	208/240VAC; 40A	-22°F to 122°F 95% RH non-condensing
EVSE LLC	AutoCoil	Wall or Pedestal	Retractable cable	1-2/J1772	Not specified	208/240VAC; 30A	-22°F to 122°F 95% RH non-condensing
GE	Durastation	Pedestal	Coil Rack	1-2/J1772	Not specified	208/240VAC; 40A	-22°F to 122°F 95% RH non-condensing
Juice Bar	Mini Bar	Wall or Pedestal	Coil and optional over head cord management system	1-2/J1772, 1-2/120 V connections	2 key secure lock for internal components	208/240VAC; 40A	-22°F to 122°F
Millbank	PowerGen	Wall or Pedestal	Cable wrap (wall) or storage (pedestal)	1/J1772	Pedestal has lockable component cabinet	208/240VAC	-22°F to 122°F
OPConnect	Mark II	Wall or Pedestal	Coil Rack	1-2/J1772	Integrated surveillance camera	208/240VAC; 30A per port	-22°F to 140°F 95% RH non-condensing

Figure 8: EVCS Selection Guide (cont'd)

Hardware – Mechanical, continued							
Manufacturer	**Model**	**Mounting**	**Cable Management**	**# Charging Ports/Type**	**Theft Deterrence**	**Power Rating input(s)**	**Operating conditions**
Level 2 EVC							
Schneider	EVlink Level 2	Wall or Pedestal	Coil Rack	1-2/J1772	Not specified	208/240VAC, 40A, 2 Pole Circuit Breaker	-22°F to 122°F 95% RH non-condensing
SemaConnect	ChargePro™	Wall or Pedestal	Coil Rack	1/J1772	Not specified	208/240VAC; 30A	-22°F to 122°F 95% RH non-condensing
Shorepower Technologies	ePump	Pedestal	Coil rack	1-4/J1772	Overcurrent & GFCI protection; car-to-cord safety detection; locking cord and access doors (optional)	240VAC per connection port; up to 30A	-4°F to 140°F
Siemens	VersiCharge	Pedestal	Cable Wrap	1/J1772	Charger locks to pedestal mount	208/240VAC; 40A circuit	-22°F to 122°F 95% RH non-condensing
Level 3 EVC							
ChargePoint	CPE200	Pedestal	Cable Hanger	1/CHAdeMO + 1/SAE CCS	Not specified	480 VAC, 63A	-35°F to 120°F 95% RH non-condensing
EV Box	BusinessLine	Wall or Pedestal	Cable Hanger	1-2/J1772	Bolted to wall or pole mount	3-phase, 400V, 32A	-22°F to 122°F 95% RH non-condensing
Schneider	EVlink DC Fast	Pedestal	Coil Rack	1/CHAdeMO or 1/CHAdeMO + 1/SAE CCS	Not specified	480VAC, 79A	-22°F to 122°F 95% RH non-condensing

Figure 8: EVCS Selection Guide (cont'd)

Management Software							
Manufacturer	**Model**	**Network-capable**	**Remote Management**	**Cross Vendor Hardware Compatibility**	**Network Protocol**	**Demand response capability**	**Data Reporting**
Level 2 EVC							
AeroVironment	TurboDock	No	Yes; Bluetooth enabled	N/A	N/A	N/A	N/A
Blink	PE-30Kice	Yes	Yes	No	Proprietary	Yes	Yes
BTC Power	Chargion	Yes	Yes	Yes	OCPP	Yes	Yes
ChargePoint	CT4000	Yes	Yes	Yes	3G GSM, 3G CDMA	Not specified	Included
Clipper Creek	LCS / HCS / CS	CS only	CS only	N/A	N/A	N/A	N/A
Efacec	Public	Yes	Yes	N/A	OCPP	Yes, automated through OpenADR	Yes
EV Box	BusinessLine	Yes	Yes	N/A	OCPP	Yes, automated through OpenADR	Yes
EVoCharge	30A EVoReel EVSE/iEVSE	Yes, not mandatory	Yes via OCPP Network	N/A	OCPP via Cellular or CAT5	Capable (Optional)	Yes via OCPP Network
EVSE LLC	AutoCoil	Yes	Yes	N/A	OCPP	Yes	Yes
GE	Durastation	Yes, not mandatory	Yes	Not Specified	Not Specified	Not Specified	Yes
Juice Bar	Mini Bar	Yes, not mandatory	Yes	N/A	OCPP	Not specified	Usage data by session
Millbank	PowerGen	No	N/A	N/A	N/A	N/A	N/A
OPConnect	Mark II	Yes	Yes	Yes	OCPP/ApenADR	Yes	Yes
Schneider	EVlink Level 2	Yes, not mandatory	Yes	N/A	OCPP	Yes	Included
SemaConnect	ChargePro™	Yes, not mandatory	Yes	Not Specified	CDMA or GPRS cellular	Yes	Yes
Shorepower Technologies	ePump	Yes, not mandatory	Yes	Yes	OpenADR 2.0b	Yes, OpenADR 2.0b	Energy use data online
Siemens	VersiCharge	Yes	Yes	N/A	OCPP	Yes, automated through OpenADR	Yes
Level 3 EVC							
ChargePoint	CPE200	Yes	Yes	Yes	3G GSM, 3G CDMA	Not specified	Included
EV Box	BusinessLine	Yes	Yes	N/A	OCPP	Yes, automated through OpenADR	Yes
Schneider	EVlink DC Fast	Yes, not mandatory	Yes	N/A	OCPP	Yes	Included

Figure 8: EVCS Selection Guide (cont'd)

Payment System					
Manufacturer	Model	Open Access	Customer Payment	Price Setting Option	Owner Payment
Level 2 EVC					
AeroVironment	TurboDock	Yes	N/A	N/A	N/A
Blink	PE-30Kice	Yes	Blink InCard, mobile app, and "800" number	Set by Blink network	Not Specified
BTC Power	Chargion	Yes	RFID or credit card	Price by duration, energy, or session. Time-variable pricing available.	Network fees, subscription plans available
ChargePoint	CT4000	Yes	Chargepoint or RFID card, "800" number	Price by duration, energy, or session. Time and user-variable pricing available.	Chargepoint network plan, fees by port. Various subscriptions lengths.
Clipper Creek	LCS / HCS / CS	Yes	Requires external device	N/A	CS may require Liberty Plugin subscription
Efacec	Public	Yes	RFID, mobile app, and call center	Price by duration, energy, or session. Time and user-variable pricing available.	Hardware maintenance and warranty bundled pricing available
EV Box	BusinessLine	Yes	RFID, mobile app, and call center	Price by duration, energy, or session. Time and user-variable pricing available.	Hardware maintenance and warranty bundled pricing available
EVoCharge	30A EVoReel EVSE/iEVSE	Yes	RFID and mobile app, optional magnetic stripe/chip based card, Google Wallet/Apple Pay	Price by duration, energy, or session. Time and user-variable pricing available.	Monthly and annual network options
EVSE LLC	AutoCoil	Yes	RFID and mobile app, optional magnetic stripe/chip based card	Price by duration, energy, or session. Time and user-variable pricing available.	Network fees, subscription plans available
GE	Durastation	Yes	Credit card, mobile app and PayPal.	Price by duration, energy, or session. Time and user-variable pricing available.	Choice of free network and yearly subscription
Juice Bar	Mini Bar	Yes	QR scan, mobile app, and "800" number available 24/7	Price by duration, energy, or session. Time and user-variable pricing available.	Some network fees, multi-year subscription discounts available
Millbank	PowerGen	Yes	N/A	N/A	N/A
OPConnect	Mark II	Yes	Major credit cards, OPConnect card, Wright Express Fleet Card®, phone number or email based PIN, mobile app	Flexible	Network fees will vary
Schneider	EVlink Level 2	Yes	RFID, PayPal	Price by duration, energy, or session. Time and user-variable pricing available.	1, 2, and 3 year subscription plans

Figure 8: EVCS Selection Guide (cont'd)

Payment System, continued					
Manufacturer	**Model**	**Open Access**	**Customer Payment**	**Price Setting Option**	**Owner Payment**
Level 2 EVC					
SemaConnect	ChargePro™	Yes	SemaConnect Pass, mobile app, and "800" number	Price by energy or duration. Time and user-variable pricing available.	Monthly network fee, available in multi-year packages
Shorepower Technologies	ePump	Yes	Major credit cards, user cards, and RFIDs	Price by duration	Annual network fee, 15% transaction fee
Siemens	VersiCharge	Yes	Mobile app and call center	Price by duration, energy, or session. Time and user-variable pricing available.	Hardware maintenance and warranty bundled pricing available
Level 3 EVC					
ChargePoint	CT4000, CPE200	Yes	Chargepoint or RFID card, "800" number	Price by duration, energy, or session. Time and user-variable pricing available.	Chargepoint network plan; $280/port/year, various subscriptions lengths.
EV Box	BusinessLine	Yes	RFID, mobile app, and call center	Price by duration, energy, or session. Time and user-variable pricing available.	Hardware maintenance and warranty bundled pricing available
Schneider	EVlink DC Fast	Yes	RFID, PayPal	Price by duration, energy, or session. Time and user-variable pricing available.	1, 2, and 3 year subscription plans

Figure 8: EVCS Selection Guide (cont'd)

Manufacturer/Certification Information					
Manufacturer	**Model**	**Listings**	**Accessibility Features**	**First Entry to EVSE Market**	**Installation Rating**
Level 2 EVC					
AeroVironment	TurboDock	UL and cUL	Insertion force: Not listed Control height: 48"	2011	NEMA 3R
Blink	PE-30Kice	NEC 625, UL and ULc to 2594	Insertion force: 45N<F<80N Control height: 48" – 60"	2012	Outdoor Rated, NEMA 3R
BTC Power	Chargion	NEC 625 UL 2231, UL2594	Insertion force: 45N<F<80N Control height: < 54"	2013	NEMA 3R
ChargePoint	CT4000	UL, cUL, NEC Article 625	Insertion force: Not listed Control height: < 48"	2009	Not Specified
Clipper Creek	LCS / HCS / CS	UL, cUL, ETL, cETL	Insertion force: 45N<F<80N Control height: Variable	2006	NEMA 4R
Efacec	Public	UL, SAE 1772	Insertion force: 45N<F<80N Control height: < 54"	2011	Not Specified
EV Box	BusinessLine	SAE 1772	Insertion force: 45N<F<80N Control height: Variable	2010	Not Specified
EVoCharge	30A EVoReel EVSE/iEVSE	UL/cUL & ETL/cETL	Insertion force: 45N<F<80N Control height: > 54"	2009	Outdoor Rated, NEMA 3R
EVSE LLC	AutoCoil	NEC 625, UL 2231&2594, CAN/CSA 22.2	Insertion force: 45N<F<80N Control height: < 54"	2009	NEMA 3R
GE	Durastation	NEC 625, UL and cUL, SAE J1772	Insertion force: 45N<F<80N Control height: < 48"	2011	NEMA 3R
Juice Bar	Mini Bar	ETL, UL 2231, UL2594, CSA C22.2 No. 280-13	Insertion force: 45N<F<80N Control height: < 54"	2009	Not Specified
Millbank	PowerGen	Unknown	Insertion force: Unknown Control height: < 48"	2011	NEMA 3R (pedestal) or NEMA 4R (wall mount)
OPConnect	Mark II	UL 2594, 2231	Insertion force: 45N<F<80N Control height: <54"	2009	NEMA 3S per 250-1997
Schneider	EVlink	NEC 625, SAE J1772, UL, CSA 22.2	Insertion force: 45N<F<80N Control height: < 54"	2011	NEMA 3R
SemaConnect	ChargePro™	NEC 625 UL 2231, UL2594	Insertion force: 45N<F<80N Control height: < 54"	2008	NEMA 3R
Shorepower Technologies	ePump	ETL & ETl	Insertion force: Unknown Control height: < 48"	2004	Not Specified
Siemens	VersiCharge	UL, SAE J1772, NEC 625	Insertion force: 45N<F<80N Control height: Variable	2011	NEMA 4R

Figure 8: EVCS Selection Guide (cont'd)

Manufacturer/Certification Information, continued					
Manufacturer	Model	Listings	Accessibility Features	First Entry to EVSE Market	Installation Rating
Level 3 EVC					
ChargePoint	CPE200	UL, cUL, NEC Article 625	Insertion force: 45N<F<80N Control height: < 54"	2009	Not Specified
EV Box	BusinessLine	SAE 1772	Insertion force: Unknown Control height: Variable	2010	Not Specified
Schneider	EVlink	cULus, CHAdeMO, SAEJ1772 (DC Fast)	Insertion force: Unknown Control height: < 54"	2011	NEMA 3R

Figure 8: EVCS Selection Guide (cont'd)

2.2 Manufacturer Information Gaps

We have endeavored to include as many EVC manufacturers and network providers as possible in this guide. When available technical specifications were insufficient, we contacted the manufacturer to request additional information. The following manufacturers have not responded to our requests for information as of January 2017:

- General Electric
- Shorepower Technologies

3 Glossary

 # Charging Ports/Type: The number of cars that can charge simultaneously on a single charger, and the type of connector(s) (e.g. CHAdeMO, J1772) available.

Accessibility Features: Charger features to facilitate greater access to potential users. As standards for electric vehicle chargers under the ADA do not extend beyond the height of operable parts, we focus on the operable part (control) height, and the insertion force required to insert a charger connector.

ADA title 24 2017 compliance (ADA): Americans with Disabilities Act EVC regulations. New scoping provisions in effect January 2017 ensures requirements such as van and general accessibility dimensions, parking designation, and path of travel are in accordance with the 2016 California Building Code. (2)

BEV: Battery-only electric vehicle. A vehicle whose only power source is an onboard battery.

Cable management: Method to physically store charging cable, typically a rack for cable coils or a retractable cable device.

Cable Hangar: A cable management method that anchors the cable to the charger such that the cable hangs above the ground.

Cable Wrap: A cable management method where the charging cord is intended to wrap around the physical charger.

CAT5: Common computer networking cable, typically used to connect internet-based devices.

CEC: California Energy Commission, a California State agency.

CHAdeMO: CHArge de MOve (CHAdeMO). An association as well as the eponymous level 3 EV fast charging process that requires a CHAdeMO charging socket on the EV. This is different from the level 2 SAE J1772 charging sockets common to most public chargers in the US.

Charging ports: Number of charging plugs, or ports, per EVC. Multiple ports per station allows for more charging ability with adjacent parking spots. EVCs may be wall-mounted, pedestal, or overhead, supporting different configurations and access. "Dual head" refers to two charging ports per EVC.

Figure 8: EVCS Selection Guide (cont'd)

Coil Rack: A cable management method where a physical rack is provided to coil the cable.

Commercial maturity: Hardware or software manufacturer is a major market participant with an established customer base and several product releases. This is a qualitative metric for general consideration and subject to interpretation. The specification tables attempt to capture this with the date of entry into the EVSE market.

Connector: PEV input receptacle for charging. Level 1 and Level 2 charging is based the Society of Automotive Engineers (SAE) International standard, or SAE J1772 standard. PEVs equipped with Level 3 charging may use the CHAdeMO connector, developed in coordination with Tokyo Electric Power Company, or the CSS Combo.

Cross vendor compatibility: The ability for EVC hardware to operate using networks from a different manufacturer (cross vendor software compatibility) or the ability for network software to operate on hardware produced by a different manufacturer (cross vendor hardware compatibility).

Customer payment methods (Customer Payment): Payment and subscription methods for customers. Magnetic strip: located on the back of a credit or debit card and can be swiped through a reader. RFID: Radio Frequency Identification device uses a copper coil antenna and a chip to store small amounts of data that can be accessed by a reader within close proximity using radio waves. Club card: existing EVC manufacturer or network RFID card. Mobile device: smartphone may contain wireless RFID chips, which allows a smartphone or plastic key ring to communicate with nearby devices without a cable.

Data reporting: Usage and service data recorded by networked EVSE.

Demand Charges: A charge levied by utility companies based upon the customer's maximum power draw during a given period. Typically only applies to large electricity consumers.

Demand Response Capability: The ability of EVCs to adjust power output based on local grid demand. Exact implementation will vary, but is typically coordinated between a service network provider and electric utility.

Energy use and data reporting (Data Reporting): Method for recording EVC energy usage and data.

EVC: Electric vehicle charger. Generally referred to outside of this guide as EVSE.

EVSE: Electric vehicle supply equipment. The common literature acronym for electric vehicle chargers.

First Entry to EVSE Market: The year in which a manufacturer first released an EVSE product.

Input Power: Power input, in voltage and amperage.

Installation Rating: Installation certifications. NEMA: National Electrical Manufacturers Association; ratings typically establish durability of outdoor installations.

J1772: An electric vehicle charging standard established by SAE International (formerly the Society of Automotive Engineers). Establishes charger connector shape, standard for Level 2 chargers in the US.

Figure 8: EVCS Selection Guide (cont'd)

kWh: kilowatt per hour.

Level 1: A charging process using a cord that plugs into a standard 120 volt outlet, usually taking between 8-20 hours to fully charge a PEV with a standard battery capacity.

Level 2: A charging process using a 240 volt electric circuit, which usually takes 4-8 hours to fully charge a PEV with a standard battery capacity. Level 2 is the most common type of public charging in California.

Level 3: A charging process that uses a 480 volt electric circuit, that will quickly charge a battery to 80% (usually taking 20 minutes for a PEV with a standard battery capacity), before reducing power to Level 2 charge capacity to fully replenish the battery.

Listings: Manufacturer certifications by either independent safety certification laboratories (such as UL or ETL) or national standards (such as the National Electric Code [NEC]).

Manufacturer: The company responsible for manufacturing the charger or network software described in the specification tables.

Model: The specific model of charger examined in the specification tables. For this guide, models have been selected to give a general idea of the capabilities of the chargers produced by that manufacturer.

Mounting: The physical mounting for the charger unit, i.e. wall-mounted or pedestal-mounted.

Network-capable: An infrastructure system of public EVCs. There are a variety of providers, administrators, and manufacturers who offer services.

Network protocol: Protocol for communication between EVC site host and an EVC network, such as the Open Charge Point Protocol (OCPP)

Network Service: An infrastructure system of public EVCs. There are a variety of providers, administrators, and manufacturers who offer services.

OCPP: Open Charge Point Protocol (OCPP), an international open communication standard. OCPP-compliant hardware and software is designed to function together regardless of manufacturer. (3)

Open Access: A charger that can be available for any customer to use, with or without a network subscription

Operating Conditions: The temperature and humidity requirements for a charger to operate normally.

Output Power: Power output provided to vehicle from the charger.

Owner Payment: Payment and subscription methods for site owners/ operators.

Pedestal: Pedestal EVCs include a pole, box, or similar structure to provide free-standing installation. These typically are mounted on a sidewalk or small concrete foundation, similar to other street-based utility equipment. Pedestal EVCs are hard-wired.

Figure 8: EVCS Selection Guide (cont'd)

PEV: Plug-in electric vehicle. A vehicle requiring battery electric power to operate that can be externally charged. Both battery-only (BEV) and plug-in hybrid (PHEV) vehicles available.

PHEV: Plug-in hybrid electric vehicle. A plug-in electric vehicle that also carries a backup gasoline generator.

Power rating input(s): Power input, in voltage and amperage.

Pricing schedules: Pricing schedule for EVCs. Variable pricing: site host offers varying price points at different locations or points-of-sale.

Price Setting Option: The different price schemes a charger is capable of supporting, i.e. dollars/kWh, dollars/hour, etc.

Range/Hours: A measurement of charger power specifying the amount of driving range added per hour of time spent charging.

RCEA: Redwood Coast Energy Authority.

Remote Management Capability: EVC can be controlled through a device not physically attached to the station. It is important for communication and control, and can be implemented to improve safety and productivity.

ROEV Compliant: Meets standards currently in development by Roaming for EV Charging (ROEV) association to allow drivers to access multiple network services with a single account. The association represents ChargePoint, Blink, and NRG EVgo networks and works with Nissan, BMW, Audi, and Honda. (4)

SAE CCS: Society of Automotive Engineers Combined Charging System. It is a fast charging method for EVs delivering high-voltage current via a specific combination plug. The plug socket is an AC connector with a DC option.

Session fees: EVC charging fees for customer. Typically determined by site host. Important to consider surcharges and commissions.

Theft Deterrence: Features to prevent EVC theft and vandalism.

Figure 8: EVCS Selection Guide (cont'd)

4 References

1. California Energy Commission. (2015) *Agreement ARV-14-046*. http://www.energy.ca.gov/business_meetings/2015_packets/2015-04-08/Item_09f_ARV-14-046_Redwood_Coast_Energy_Authority.pdf. Accessed October 31, 2016.
2. Corelis, Dennis J. (2016). *Access California: New Regulations for Electric Vehicle Charging Stations*. Presentation of behalf of Division of the State Architect, archived by Electric Vehicle Charging Association. www.evassociation.org/uploads/5/8/0/5/58052251/EVC_update_30_march_2016_epri_presentation.pptx. Accessed October 31, 2016.
3. Open Charge Alliance. (2016). *Open Charge Alliance Factsheet*. http://www.openchargealliance.org/uploads/files/Factsheet_OCPP_1.6_2016.pdf. Accessed October 31, 2016.
4. Roaming for EV Charging (ROEV). (2016). *How Public EV Charging Works*. http://roev.org/How-It-Works/Overview. Accessed October 31, 2016.

5 Acknowledgments

This guide was made possible through the generous support of many organizations. Funding was provided by California Energy Commission grants CEC-ARV-14-046 and CEC-ARV-14-058, as well as financial support from the City of Mount Shasta and the Siskiyou County Economic Development Council. Without hard work from the following representatives of the Redwood Coast Energy Authority, the Schatz Energy Research Center, the Local Government Commission/Civic Spark, and the Siskiyou County Economic Development Council, this guide would not exist:

Redwood Cost Energy Authority:

- Dana Boudreau
- Pierce Schwalb
- Lori Biondini
- Allison Campbell
- Lexie Fischer
- Matthew Marshall
- Ben Winker

Schatz Energy Research Center

- Jerome Carman
- Andrew Harris
- Greg Chapman
- Kristen Radecsky

Local Government Commission/Civic Spark

- Amanda Le

Figure 8: EVCS Selection Guide (cont'd)

Siskiyou County Economic Development Council

- Logan Smith

Figure 8: EVCS Selection Guide (cont'd)

6 Product Photos

This section shows the general appearance of some of the EVC models described in this guide.

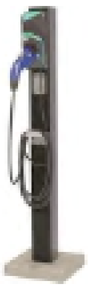
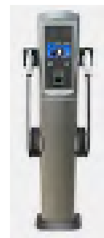
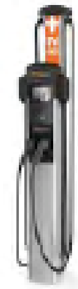
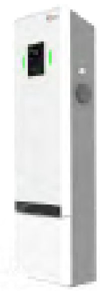
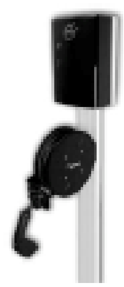
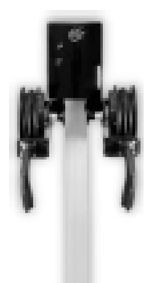
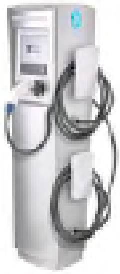
AeroVironment TurboDock (P4) 	Blink, single port (P5) 	BTC Power Chargion EVP, single port (P6) 	BTC Power Chargion EVP, dual port (P7) 	ChargePoint CT 4000 (P8P8) 
ChargePoint CPE200 (P9P9) 	ClipperCreek LCS (P10) 	ClipperCreek HCS (P11) 	ClipperCreek CS (P12) 	Efacec Public Charger (P13) 
EV Box Business (P14) 	EVSE LLC AutoCoil (P15) 	EvoCharge, EVoReel (P16) 	EVoCharge, single port (P17) 	EVoCharge, dual port (P17) 

Figure 8: EVCS Selection Guide (cont'd)

GE DuraStation Double Pedestal (P18) 	JuiceBar LLC, Minibar double port (P19) 	Millbank PowerGen (P20) 	OPConnect Mark II (P21) 	Schneider EV Link Level 2 (P22) 
Schneider EV Link DC Fast (P23) 	SemaConnect ChargePro (P24) 	Shorepower Technologies, ePump (P25) 	Siemens VersiCharger (P26) 	

Stations not to scale; please see manufacturing specifications for physical dimensions. Image credits are given in section 6.1. Current models may vary from those shown here.

Figure 8: EVCS Selection Guide (cont'd)

6.1 Photo credits

P1. PCS-15 by ClipperCreek. https://store.clippercreek.com/level1/pcs-15-portable-ev-charging-station.

P2. Image by Chargepoint. http://strattonreport.com/news/chargepoint-invest-20-million-national-network-high-speed-ev-chargers/.

P3. Prototype image by Aerovironment. http://www.evsolutions.com/Upload/Product/635652532473270000.pdf.

P4. TuboDock, by AeroVironment. http://store.evsolutions.com/turbodock-ev-charging-stations-c42.aspx.

P5. Blink Level 2 Pedestal Charger by Blink. http://www.blinknetwork.com/file/18762/CCGI_Blink_EVSE-L2AC-G1_OwnersManual-Commercial_2.2%5B1%5D.pdf.

P6. Level 2 Commerical EV Charging Station by BTCPower. http://www.btcpower.com/products-and-applications/Level-2-Commercial-EV-Charging-Station/.

P7. BTCPower Dual Pedestal by BTCPower. http://www.thebluebook.com/iProView/813090/national-car-charging-llc/subcontractors//images/564078_-electric-vehicle-charging-stations/866745_btcpower-dual-pedestal.html.

P8. CT4000 Family by ChargePoint. https://www.chargepoint.com/products/commercial/ct4000/.

P9. ChargePoint Express 200 by ChargePoint. http://www.chargepoint.com/products/commercial/cpe200/.

P10. LCS-30 by ClipperCreek. https://store.clippercreek.com/all-products/lcs-30-24-amp-ev-charging-station.

P11. HCS-40 by ClipperCreek. https://store.clippercreek.com/all-products/hcs-40-hcs-40p-ev-charging-station.

P12. CS-40 by ClipperCreek. https://store.clippercreek.com/all-products/cs-40-32-amp-ev-charging-station.

P13. Public Charger by Efacec. http://electricmobility.efacec.com/ev-public-charger/.

P14. BusinessLine, by EV Box. http://www.ev-box.com/products/businessline/.

P15. 3704 AutoCoil EV Charger, by EVSE LLC. http://evsellc.com/download/AutoCoil_crop_6_9_15.pdf.

P16. EVoReel Charging Station by EVoCharge. https://www.evocharge.com/uploaded/Product_Page_1.jpg.

P17. Pedestal Mount – EVoReel Charging Station by EVoCharge. https://www.evocharge.com/uploaded/Product_Page_2.jpg.

P18. Double Pedestal by GE Industrial Solutions. http://apps.geindustrial.com/publibrary/checkout/DET-834?TNR=Cross%20Reference%7CDET-834%7CPDF&filename=DET-834.pdf.

P19. Mini Bar™ Double by Juice Bar. http://www.juicebarev.com/products/electric-car-charging-stations-mini-bar-double.

Figure 8: EVCS Selection Guide (cont'd)

P20. PowerGen, by Millbank. http://milbankworks.com/blog/wp-content/uploads/2013/03/CPEV0111JSW1_Pedestal_2-2013_Web.pdf.

P21. Mark II, by OPConnect. http://www.opconnect.com/press/ev-charging-stations-solutions/.

P22. EV230PDRR by Schneider Electric. http://download.schneider-electric.com/files?p_Reference=0100CT1501_SEC-05&p_EnDocType=Catalog&p_File_Id=5024286529&p_File_Name=0100CT1501_SEC-05.pdf.

P23. DC Quick Charging by Schneider Electric. http://download.schneider-electric.com/files?p_Reference=0100CT1501_SEC-05&p_EnDocType=Catalog&p_File_Id=5024286529&p_File_Name=0100CT1501_SEC-05.pdf.

P24. ChargePro Charging Station, by SemaConnect. http://sweets.construction.com/Manufacturer/SEMACONNECT--INC--NST153424/products/ChargePro-Charging-Station-NST63552-P.

P25. Tower model S2211 by Shorepower Technologies. http://www.shorepower.com/docs/Shorepower_EVSE_Product_Datasheet.pdf.

P26. Siemens VersiCharge™, by Siemens. https://www.downloads.siemens.com/download-center/Download.aspx?pos=download&fct=getasset&id1=BTLV_41755.

Source: Redwood Coast Energy Authority

Appendix F:
Ten Percent Engineering Designs and Probable Costs

Figure 9 shows the initial ten percent engineering designs and the probably associated costs.

Figure 9: Ten Percent Engineering Designs and Probable Costs

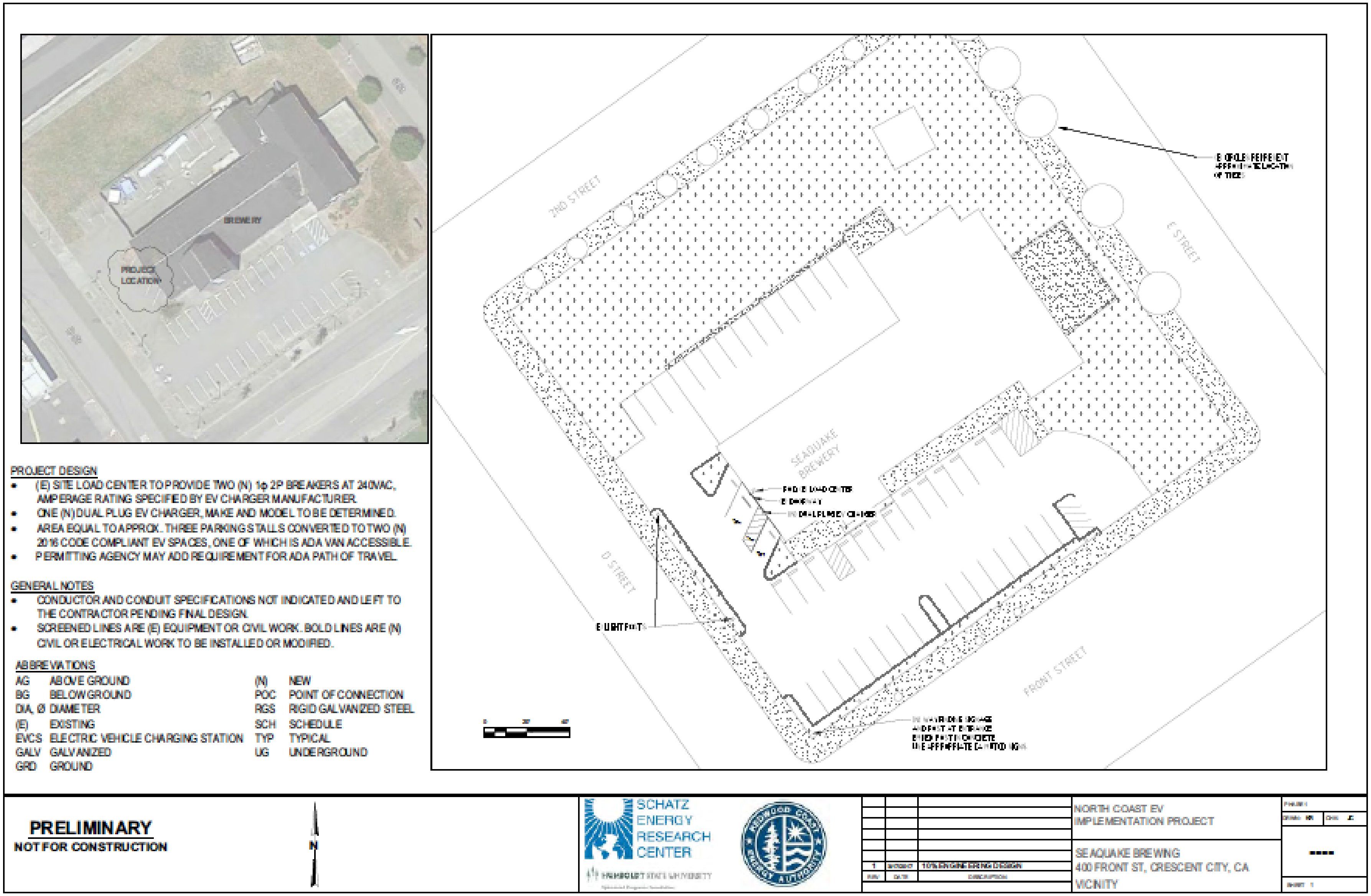


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

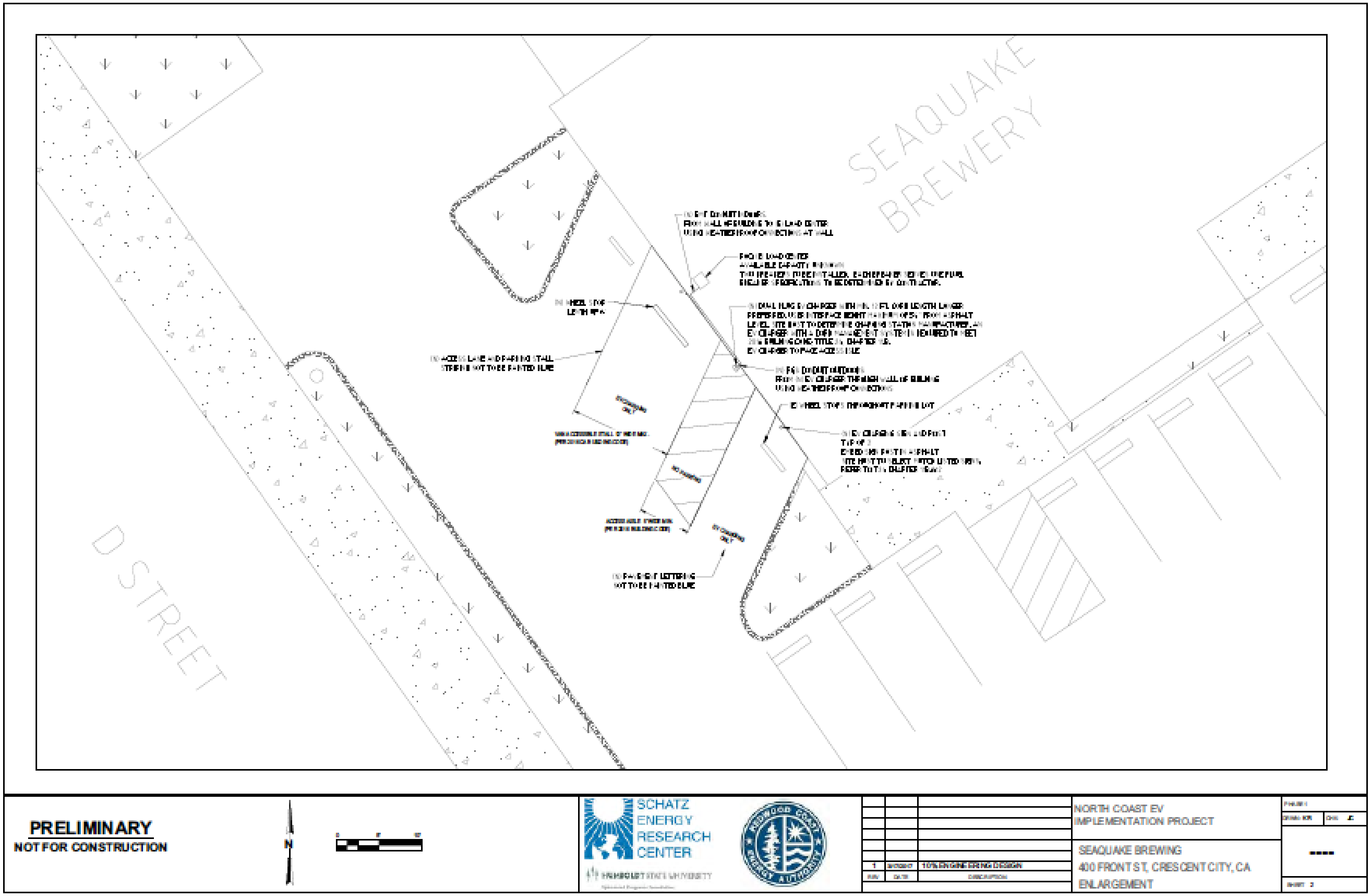


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Client: Seaquake Brewing
Purpose: Cost estimate for the preliminary design of an electric vehicle charging station install
Project: ARV-14-046 PEV Readiness NorthCoast
Prepared by: Schatz Energy Research Center

__Preliminary design costs based on:__
Two 50 A circuits for EV charger in existing load center located inside building
Trench from EV charger to outdoor pullbox near to indoor load center
Installation of a smart dual Level 2 EV charger (substitute a basic dual charger to reduce costs, if needed)
Installation of a protective bollards for electrical equipment
Installation of code required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax	Notes
2: Existing Conditions - Demolition									$ -	$ -	No demolition required for site
									$ -	$ -	
									$ -	$ -	
									$ -	$ -	
								Divison 2 Subtotal	$ -		
3: Concrete	Concrete core drilling, reinforced concrete slab, up to 6" thick, incl bit, layout, and setup, 2" diameter hole	4	EA	$ 0.28	$ 42.00	$ 7.00	$ 72.50	Total with O&P	$ 290	$ -	Holes for sign poles (2 EV spots) and 2 bollards
								Divison 3 Subtotal	$ 290		
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29	$ 0.66	Charger mounting hardware
								Division 5 Subtotal	$ 29		
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	7	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 722	$ 51.80	2 way-finding signs, 2 EV charging only signs, 2 parking time limit signs, 1 Van Accessible sign
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	3	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 177	$ 11.95	1 pole for each stall, 1 pole for way-finding sign
								Division 10 Subtotal	$ 900		
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	0.6	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 99	$ -	4x 6 AWG from load center to EV Charger (2 per plug) 15' L x 4
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.2	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 19	$ -	1x 8 AWG from load center to EV Charger (1 ground) 15' L x 1
	Conduit to 15' high, includes 2 terminations, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1" diameter	1	LF	$ 3.95	$ 6.75	$ -	$ 14.45	Total with O&P	$ 14	$ -	Above ground, outdoor section of conduit from EV charger to inside building (1' estimated)
	Conduit to 15' high, includes 2 terminations, 2 elbows, 11 beam clamps and 11 couplings per 100LF: electric metallic tubing (EMT) 1" diameter	14	LF	$ 1.60	$ 3.81	$ -	$ 7.45	Total with O&P	$ 104	$ -	Above ground, Indoor section of conduit from building penetration to indoor load center (14' estimated)
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -	2 circuits
								Division 26 Subtotal	$ 480		
31: Earthwork									$ -	$ -	No trenching required for wall-mounted charging station
								Division 31 Subtotal	$ -		
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3	STALL	--	--	--	$ 120.75	Total with O&P	$ 362	$ -	2 EV spaces + access aisle
	Pavement Parking Marking, painted letter, 6"	35	EA	--	--	--	$ 11.50	Total with O&P	$ 403	$ -	EV PARKING ONLY: 13 letters x 2 stalls = 26; NO PARKING: 9 letters; Total: 35 letters
									$ -	$ -	No bollard for wall-mounted charging station
								Divison 32 Subtotal	$ 765		
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25	Assume wall-mounted price is same as ground-mounted
								Equipment Subtotal	$ 7,300		

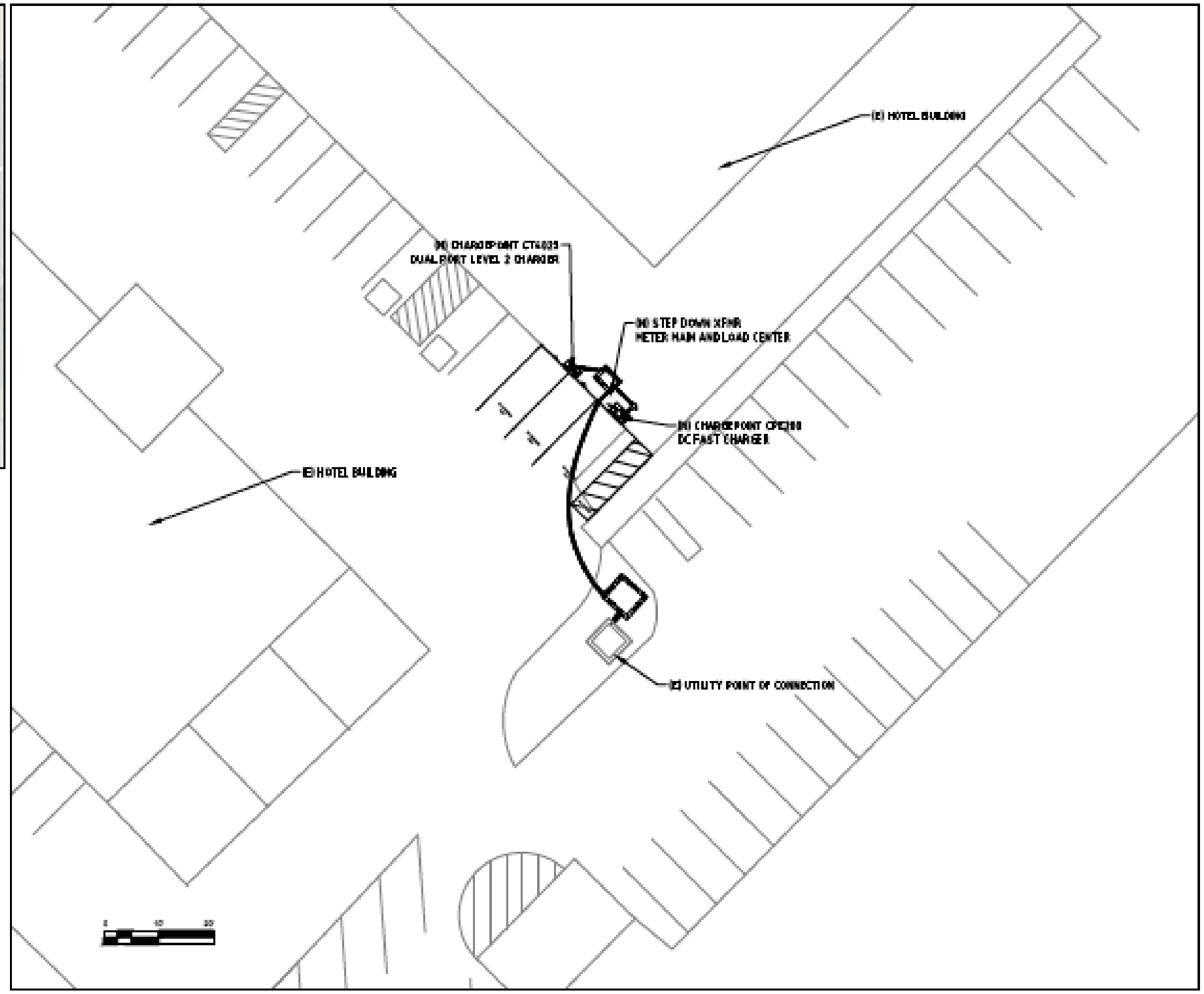
Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups

RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate. Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal			$ 9,764
General Contractor General Requirement (access, project clean up, testing, etc.)		8%	$ 781
	Sales Tax	8.25%	$ 667
	Subtotal		$ 11,212
	Contingency	25%	$ 2,803
	Subtotal		$ 14,015
	Bonds ($/1000 per RS Means)	$12.00	$ 168
	Subtotal		$ 14,183
Weighted Average Total Location Adjustment Factor for Eureka CA (%)		108.4	$ 1,191
Construction and Equipment Total			$ 15,375
	Construction Administration	7%	$ 1,076
	Design Bidding, Construction Admin Assistance (consultant)	20%	$ 3,075
Grand Total			$ 19,526

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- RECOMMEND CONTRACTOR UPDATE CURRENT DESIGN TO MEET SPIRIT OF CHAPTER 11B ACCESSIBILITY REQUIREMENTS.
- (N) 480VAC 3ϕ UTILITY XFMR, (N) LOAD CENTER WITH 400A PANEL AND 480V-TO-240V STEP DOWN XFMR.
- ONE (N) 50KW DC FAST CHARGER AND ONE (N) DUAL PLUG 7.2KW EV CHARGER, MAKE AND MODEL TO BE DETERMINED.
- THREE (E) PARKING STALLS CONVERTED TO THREE (N) 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK, BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS AND SYMBOLS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER
ϕ	ELECTRICAL PHASE		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER

HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
4	[illegible]	REVISION
3	[illegible]	REVISION
2	[illegible]	REVISION
1	[illegible]	10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

BEST WESTERN PLUS NORTHWOODS INN
655 U.S. HWY 101 S, CRESCENT CITY

VICINITY

DRWN: JC CHK: KR

SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

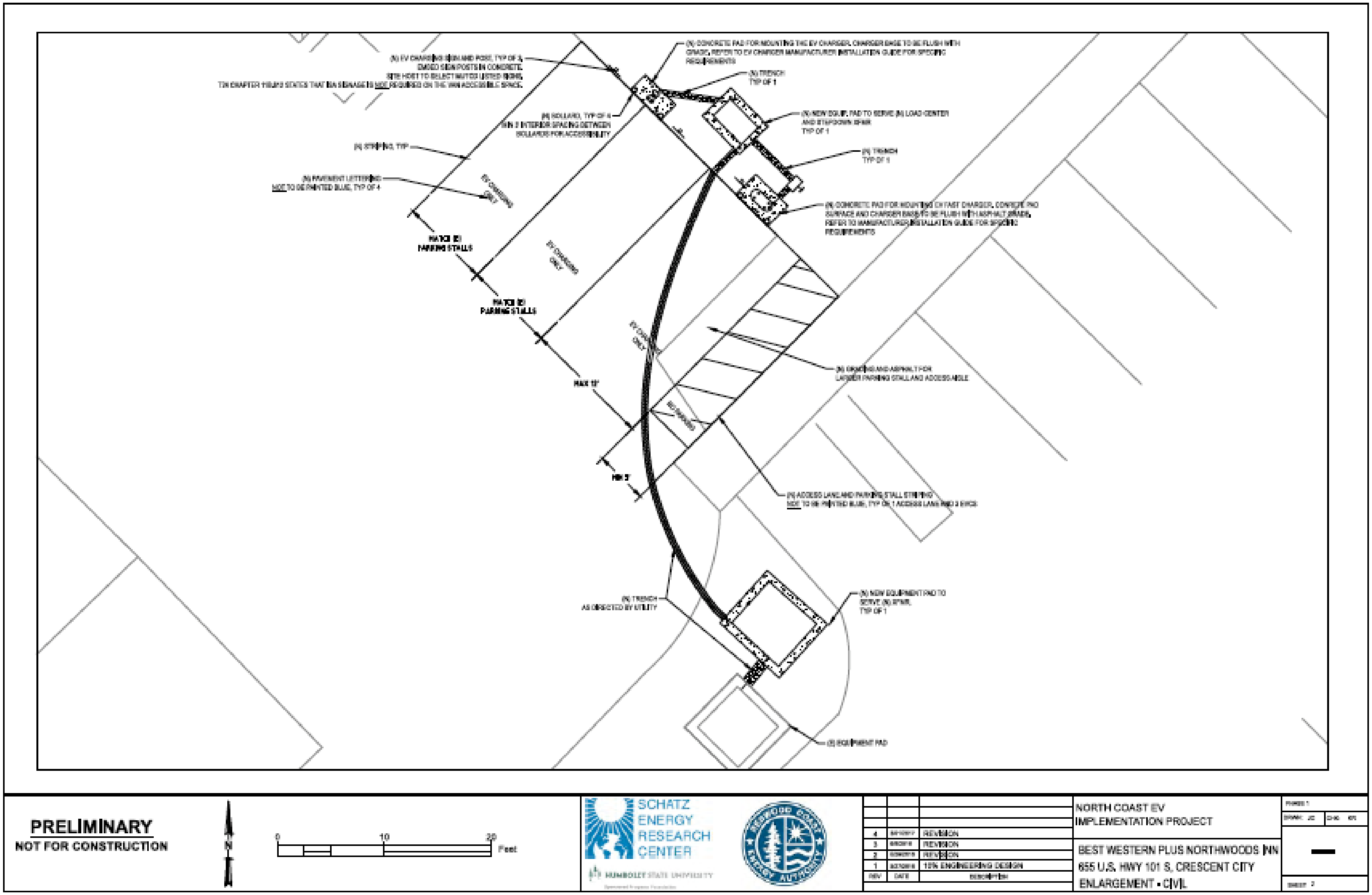
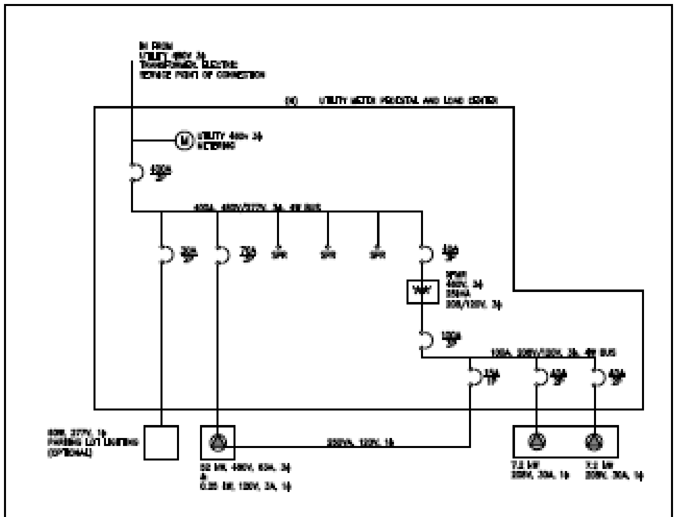


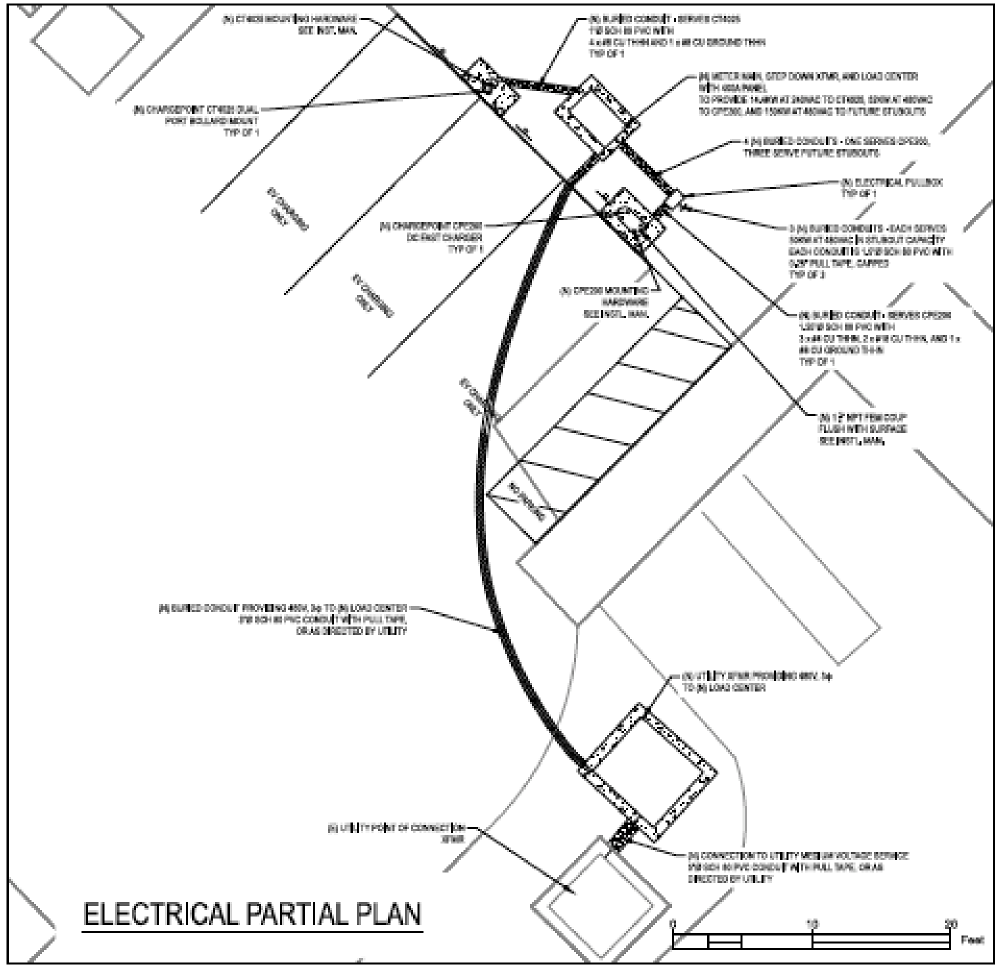
Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

SHEET NOTES

- (N) 480VAC 3φ UTILITY XFMR TO BE SIZED TO SUPPORT (N) 400A LOAD PANEL, MAJORITY OF THIS LOAD IS ASSOCIATED WITH EXPECTED FUTURE LOAD SUPPORTED BY STUBOUTS
- PROPOSED DESIGN PLACES A 25KVA STEP DOWN XFMR AT THE LOAD CENTER TO PROVIDE 208VAC TO CT4025, AND 120VAC TO CPE200,
- LOAD CENTER TO HAVE SUFFICIENT PANEL CAPACITY TO SUPPORT UP TO THREE ADDITIONAL FUTURE CPE200 CHARGERS,
- NO SUPPLEMENTAL LIGHTING IS INCLUDED, CONTRACTOR TO DETERMINE IF SUPPLEMENTAL LIGHTING IS NEEDED.



SINGLE LINE DIAGRAM



ELECTRICAL PARTIAL PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

SCHATZ ENERGY RESEARCH CENTER

REV	DATE	DESCRIPTION
4		REVISION
3		REVISION
2		REVISION
1		10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

BEST WESTERN PLUS NORTHWOODS INN
655 U.S. HWY 101 S, CRESCENT CITY
ENLARGEMENT - ELECTRICAL

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Crescent City Best Western and Northridge Inn
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Three EV spaces, two served by one dual head level 2 charger, and one served by one level 3 charger.
New utility transformer, new meter and load center, stubout expansion for 150kw of future level 3 chargers
Design of code-compliant EV spaces, uses existing access aisle for van accessible EV space
Installation of code-required signage

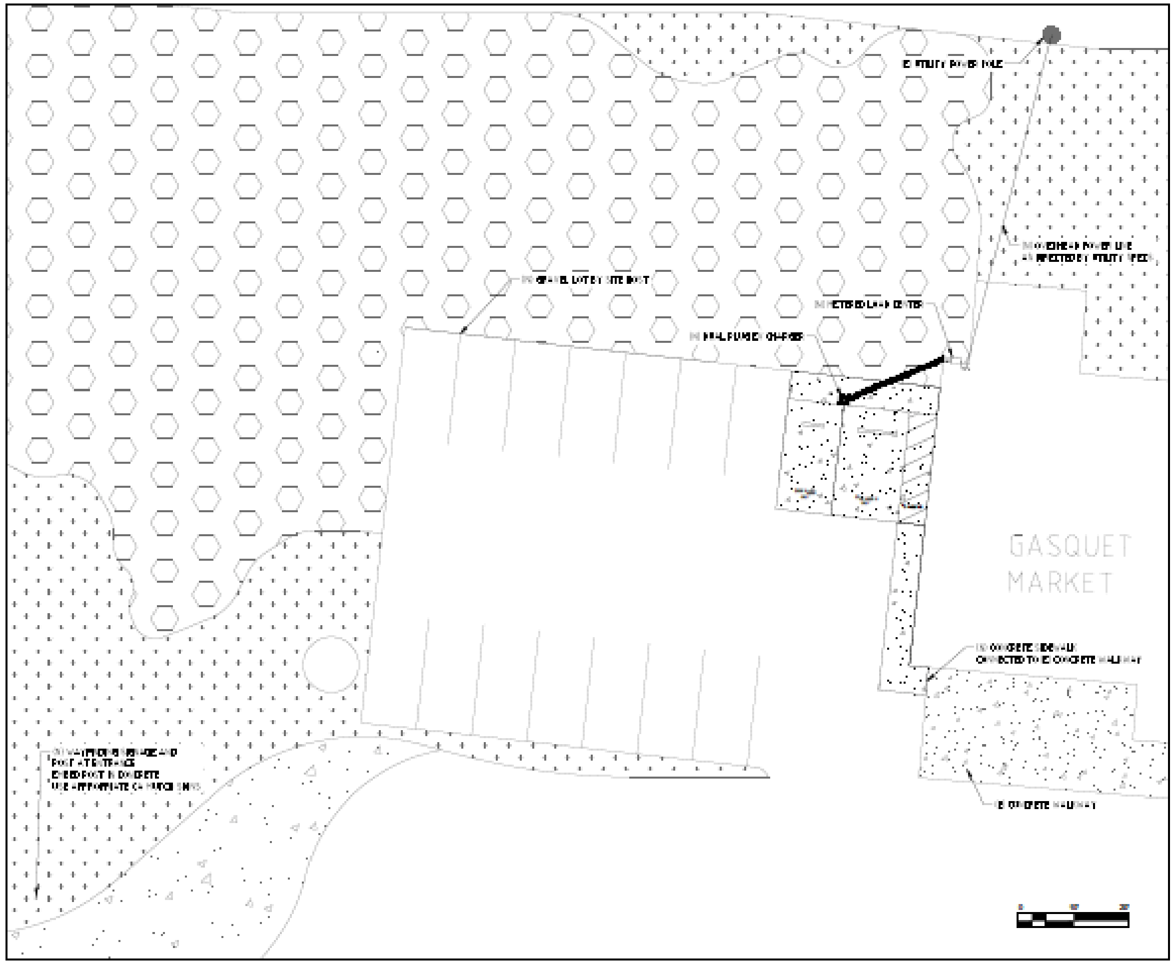
RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	17.5	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 276	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	8.0	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 308	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	48.0	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 51	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	11.9	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 962	$ -
								Divison 2 Subtotal	$ 1,597	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 4' x 4' x 6" thick	3	EA	$ 69.50	$ 74.00	$ 1.04	$ 191.00	Total with O&P	$ 573	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	93	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 2,279	$ -
								Divison 3 Subtotal	$ 2,852	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	3	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 88	$ 1.99
								Division 5 Subtotal	$ 88	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	9	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 929	$ 66.60
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 236	$ 15.94
								Division 10 Subtotal	$ 1,165	
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #4	0.7	CLF	$ 87.50	$ 82.50	$ -	$ 220.00	Total with O&P	$ 150	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.4	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 55	$ -
	3" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	58	LF	$ 6.30	$ 7.95	$ -	$ 18.80	Total with O&P	$ 1,090	$ -
	1 1/4" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	56	LF	$ 2.63	$ 3.98	$ -	$ 8.85	Total with O&P	$ 496	$ -
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -
	Meter and load center, 3P, 4W, 480/277V, 400A with 25kVA XFMR to 120/208 (local estimate)	1	EA	$ 25,000.00	$ -	$ -	$ 25,000.00	Total with O&P	$ 25,000	$ -
	Smart metering, in panel, three phase, 277/480V, 400A	1	EA	$ 775.00	$ 93.50	$ -	$ 990.00	Total with O&P	$ 990	$ -
	Enclosed (NEMA 1) circuit breaker, 600V, 3P, 400A	1	EA	$ 2,775.00	$ 545.00	$ -	$ 3,900.00	Total with O&P	$ 3,900	$ -
	Panelboard and load center circuit breakers, 277 volt, 1 pole, 15 - 30A	1	EA	$ 44.00	$ 54.50	$ -	$ 131.00	Total with O&P	$ 131	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 70 - 225 amp	1	EA	$ 780.00	$ 190.00	$ -	$ 1,150.00	Total with O&P	$ 1,150	$ -
	Panelboard and load center circuit breakers, 208Y - 240VAC, 3 pole, 100A (local estimate)	1	EA	$ 370.24	$ 122.00	$ -	$ 569.24	Total with O&P	$ 569	$ -
	Panelboard and load center circuit breakers, 120 volt, 1 pole, 15-50 amp	1	EA	$ 16.50	$ 44.00	$ -	$ 84.00	Total with O&P	$ 84	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 40 amp (local estimate)	1	EA	$ 644.54	$ 190.00	$ -	$ 1,014.54	Total with O&P	$ 1,015	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -
								Division 26 Subtotal	$ 35,064	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	70	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 90	$ -
	Aggregate base for trench backfill	1.9	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 28	$ 2.29
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	2.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 232	$ -
								Division 31 Subtotal	$ 349	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	8.8	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ 421	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	4	STALL	--	--	--	$ 120.75	Total with O&P	$ 483	$ -
	Pavement Parking Marking, painted letter, 6"	48	EA	--	--	--	$ 11.50	Total with O&P	$ 552	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	4	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 3,531	$ 267.55
								Divison 32 Subtotal	$ 4,987	
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25
	Level 3 Smart Charger	1	EA	$ 35,000.00	$ -	$ -	--	Unit costs	$ 35,000	$ 2,887.50
								Equipment Subtotal	$ 42,300	
Utility Cost	Pacific Power: Average quoted cost for (N) PM XFMR, easy straightforward project.	1	EA	$ -	$ -	$ -	$ 20,000.00	Total with O&P	$ 20,000	$ -
								Utility Subtotal	$ 20,000	

Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 108,403
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 8,672
Sales Tax	8.25%	$ 3,844
Subtotal		$ 120,919
Contingency	25%	$ 30,230
Subtotal		$ 151,149
Bonds ($/1000 per RS Means)	$12.00	$ 1,814
Subtotal		$ 152,963
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 12,849
Construction and Equipment Total		$ 165,812

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- (N) SITE LOAD CENTER TO PROVIDE TWO (N) 1φ 2P BREAKERS AT 240V AC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- ONE (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED.
- AREA EQUAL TO APPROX. THREE PARKING STALLS CONVERTED TO TWO 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE WITH AN ACCESS AISLE AND ONE OF WHICH IS A STANDARD EV CHARGING SPACE.
- PATH OF TRAVEL AT HEAD OF PARKING STALLS IS REQUIRED TO MEET THE SPIRIT OF ACCESSIBILITY. ADDITIONAL SIDEWALK EXTENDED FROM ACCESS ISLE IS REQUIRED TO ENABLE PATH OF TRAVEL TO THE LOCATION'S SERVICES.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

1	[illegible]	10% ENGINEERING DESIGN
REV	DATE	DESCRIPTION

NORTH COAST EV IMPLEMENTATION PROJECT

GASQUET MARKET
10332 US-199, GASQUET, CA
VICINITY

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

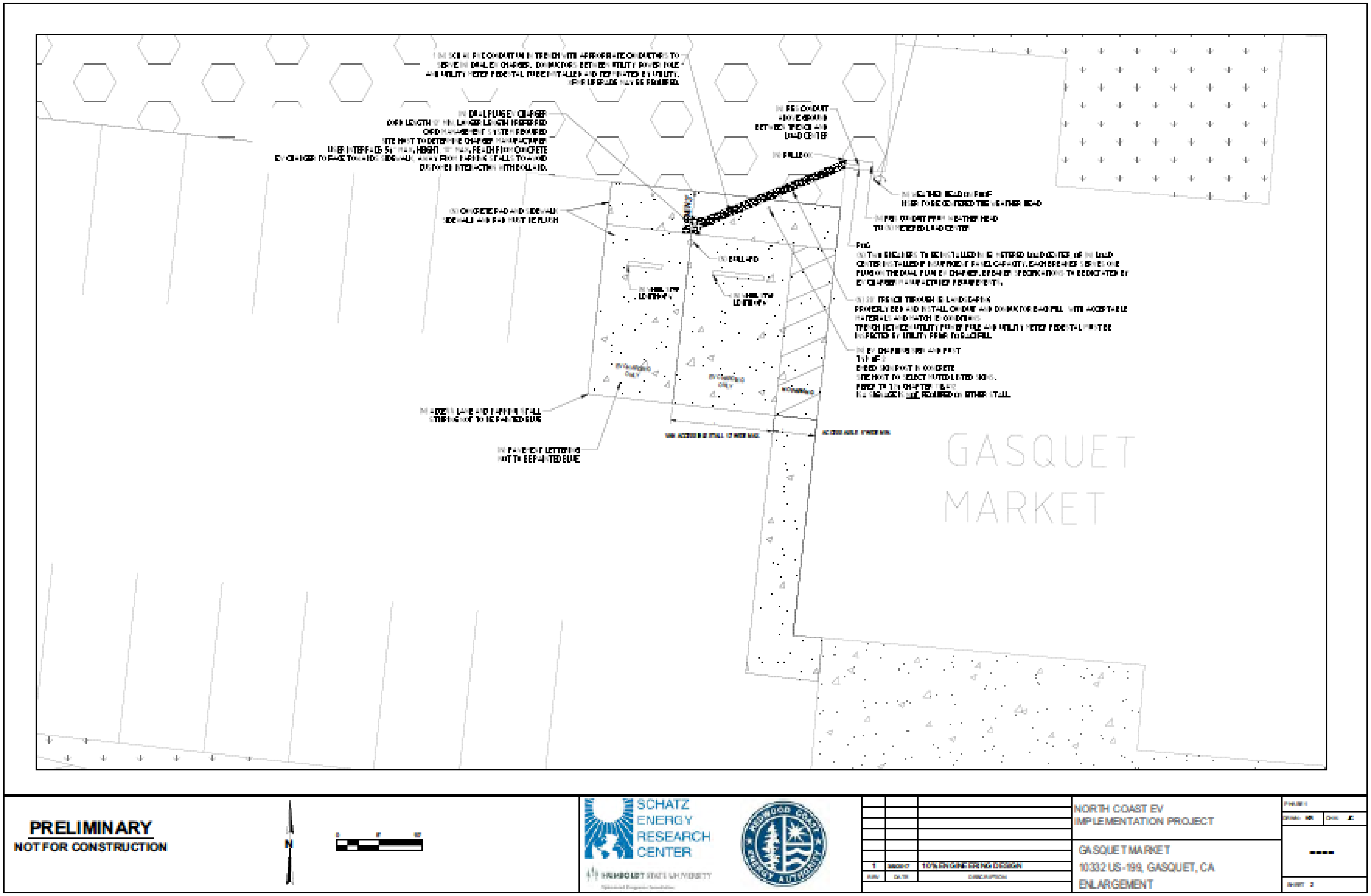


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Client: Gasquet Market
Purpose: Cost estimate for the preliminary design of an electric vehicle charging station install
Project: ARV-14-046 PEV Readiness NorthCoast
Prepared by: Schatz Energy Research Center

Preliminary design costs based on:
New meter 200 A load center and two 50 A circuits for EV charger
Trench from new meter center to EV charger
Installation of a smart dual Level 2 EV charger (substitute a basic dual charger to reduce costs, if needed)
Installation of a protective bollard for electrical equipment
Installation of code required signage
Utility to install overhead line to new weather head on roof of building

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax	Notes
2: Existing Conditions - Demolition									$ -	$ -	No demolition required for site
									$ -	$ -	
									$ -	$ -	
									$ -	$ -	
								Divison 2 Subtotal	$ -		
3: Concrete	Concrete forming, structural cast-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, ob grade, to 6" high	165	LF	$ 0.35	$ 2.38	$ -	$ 4.04	Total with O&P	$ 667	$ -	Form for sidewalk and slab Perimeter of concrete slab (27' x 25') and sidewalk
	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	15.6	CY	$ 102.00	$ -	$ -	$ 112.00	Total with O&P	$ 1,747	$ -	Concrete for sidewalk and slab
	Placing concrete, labor and equipmt to place, level and consolidate, Footing, continuous, shallow, direct chute (> 5 CY)	15.6	CY	$ -	$ 15.65	$ 0.52	$ 24.50	Total with O&P	$ 382	$ -	Labor for sidewalk and slab
								Divison 3 Subtotal	$ 2,796		
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29	$ 0.66	Charger mounting hardware
								Division 5 Subtotal	$ 29		
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	7	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 722	$ 51.80	2 way-finding signs, 2 EV charging only signs, 2 parking time limit signs, 1 Van Accessible sign
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	3	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 177	$ 11.95	1 pole for each stall, 1 pole for way-finding sign
								Division 10 Subtotal	$ 900		
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	1.2	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 198	$ -	4x 6 AWG from load center to EV Charger (2 per plug) 30' L x 4
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.3	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 37	$ -	1x 8 AWG from load center to EV Charger (1 ground) 30' L x 1
	1" dia. conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	34	LF	$ 2.11	$ 3.50	$ -	$ 7.55	Total with O&P	$ 257	$ -	Underground section of conduit from load center to the charger
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1 1/2" diameter	15	LF	$ 6.10	$ 7.95	$ -	$ 18.65	Total with O&P	$ 280	$ -	Above ground section of conduit from load center to the charger (5' estimate) + between weatherhead and load center (10' estimate)
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -	Pull box to be located where conduit comes out from ground at the load center
	Meter center and sockets, single position, 4 terminal, 200 amp	1	EA	$ 92.00	$ 230.00	$ -	$ 322.00	Unit costs	$ 322	$ 7.59	New load center holding circuit breakers, where PG&E line comes in (via weather head), and power goes out to the dual charger
	Smart metering, in panel, single phase, 120/208V, 200A	1	EA	$ 375.00	$ 50.00	$ -	$ 485.00	Unit costs	$ 425	$ 30.94	Meter
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -	2 circuits
								Division 26 Subtotal	$ 1,954		
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	20	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 26	$ -	Trench length 20'
	Aggregate base for trench backfill	1.9	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 26	$ 2.18	Trench depth is 20" (bottom 4 inches are sand, but assumed same cost as AB)
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -	For detailed shoveling while trenching
								Division 31 Subtotal	$ 168		
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3	STALL	--	--	--	$ 120.75	Total with O&P	$ 362	$ -	2 EV spaces + access aisle
	Pavement Parking Marking, painted letter, 6"	35	EA	--	--	--	$ 11.50	Total with O&P	$ 403	$ -	EV PARKING ONLY: 13 letters x 2 stalls = 26; NO PARKING: 9 letters; Total: 35 letters
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4' D hole, 6" DIA	1	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 883	$ 66.89	
	Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	2	EA	$ 68.43	$ 13.63	$ -	--	Unit costs	$ 164	$ 11.29	One wheel stop per stall
	Mechanical turf seeding, hand push spreader, 4.5 lb per 1000 SF (MSF)	0.02	MSF	$ 20.47	$ 1.79	$ -	--	Unit costs	$ 0	$ 0.03	12' of trenching in the landscaping x 1.5' wide trench
								Divison 32 Subtotal	$ 1,812		
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25	
								Equipment Subtotal	$ 7,300		
Utility Cost	PG&E: Electric Service Connection - engineering, tie-in, distribution line installation	1	EA	$ -	$ -	$ -	$ 2,000.00	Total with O&P	$ 2,000	$ -	Assumed that Pacific Power costs are similar to PG&E
								Equipment Subtotal	$ 2,000		

Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups

RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
- CLF Hundred linear feet
- MSF Thousand square feet
- LF Linear foot
- EA Each
- SY Square yard
- STALL Parking stall
- BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 9,659
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 773
Sales Tax	8.25%	$ 786
Subtotal		$ 11,217
Contingency	25%	$ 2,804
Subtotal		$ 14,022
Bonds ($/1000 per RS Means)	$12.00	$ 168
Subtotal		$ 14,190
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 1,192
Construction and Equipment Total		$ 15,382
Construction Administration	7%	$ 1,077
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 3,076
Grand Total		$ 19,535

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

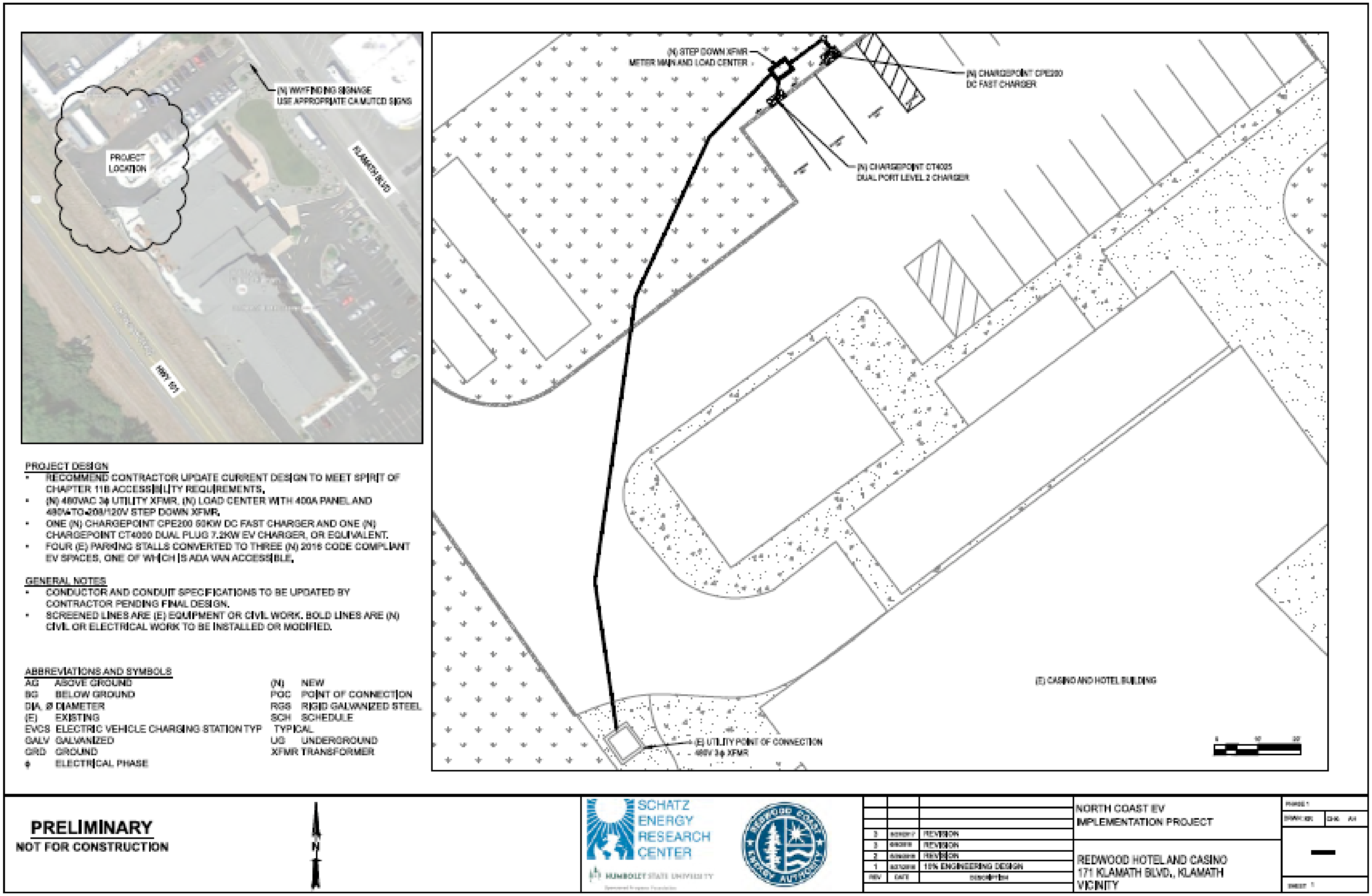


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

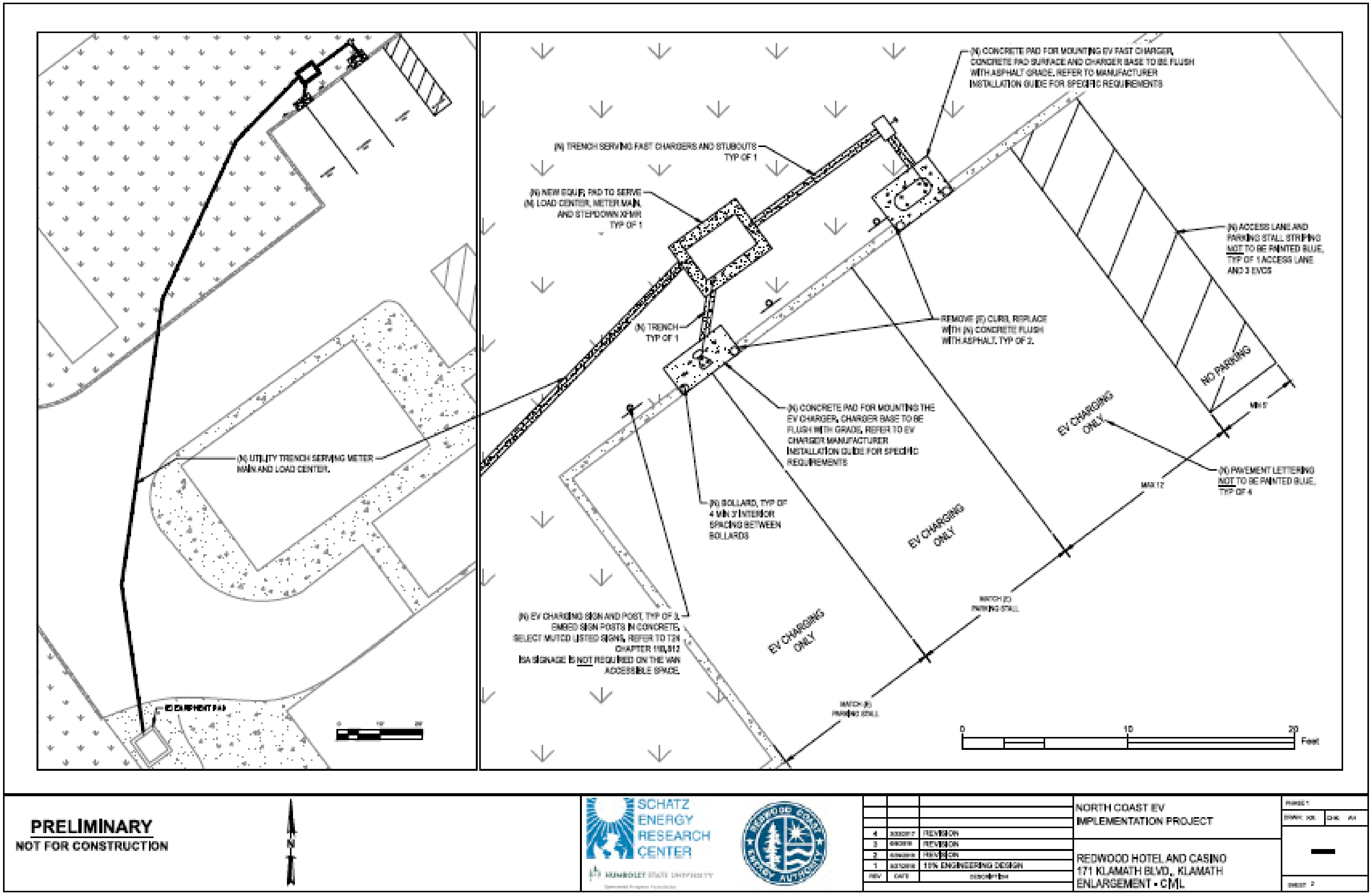


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

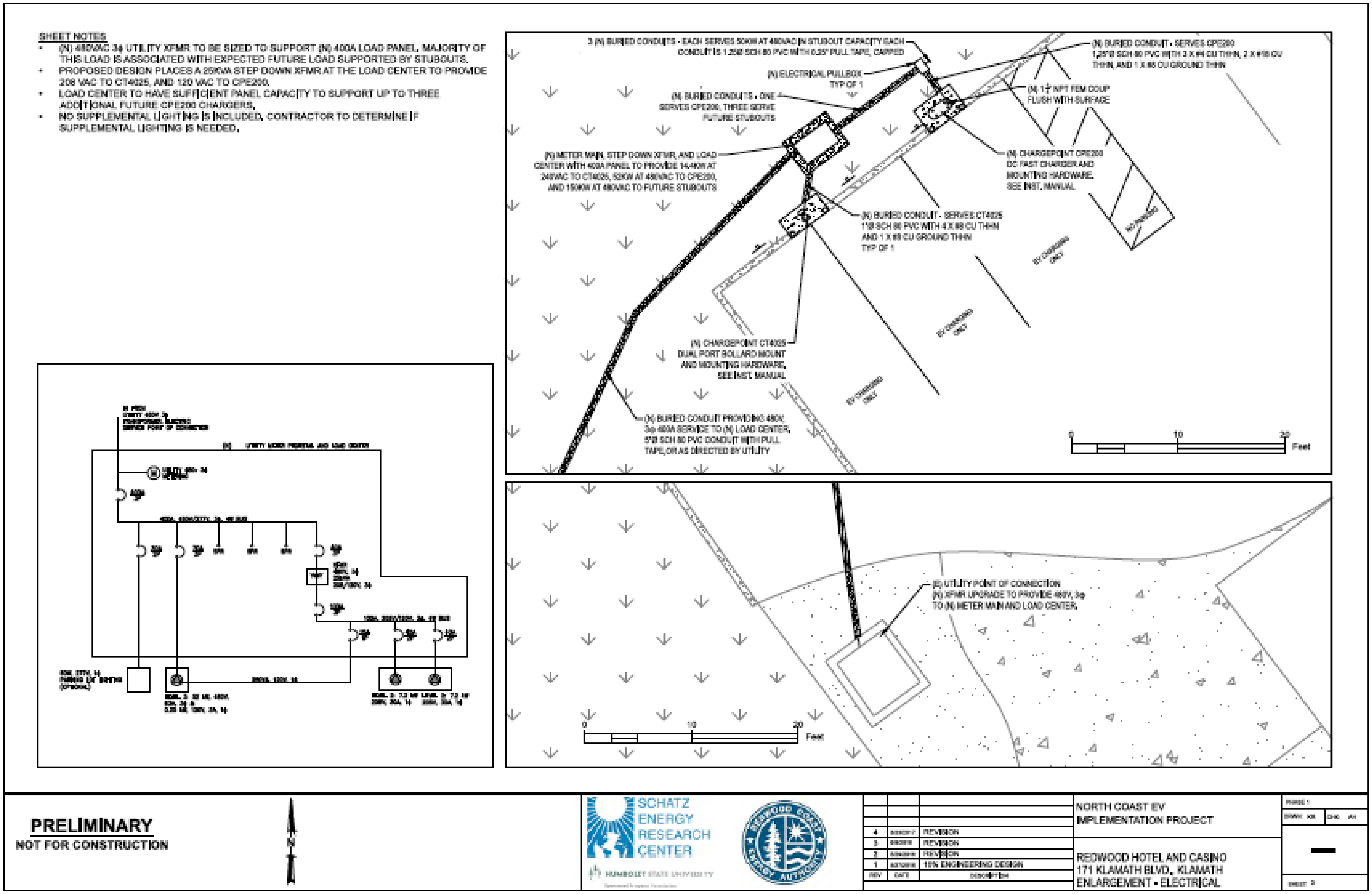


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Redwood Hotel and Casino - Klamath
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

<u>Design costs based on:</u>
Three EV spaces, two served by one dual head level 2 charger, and one served by one level 3 charger.
New utility transformer, new meter and load center, stubout expansion for 150kw of future level 3 chargers.
Design of code-compliant EV spaces, uses existing access aisle for van accessible EV space
Installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	15.3	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 241	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	3.2	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 122	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	355.2	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 380	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	4.7	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 381	$ -
								Divison 2 Subtotal	$ 1,124	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 4' x 4' x 6" thick	3	EA	$ 69.50	$ 74.00	$ 1.04	$ 191.00	Total with O&P	$ 573	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	25	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 613	$ -
								Divison 3 Subtotal	$ 1,186	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	3	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 88	$ 1.99
								Division 5 Subtotal	$ 88	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	9	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 929	$ 66.60
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 236	$ 15.94
								Division 10 Subtotal	$ 1,165	
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #4	11.1	CLF	$ 87.50	$ 82.50	$ -	$ 220.00	Total with O&P	$ 2,444	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	3.8	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 476	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #14	0.3	CLF	$ 11.05	$ 33.50	$ -	$ 62.50	Total with O&P	$ 17	$ -
	5" dia conduit, In trench, Including terminations, fittings, supports, Sched 40 PVC	163	LF	$ 12.45	$ 12.50	$ -	$ 32.50	Total with O&P	$ 5,298	$ -
	1 1/2" dia conduit, In trench, Including terminations, fittings, supports, Sched 40 PVC	49	LF	$ 2.99	$ 4.38	$ -	$ 9.85	Total with O&P	$ 478	$ -
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -
	Meter and load center, 3P, 4W, 480/277V, 400A with 25kVA XFMR to 120/208 (local estimate)	1	EA	$ 25,000.00	$ -	$ -	$ 25,000.00	Total with O&P	$ 25,000	$ -
	Smart metering, In panel, three phase, 277/480V, 400A	1	EA	$ 775.00	$ 93.50	$ -	$ 990.00	Total with O&P	$ 990	$ -
	Enclosed (NEMA 1) circuit breaker, 600V, 3P, 400A	1	EA	$ 2,775.00	$ 545.00	$ -	$ 3,900.00	Total with O&P	$ 3,900	$ -
	Panelboard and load center circuit breakers, 277 volt, 1 pole, 15 - 30A	1	EA	$ 44.00	$ 54.50	$ -	$ 131.00	Total with O&P	$ 131	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 70 - 225 amp	1	EA	$ 780.00	$ 190.00	$ -	$ 1,150.00	Total with O&P	$ 1,150	$ -
	Panelboard and load center circuit breakers, 208Y - 240VAC, 3 pole, 100A (local estimate)	1	EA	$ 370.24	$ 122.00	$ -	$ 569.24	Total with O&P	$ 569	$ -
	Panelboard and load center circuit breakers, 120 volt, 1 pole, 15-50 amp	1	EA	$ 16.50	$ 44.00	$ -	$ 84.00	Total with O&P	$ 84	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 40 amp (local estimate)	1	EA	$ 644.54	$ 190.00	$ -	$ 1,014.54	Total with O&P	$ 1,015	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -
								Division 26 Subtotal	$ 41,986	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	185	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 237	$ -
	Aggregate base for trench backfill	5.0	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 71	$ 5.85
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	2.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 232	$ -
								Division 31 Subtotal	$ 540	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	4.9	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ 233	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	4	STALL	--	--	--	$ 120.75	Total with O&P	$ 483	$ -
	Pavement Parking Marking, painted letter, 6"	51	EA	--	--	--	$ 11.50	Total with O&P	$ 587	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	4	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 3,531	$ 267.55
								Divison 32 Subtotal	$ 4,834	
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25
	Level 3 Smart Charger	1	EA	$ 35,000.00	$ -	$ -	--	Unit costs	$ 35,000	$ 2,887.50
								Equipment Subtotal	$ 42,300	
Utility Cost	Pacific Power: Average quoted cost for (N) PM XFMR, easy straightforward project.	1	EA	$ -	$ -	$ -	$ 20,000.00	Total with O&P	$ 20,000	$ -
								Utility Subtotal	$ 20,000	

Construction and Equipment Subtotal		$ 113,223
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 9,058
Sales Tax	8.25%	$ 3,848
Subtotal		$ 126,128
Contingency	25%	$ 31,532
Subtotal		$ 157,660
Bonds ($/1000 per RS Means)	$12.00	$ 1,892
Subtotal		$ 159,552
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 13,402
Construction and Equipment Total		$ 172,954

Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications.

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

PROJECT DESIGN
- (E) LOAD CENTER TO SUPPLY TWO 208 VAC, 1ϕ CIRCUITS TO EVCS, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED
- CHARGING SPACES DESIGNED TO MEET 2016 CODE COMPLIANT EV SPACES

GENERAL NOTES
- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK, BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- 2016 CA BUILDING CODE SPECIFIES THAT AN EVCS IS NOT A PARKING SPACE. THIS DESIGN REDUCES THE NUMBER OF EXISTING PARKING SPACES BY 1. CONFIRM THIS DOES NOT IMPACT PERMIT REQUIREMENTS FOR PARKING SPACES.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REDWOOD COAST ENERGY AUTHORITY

REV	DATE	DESCRIPTION
2		REVISION
1		10% DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

YUROK TRIBE - KLAMATH OFFICE
190 KLAMATH BLVD, KLAMATH, CA
PLAN VIEW - VICINITY

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

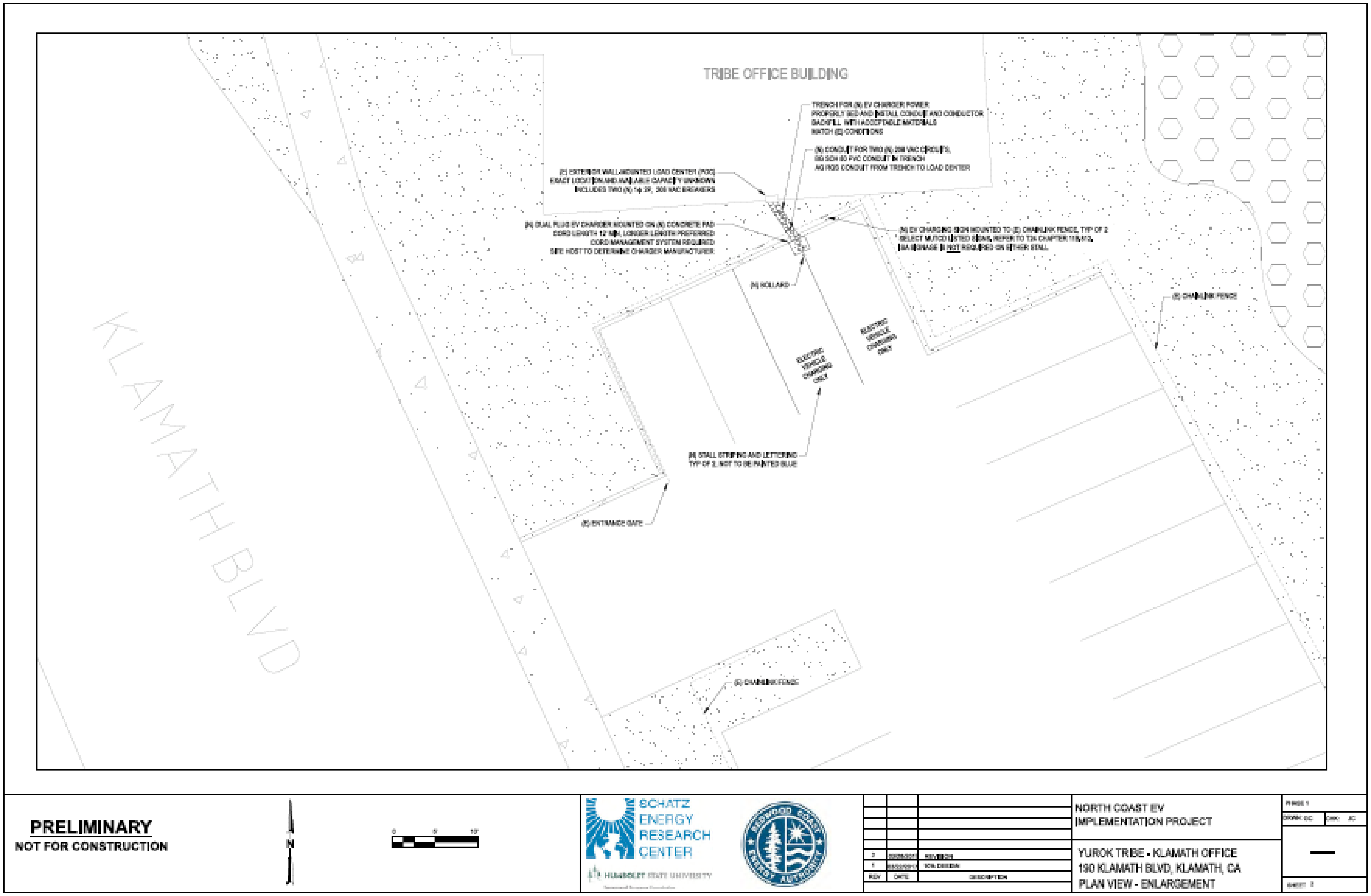


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Yurok Tribe - Klamath Administration Office
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Use (E) load center (panel review recommended)
Two EV spaces served by new dual head basic EV charger (substitute single charger if power supply limited)
Installation of pavement markings and signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128
								Divison 3 Subtotal	$ 128
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29
								Division 5 Subtotal	$ 29
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	2	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 206
								Division 10 Subtotal	$ 206
26: Electrical	1" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	15.0	LF	$ 2.11	$ 3.50	$ -	$ 7.55	Total with O&P	$ 113
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1" diameter	10.0	LF	$ 3.95	$ 6.75	$ -	$ 14.45	Total with O&P	$ 145
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	1	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 93
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244
								Division 26 Subtotal	$ 595
31: Earthwork	Aggregate base for trench backfill	1.0	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 14
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116
								Division 31 Subtotal	$ 130
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL	--	--	--	$ 120.75	Total with O&P	$ 242
	Pavement Parking Marking, painted letter, 6"	26	EA	--	--	--	$ 11.50	Total with O&P	$ 299
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	1	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 883
								Divison 32 Subtotal	$ 1,423
EV Charger	Dual, Level 2 Basic Charger	1	EA	$ 1,200.00	$ -	$ -	--	Unit costs	$ 1,200
								Equipment Subtotal	$ 1,200

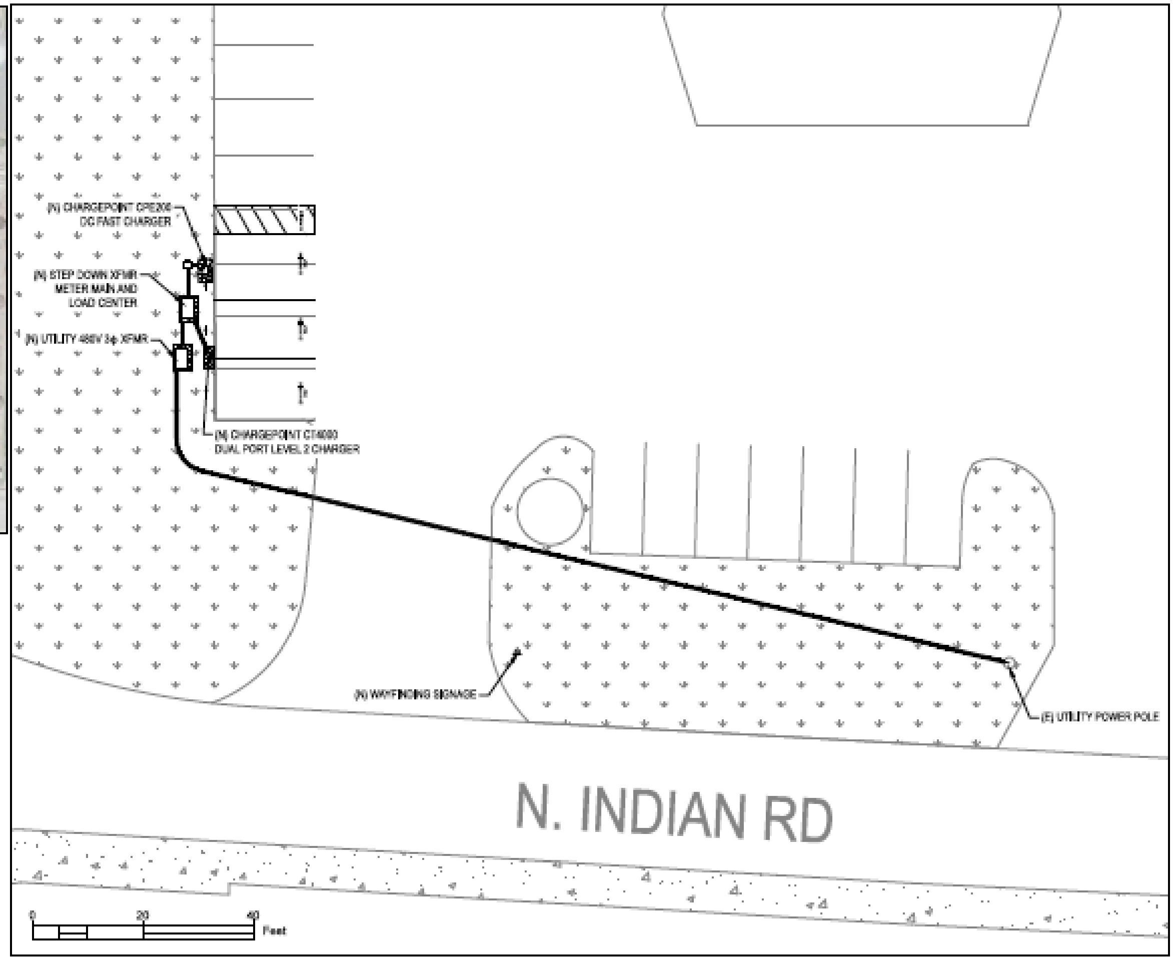
Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups

Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 3,712
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 296.97
Sales Tax	8.25%	$ 183
Subtotal		$ 4,192
Contingency	25%	$ 1,047.92
Subtotal		$ 5,240
Bonds ($/1000 per RS Means)	$12.00	$ 63
Subtotal		$ 5,302
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 445
Construction and Equipment Total		$ 5,748
Construction Administration	7%	$ 402.35
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 1,149.57
Grand Total		$ 7,300

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- RECOMMEND CONTRACTOR UPDATE CURRENT DESIGN TO MEET SPIRIT OF CHAPTER 11B ACCESSIBILITY REQUIREMENTS.
- (N) 480VAC 3ϕ UTILITY XFMR, (N) LOAD CENTER WITH 400A PANEL AND 480V-TO-208/120V STEP DOWN XFMR.
- ONE (N) CHARGEPOINT CPE200 50KW DC FAST CHARGER AND ONE (N) CHARGEPOINT CT4027 DUAL PLUG 7.2KW EV CHARGER, OR EQUIVALENT.
- FOUR (E) PARKING STALLS CONVERTED TO THREE (N) 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS VAN ACCESSIBLE.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS TO BE UPDATED BY CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- UTILITY CONDUIT SHOULD BE PLACED OUTSIDE A 20' HORIZONTAL RADIUS FROM ANY GAS PUMP AND A 10' HORIZONTAL RADIUS FROM ANY UNDERGROUND GAS TANKS TO AVOID ADDITIONAL SAFETY REQUIREMENTS.

ABBREVIATIONS AND SYMBOLS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER
ϕ	ELECTRICAL PHASE		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER

REV	DATE	DESCRIPTION
3		REVISION
2		REVISION
1		10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

LUCKY 7 FUEL MART
13450 US-101, SMITH RIVER, CA
VICINITY

PHASE 1

SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

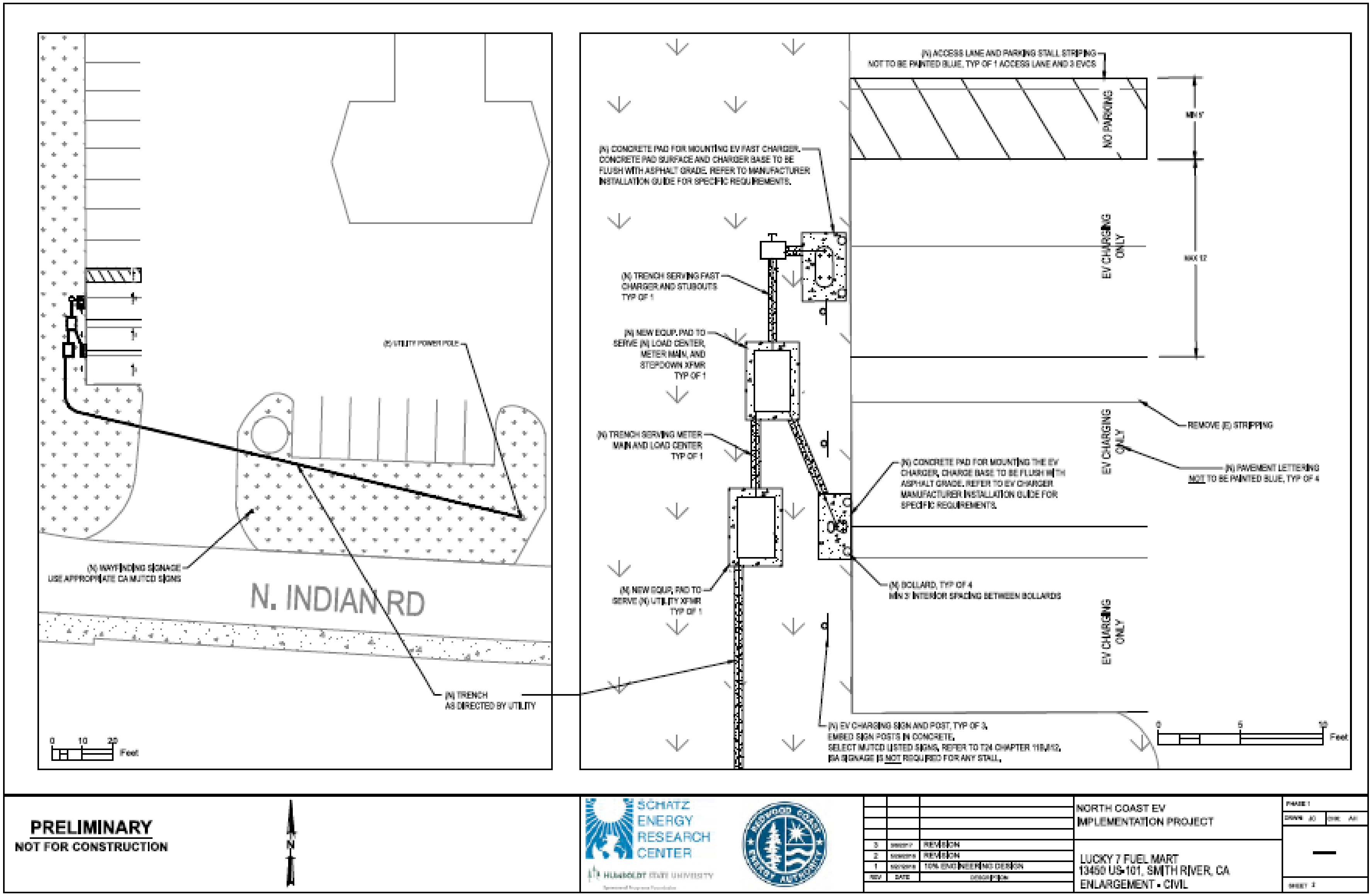


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

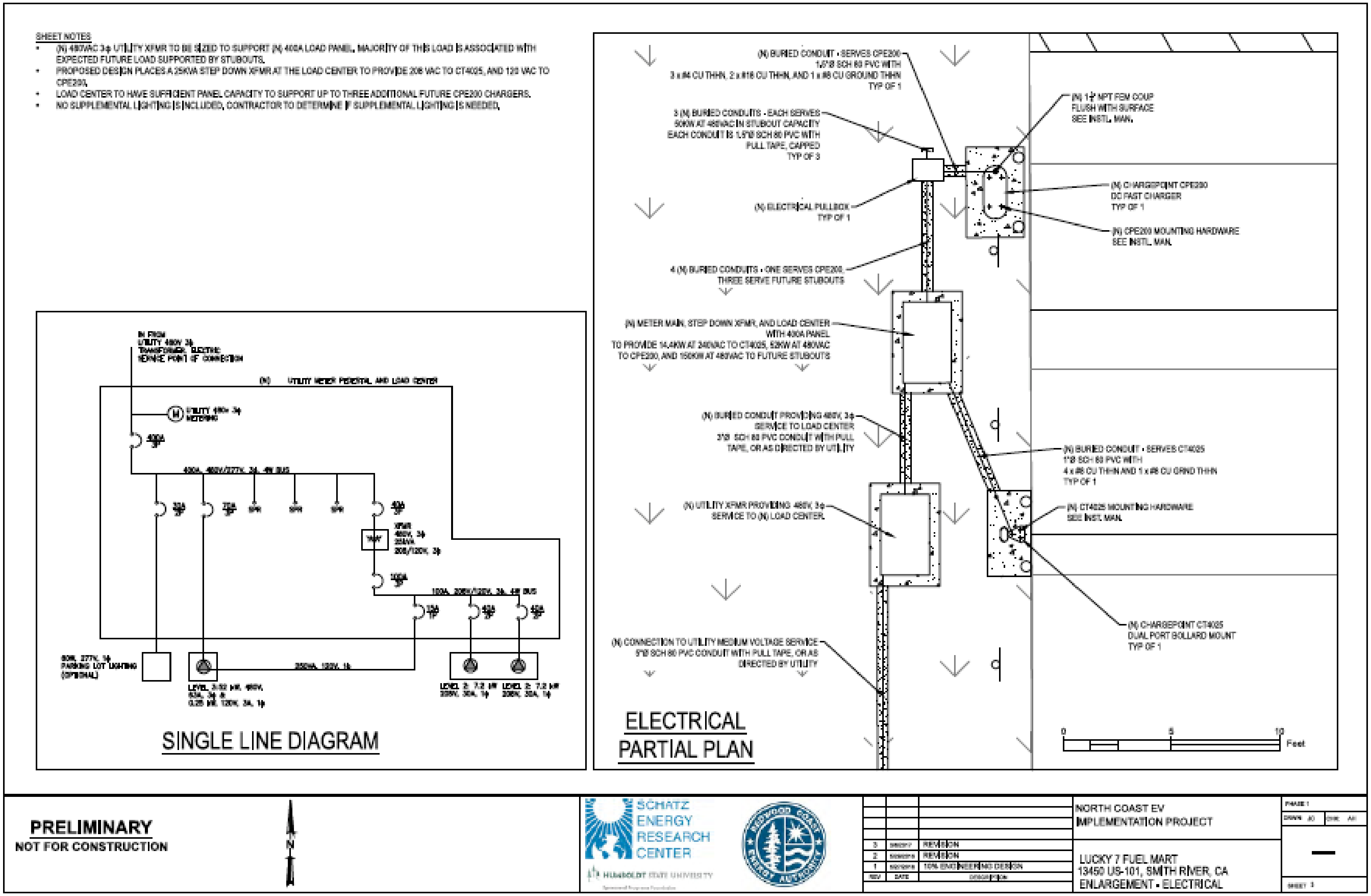


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Lucky 7 Fuel Mart - Smith River
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Three EV spaces, two served by one dual head level 2 charger, and one served by one level 3 charger.
New utility transformer, new meter and load center, stubout expansion for 150kw of future level 3 chargers
Design of code-compliant EV spaces, uses existing access aisle for van accessible EV space
Installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, pavement removal, bituminous roads, 3" thick	5.5	SY	$ -	$ 2.48	$ 1.85	$ 5.80	Total with O&P	$ 32	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	1.9	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 73	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	57.8	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 62	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	2.8	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 229	$ -
								Divison 2 Subtotal	$ 396	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 4' x 4' x 6" thick	3	EA	$ 69.50	$ 74.00	$ 1.04	$ 191.00	Total with O&P	$ 573	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	89.5	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 2,193	$ -
								Divison 3 Subtotal	$ 2,766	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	3	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 88	$ 1.99
								Division 5 Subtotal	$ 88	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	9	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 929	$ 66.60
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 236	$ 15.94
								Division 10 Subtotal	$ 1,165	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #4	11.8	CLF	$ 87.50	$ 82.50	$ -	$ 220.00	Total with O&P	$ 2,587	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	4.4	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 542	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #14	0.2	CLF	$ 11.05	$ 33.50	$ -	$ 62.50	Total with O&P	$ 13	$ -
	5" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	175	LF	$ 12.45	$ 12.50	$ -	$ 32.50	Total with O&P	$ 5,688	$ -
	1 1/4" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	33	LF	$ 2.63	$ 3.98	$ -	$ 8.85	Total with O&P	$ 292	$ -
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -
	Meter and load center, 3P, 4W, 480/277V, 400A with 25kVA XFMR to 120/208 (local estimate)	1	EA	$ 25,000.00	$ -	$ -	$ 25,000.00	Total with O&P	$ 25,000	$ -
	Smart metering, in panel, three phase, 277/480V, 400A	1	EA	$ 775.00	$ 93.50	$ -	$ 990.00	Total with O&P	$ 990	$ -
	Enclosed (NEMA 1) circuit breaker, 600V, 3P, 400A	1	EA	$ 2,775.00	$ 545.00	$ -	$ 3,900.00	Total with O&P	$ 3,900	$ -
	Panelboard and load center circuit breakers, 277 volt, 1 pole, 15 - 30A	1	EA	$ 44.00	$ 54.50	$ -	$ 131.00	Total with O&P	$ 131	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 70 - 225 amp	1	EA	$ 780.00	$ 190.00	$ -	$ 1,150.00	Total with O&P	$ 1,150	$ -
	Panelboard and load center circuit breakers, 208Y - 240VAC, 3 pole, 100A (local estimate)	1	EA	$ 370.24	$ 122.00	$ -	$ 569.24	Total with O&P	$ 569	$ -
	Panelboard and load center circuit breakers, 120 volt, 1 pole, 15-50 amp	1	EA	$ 16.50	$ 44.00	$ -	$ 84.00	Total with O&P	$ 84	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 40 amp (local estimate)	1	EA	$ 644.54	$ 190.00	$ -	$ 1,014.54	Total with O&P	$ 1,015	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -
								Division 26 Subtotal	$ 42,394	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	180	LF	$ 0.52	$ 0.45	$ 0.87	$ 1.28	Total with O&P	$ 230	$ -
	Aggregate base for trench backfill	4.9	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 70	$ 5.78
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	2.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 232	$ -
								Division 31 Subtotal	$ 533	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	5.5	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ 264	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	4	STALL	--	--	--	$ 120.75	Total with O&P	$ 483	$ -
	Pavement Parking Marking, painted letter, 6"	51	EA	--	--	--	$ 11.50	Total with O&P	$ 587	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	4	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 3,531	$ 267.55
								Divison 32 Subtotal	$ 4,865	
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25
	Level 3 Smart Charger	1	EA	$ 35,000.00	$ -	$ -	--	Unit costs	$ 35,000	$ 2,887.50
								Equipment Subtotal	$ 42,300	
Utility Cost	Pacific Power: Average quoted cost for (N) PM XFMR, easy straightforward project.	1	EA	$ -	$ -	$ -	$ 20,000.00	Total with O&P	$ 20,000	$ -
								Utility Subtotal	$ 20,000	

Construction and Equipment Subtotal $ 114,507

General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 9,161
Sales Tax	8.25%	$ 3,848
Subtotal		$ 127,515
Contingency	25%	$ 31,879
Subtotal		$ 159,394
Bonds ($/1000 per RS Means)	$12.00	$ 1,913
Subtotal		$ 161,306
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 13,550

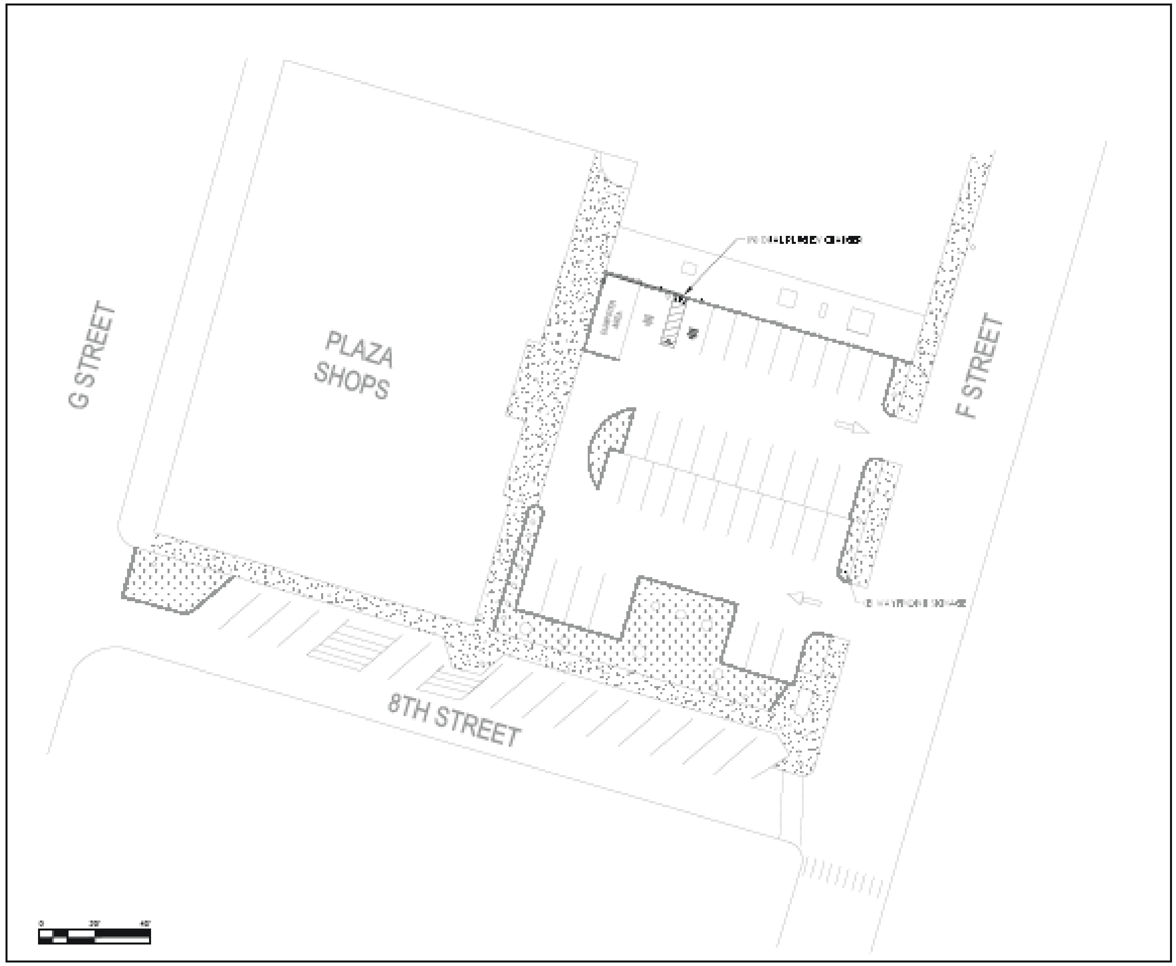
Construction and Equipment Total $ 174,856

Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- (E) SITE LOAD CENTER TO INCLUDE TWO (N) 1ϕ 2P BREAKERS AT 208 / 240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED
- CHARGING SPACES DESIGNED TO MEET 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE.
- INSTALLATION OF SPARE CONDUIT FOR A POSSIBLE FUTURE EVCS TO BE LOCATED TO THE EAST OF THE (N) EVCS.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- 2016 BUILDING CODE SPECIFIES THAT AN EVCS IS NOT A PARKING SPACE. THIS DESIGN REDUCES THE NUMBER OF EXISTING PARKING SPACES BY 1. CONFIRM THIS DOES NOT IMPACT PERMIT REQUIREMENTS FOR PARKING SPACES.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER

HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
2		REVISION
1		10% DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

CITY OF ARCATA
8TH & F ST PARKING LOT
PLAN VIEW - VICINITY

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

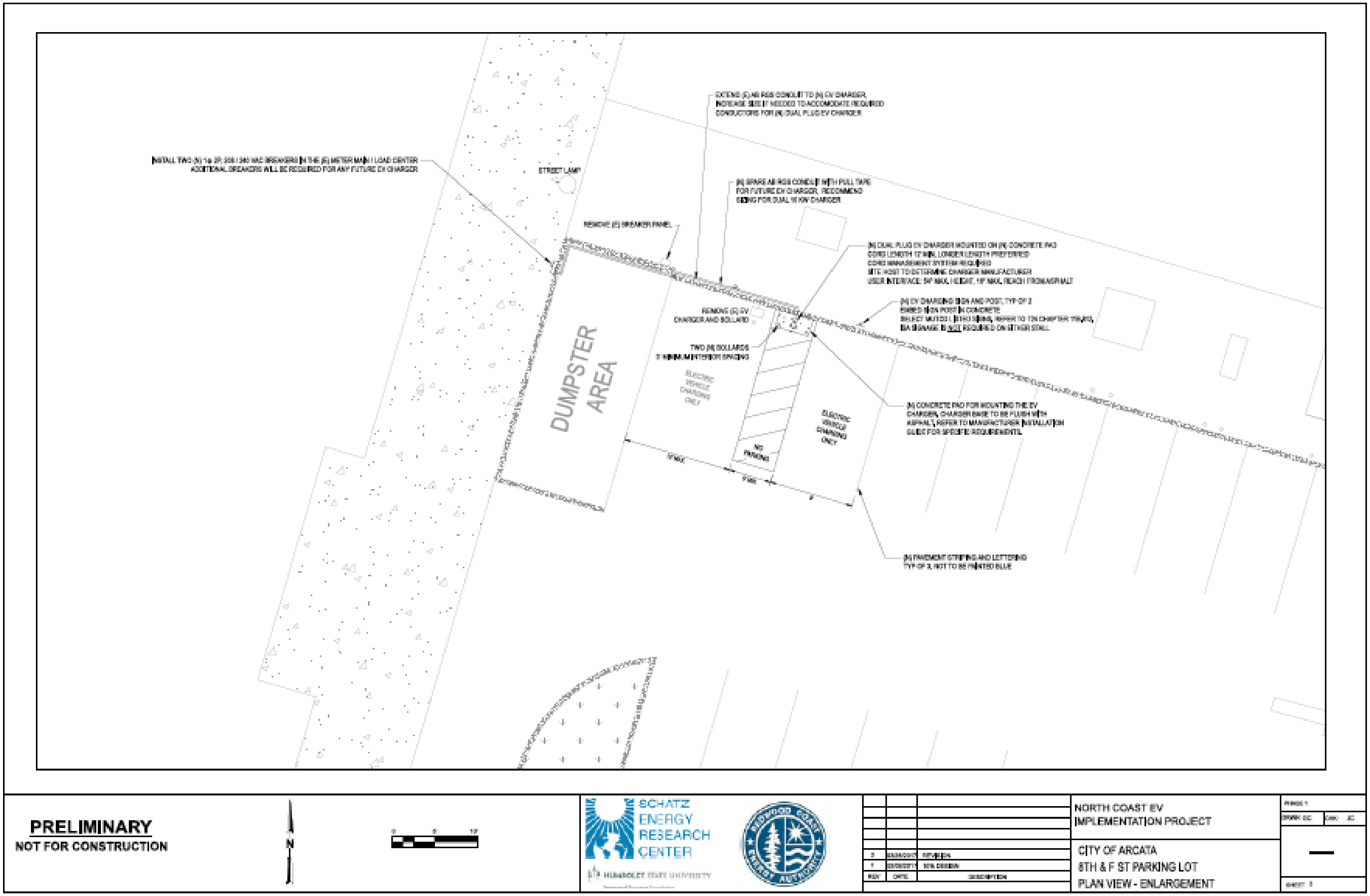


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Arcata - F St Parking Lot
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Two EV spaces served by one dual head "smart" EV charger
Use of existing meter main/load center
Installation of spare conduit to enable future expansion
Design of code-compliant EV spaces, and installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	8	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 196
								Divison 3 Subtotal	$ 324
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	2	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 59
								Division 5 Subtotal	$ 59
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	5	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 516
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 118
								Division 10 Subtotal	$ 634
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	2.0	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 248
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1 1/2" diameter	25	LF	$ 6.10	$ 7.95	$ -	$ 18.65	Total with O&P	$ 466
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1 1/2" diameter	40	LF	$ 6.10	$ 7.95	$ -	$ 18.65	Total with O&P	$ 746
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244
								Division 26 Subtotal	$ 1,704
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3	STALL	--	--	--	$ 120.75	Total with O&P	$ 362
	Pavement Parking Marking, painted letter, 6"	35	EA	--	--	--	$ 11.50	Total with O&P	$ 403
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	2	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 1,766
								Divison 32 Subtotal	$ 2,530
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300
								Equipment Subtotal	$ 7,300

Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
- CLF Hundred linear feet
- MSF Thousand square feet
- LF Linear foot
- EA Each
- SY Square yard
- STALL Parking stall
- BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 12,552
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 1,004
Sales Tax	8.25%	$ 782
Subtotal		$ 14,338
Contingency	25%	$ 3,585
Subtotal		$ 17,923
Bonds ($/1000 per RS Means)	$12.00	$ 215
Subtotal		$ 18,138
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 1,524
Construction and Equipment Total		$ 19,661
Construction Administration	7%	$ 1,376
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 3,932
Grand Total		$ 24,970

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

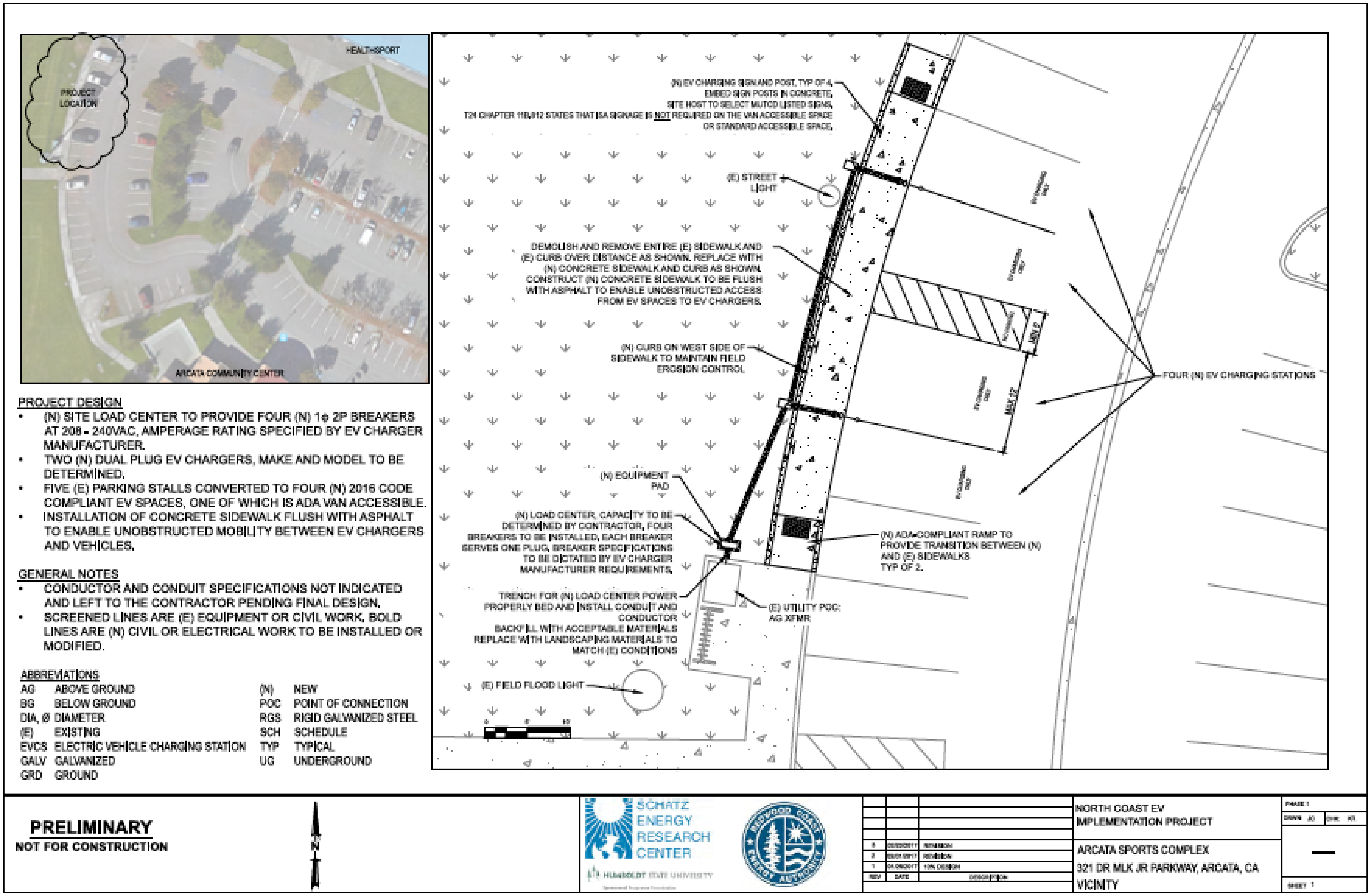


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

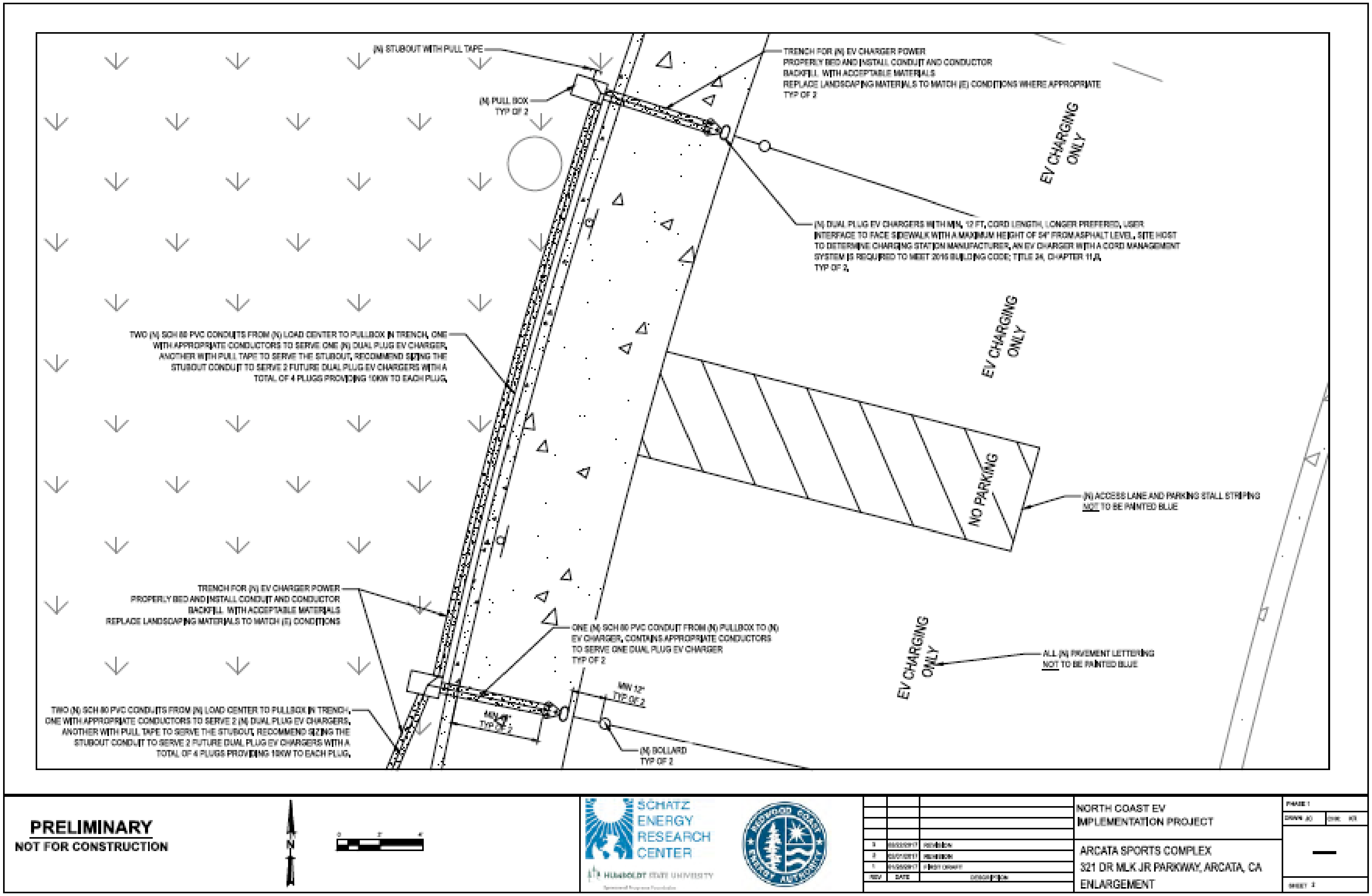


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Site: Arcata Sports Complex
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Four EV spaces served by two dual head "smart" EV chargers (substitute basic dual chargers to reduce costs)
Installation of new meter and load center supporting four new circuits
Demolition of portion of (E) sidewalk and replace and extend (N) sidewalk flush with asphalt to enable unobstructed mobility
Design of code-compliant EV spaces, and installation of code-required signage

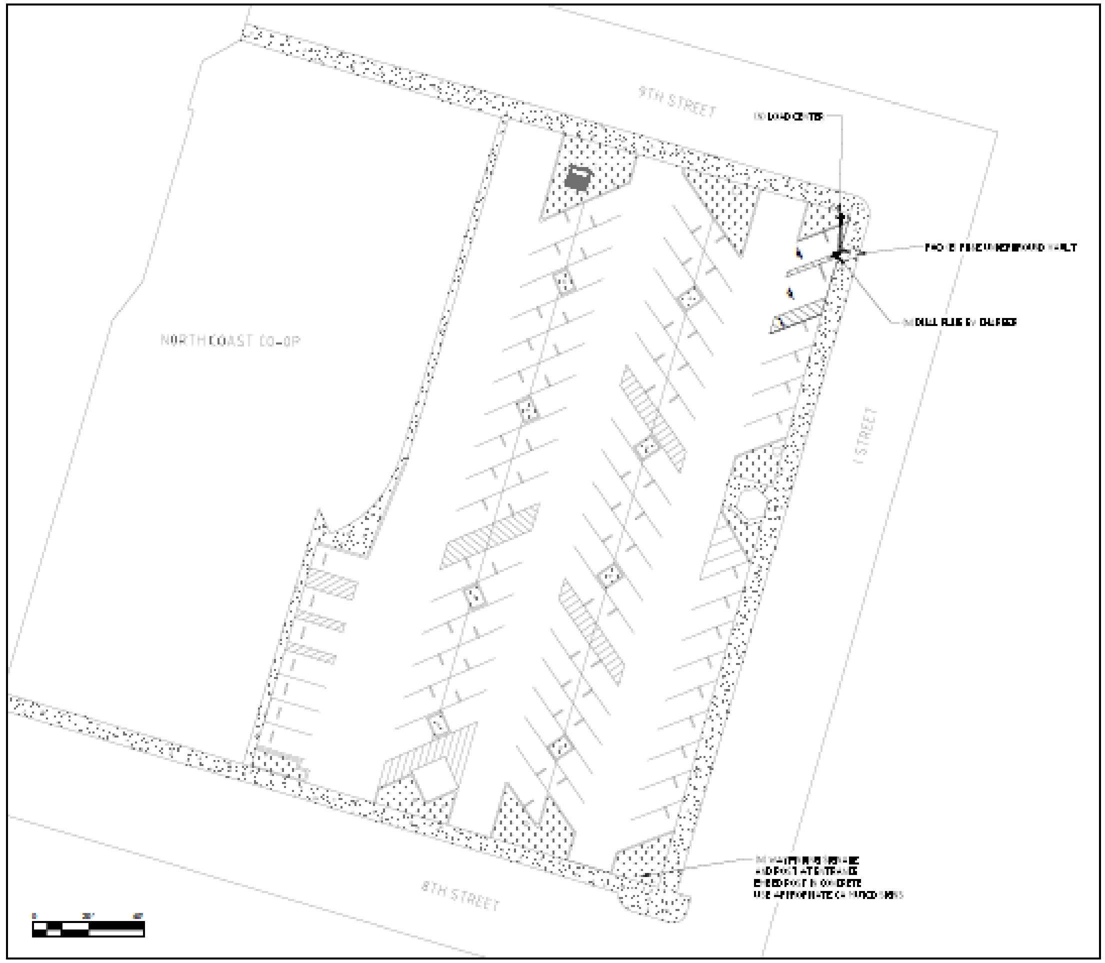
RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	42.8	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 674	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	7.3	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 279	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	116.0	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 124	$ -
	Selective demolition, dump charges, dump charges - local disposal at HWMA rates	10.8	Ton	--	--	--	$ 175.41	Total with O&P	$ 1,889	$ -
								Divison 2 Subtotal	$ 2,965	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	15	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 368	$ -
	Concrete forming, structural cast-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, ob grade, to 6" high	215	LF	$ 0.35	$ 2.38	$ -	$ 4.04	Total with O&P	$ 869	$ -
	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	9.25	CY	$ 102.00	$ -	$ -	$ 112.00	Total with O&P	$ 1,036	$ -
	Placing concrete, labor and equipmnt to place, level and consolidate, Footing, continuous, shallow, direct chute (≥ 1 CY and ≤ 5 CY)	9.25	CY	$ -	$ 34.00	$ 1.13	$ 53.50	Total with O&P	$ 495	$ -
								Divison 3 Subtotal	$ 2,896	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	2	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 59	$ 1.33
								Division 5 Subtotal	$ 59	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	9	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 929	$ 66.60
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 236	$ 15.94
								Division 10 Subtotal	$ 1,165	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded 600 kcmil	0.1	CLF	$ 1,350.00	$ 335.00	$ -	$ 1,975.00	Total with O&P	$ 221	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	1.8	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 302	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	3.6	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 440	$ -
	1 1/4" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	70	LF	$ 2.63	$ 3.98	$ -	$ 8.85	Total with O&P	$ 620	$ -
	2 1/2" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	6	LF	$ 5.45	$ 6.75	$ -	$ 16.10	Total with O&P	$ 90	$ -
	1" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	50	LF	$ 2.11	$ 3.50	$ -	$ 7.55	Total with O&P	$ 378	$ -
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	2	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 382	$ -
	Meter center and sockets, meter center, main fusible switch, rainproof, 1P, 3W, 120/240 Volt, 400 amp	1	EA	$ 3,000.00	$ 545.00	$ -	$ 3,545.00	Unit costs	$ 3,545	$ 247.50
	Smart metering, in panel, single phase, 120/208V, 200A	1	EA	$ 375.00	$ 50.00	$ -	$ 485.00	Total with O&P	$ 485	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	4	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 488	$ -
								Division 26 Subtotal	$ 6,951	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	83	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 106	$ -
	Aggregate base for trench backfill	2.3	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 33	$ 2.70
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -
								Division 31 Subtotal	$ 255	
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	5	STALL	--	--	--	$ 120.75	Total with O&P	$ 604	$ -
	Pavement Parking Marking, painted letter, 6"	61	EA	--	--	--	$ 11.50	Total with O&P	$ 702	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4' D hole, 6" DIA	2	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 1,766	$ 133.77
								Divison 32 Subtotal	$ 3,071	
EV Charger	Dual, Level 2 Smart Charger	2	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 14,600	$ 1,204.50
								Equipment Subtotal	$ 14,600	

Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 31,961
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 2,557
Sales Tax	8.25%	$ 1,672
Subtotal		$ 36,190
Contingency	25%	$ 9,048
Subtotal		$ 45,238
Bonds ($/1000 per RS Means)	$12.00	$ 543
Subtotal		$ 45,781
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 3,846
Construction and Equipment Total		$ 49,626
Construction Administration	7%	$ 3,474
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 9,925
Grand Total		$ 63,025

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- (N) SITE LOAD CENTER TO PROVIDE TWO (N) 1ϕ 2P BREAKERS AT 240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- TAP INTO (E) UNDERGROUND VAULT AS POINT OF CONNECTION.
- ONE (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED.
- THREE PARKING STALLS CONVERTED TO TWO 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE WITH AN ACCESS AISLE AND ONE OF WHICH IS A STANDARD EV CHARGING SPACE.
- OPTIONAL 1' MARKED SPACING RECOMMENDED BETWEEN STALLS TO PREVENT DRIVERS FROM PARKING IN FRONT OF CHARGING STATION.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER

HUMBOLDT STATE UNIVERSITY

1 | 10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

NORTH COAST CO-OP
811 I ST, ARCATA, CA
VICINITY

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

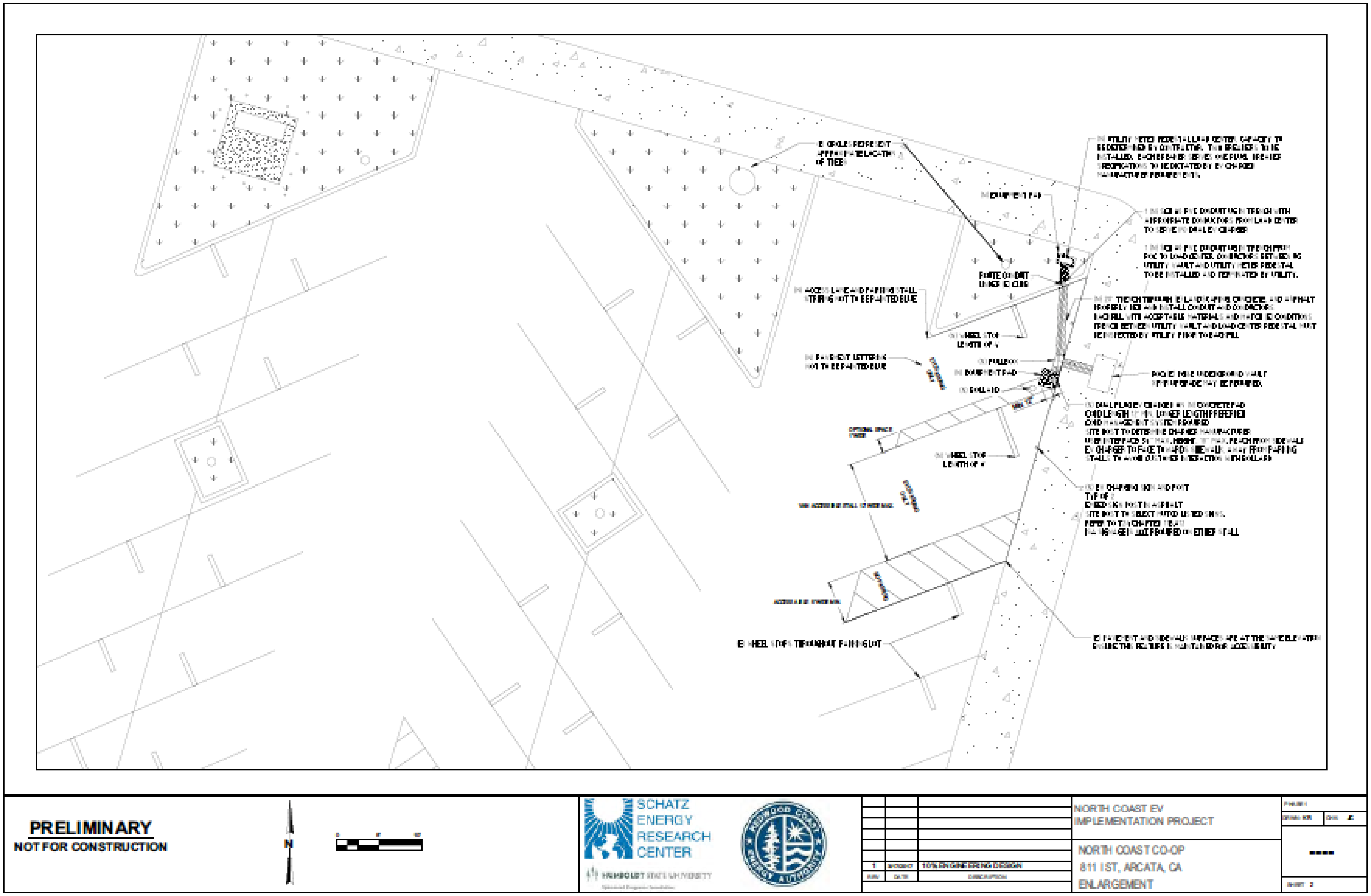


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Client: Arcata North Coast Co-Op
Purpose: Cost estimate for the preliminary design of an electric vehicle charging station install
Project: ARV-14-046 PEV Readiness NorthCoast
Prepared by: Schatz Energy Research Center

Preliminary design costs based on:
New meter 200 A load center and two 50 A circuits for EV charger
Trench from utility point of connection (underground vault) to new meter center
Trench from new meter center to EV charger (partially sharing a trench with utility point of connection trench)
Installation of a smart dual Level 2 EV charger (substitute a basic dual charger to reduce costs, if needed)
Installation of one protective bollard for electrical equipment; allowing for easily access to station by user via existing sidewalk
Installation of code required signage
Utility to install cable between underground vault and load center

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax	Notes
2: Existing Conditions - Demolition									$ -	$ -	No demolition required for site
									$ -	$ -	
									$ -	$ -	
									$ -	$ -	
								Division 2 Subtotal	$ -		
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	2	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 256	$ -	Load center and charging station
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	35	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 869	$ -	Cutting existing pavement and concrete sidewalk where charging station will go, assume trench is 1.5' wide
	Concrete core drilling, reinforced concrete slab, up to 6" thick, incl bit, layout, and setup, 3" diameter hole	4	EA	$ 0.28	$ 42.00	$ 7.00	$ 72.50	Total with O&P	$ 290	$ -	Holes for sign poles (2 EV spots) and 2 bollards
								Division 3 Subtotal	$ 1,415		
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29	$ 0.66	Charger mounting hardware
								Division 5 Subtotal	$ 29		
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	7	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 722	$ 51.80	2 way-finding signs, 2 EV charging only signs, 2 parking time limit signs, 1 Van Accessible sign
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	3	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 177	$ 11.95	1 pole for each stall, 1 pole for way-finding sign
								Division 10 Subtotal	$ 900		
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	0.8	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 132	$ -	4x 6 AWG from load center to EV Charger (2 per plug) 20' L x 4
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.2	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 25	$ -	1x 8 AWG from load center to EV Charger (1 ground) 20' L x 1
	1" dia. conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	20	LF	$ 2.11	$ 3.50	$ -	$ 7.55	Total with O&P	$ 151	$ -	Underground section of conduit from load center to the charger
	2" dia SCH 40 PVC conduit, above ground, up to 15' high, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	33	LF	$ 3.90	$ 4.86	$ -	$ 11.60	Total with O&P	$ 383	$ -	Conduit for PG&E's wires from power pole base to load center + 33' (includes 18" in and out of trench)
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -	Pull box to be located where conduit comes out from ground at the load center
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -	2 circuits
	Meter center and sockets, single position, 4 terminal, 200 amp	1	EA	$ 92.00	$ 230.00	$ -	$ 322.00	Unit costs	$ 322	$ 7.59	New load center
	Smart metering, in panel, single phase, 120/208V, 200A	1	EA	$ 375.00	$ 50.00	$ -	$ 485.00	Unit costs	$ 425	$ 30.94	Meter
								Division 26 Subtotal	$ 1,873		
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	20	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 26	$ -	Trench length 20'
	Aggregate base for trench backfill	1.9	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 26	$ 2.18	Trench depth is 30" (bottom 4 inches are sand, but assumed same cost as AB)
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -	For detailed shoveling while trenching
								Division 31 Subtotal	$ 168		
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3.5	STALL	--	--	--	$ 120.75	Total with O&P	$ 423	$ -	2 EV spaces + access aisle + partial access aisle
	Pavement Parking Marking, painted letter, 6"	35	EA	--	--	--	$ 11.50	Total with O&P	$ 403	$ -	EV PARKING ONLY: 13 letters x 2 stalls = 26; NO PARKING: 9 letters; Total: 35 letters
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4' D hole, 6" DIA	1	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 883	$ 66.89	2 bollards to prevent cars from rolling (since curb is removed) and 1 bollard to protect charger
	Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	2	EA	$ 68.43	$ 13.63	$ -	--	Unit costs	$ 164	$ 11.29	One wheel stop per stall
	Sidewalks, driveways, patios, concrete, 3000 psi, CIP, mesh reinforcement, 6" thick	5	SF	$ 30.36	$ 21.97	$ -	--	Unit costs	$ 280	$ 13.41	Concrete replacement in sidewalk over trench, assume trench is 1.5' wide
	Asphalt Paving- Pavement replacement over trench, 4" thick	24	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ 1,136	$ 31.23	Asphalt replacement in parking lot over trench, assume trench is 1.5' wide
								Division 32 Subtotal	$ 3,289		
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25	
								Equipment Subtotal	$ 7,300		
Utility Cost	PG&E: Electric Service Connection - engineering, tie-in, distribution line installation	1	EA	$ -	$ -	$ -	$ 2,000.00	Total with O&P	$ 2,000	$ -	Estimated price for typical project
								Equipment Subtotal	$ 2,000		

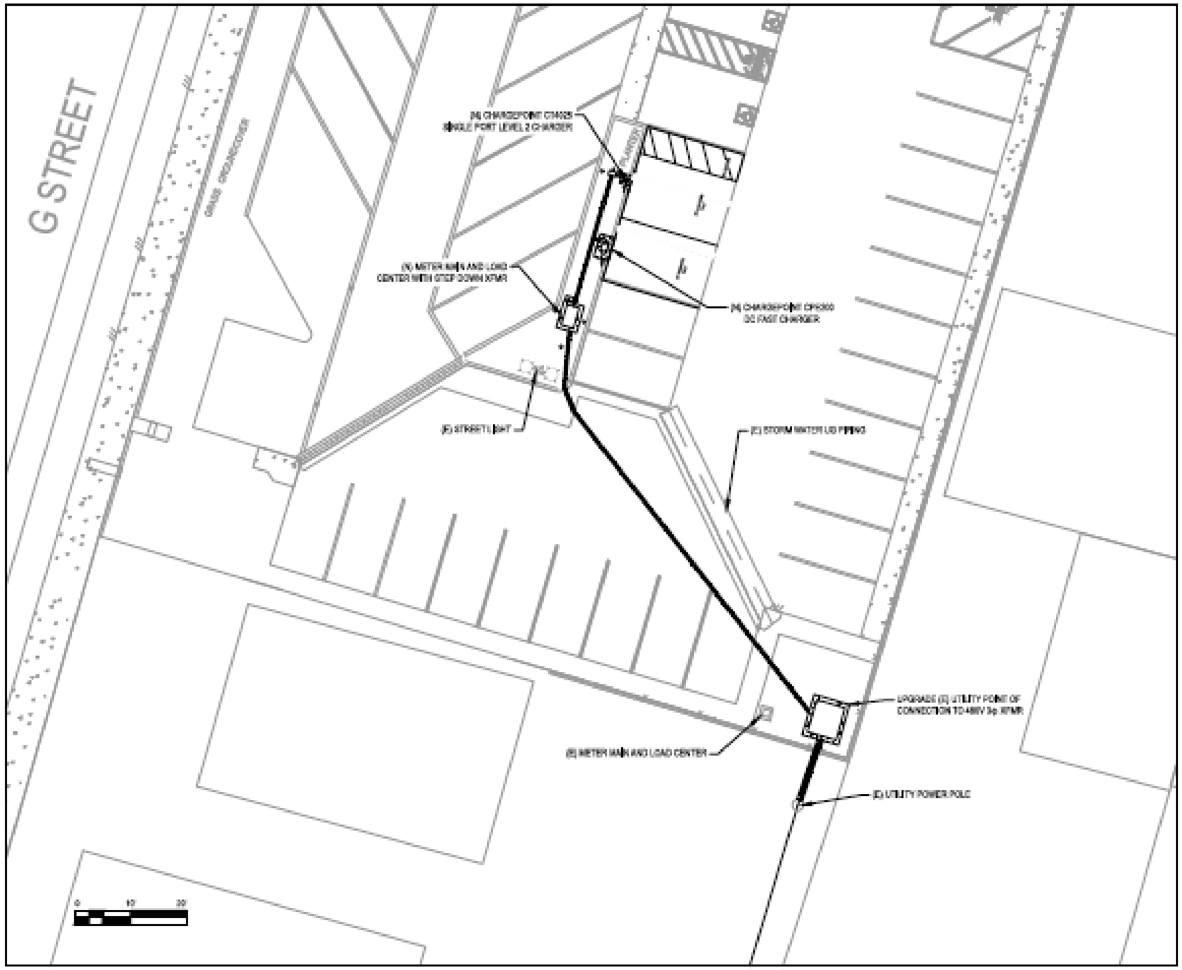
Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups

RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$	9,674
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$	774
Sales Tax	8.25%	$	830
Subtotal		$	11,278
Contingency	25%	$	2,819
Subtotal		$	14,097
Bonds ($/1000 per RS Means)	$12.00	$	169
Subtotal		$	14,266
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$	1,198
Construction and Equipment Total		$	15,465
Construction Administration	7%	$	1,083
Design Bidding, Construction Admin Assistance (consultant)	20%	$	3,093
Grand Total		$	19,640

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- RECOMMEND CONTRACTOR UPDATE CURRENT DESIGN TO MEET SPIRIT OF CHAPTER 11B ACCESSIBILITY REQUIREMENTS.
- (N) 480VAC 3φ UTILITY XFMR, (N) LOAD CENTER WITH 400A PANEL AND 480V-TO-208/120V STEP DOWN XFMR,
- ONE (N) 50KW DC FAST CHARGER AND ONE (N) SINGLE PLUG 7.2KW EV CHARGER, MAKE AND MODEL TO BE DETERMINED.
- THREE (E) PARKING STALLS CONVERTED TO TWO (N) 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS VAN ACCESSIBLE.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS TO BE UPDATED BY CONTRACTOR PENDING FINAL DESIGN,
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK, BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS AND SYMBOLS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER
φ	ELECTRICAL PHASE		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
4	4/05/2017	REVISION
3	3/08/2017	REVISION
2	6/06/2016	REVISION
1	5/31/2016	10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

G & 7TH ST CITY PARKING LOT
ARCATA, CA
VICINITY

PHASE 1
DRWN KT | CHK AH
SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

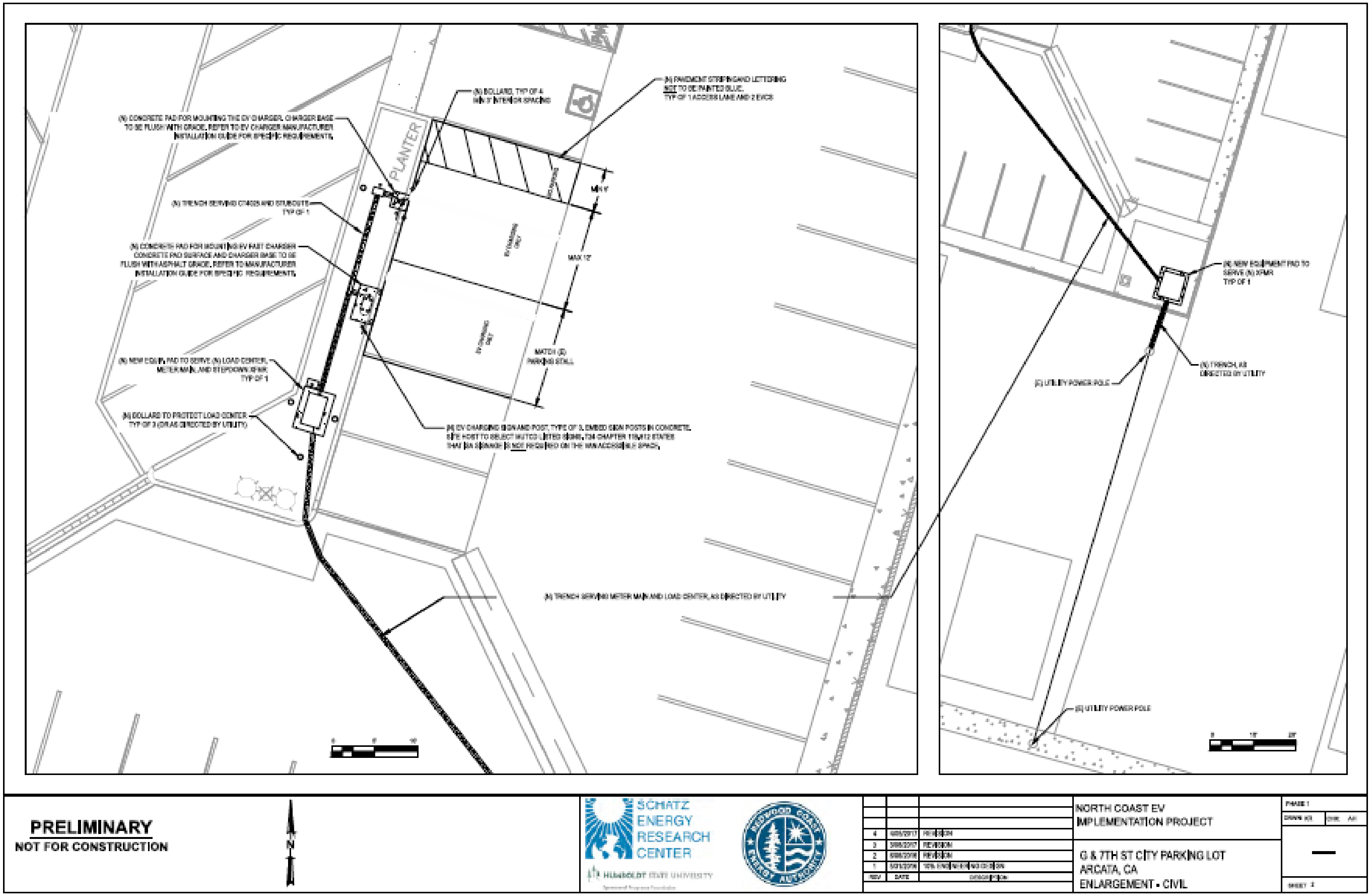


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

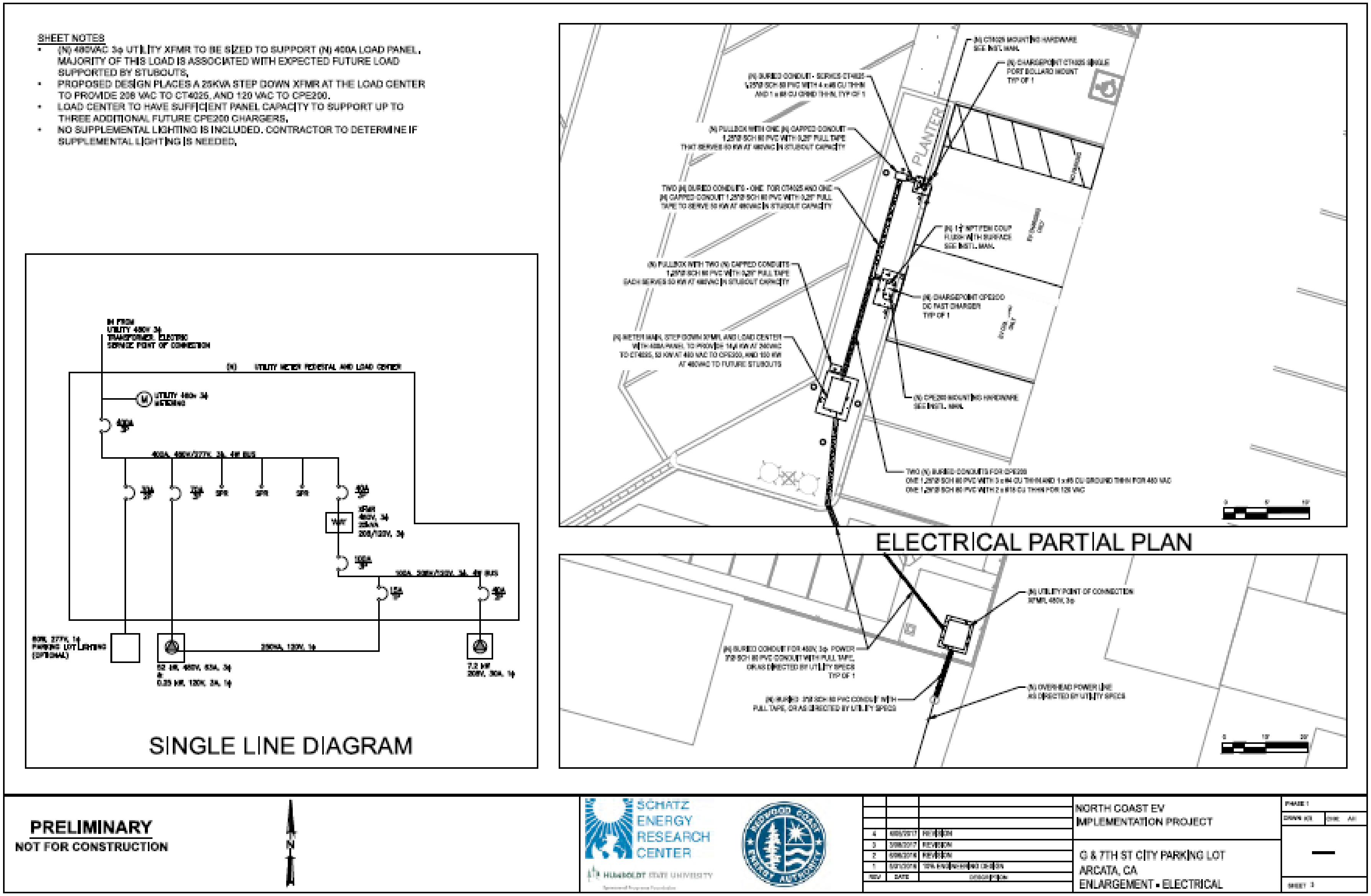


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Arcata G & 7 St
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
One EV space for single head level 2 charger, and one EV space for level 3 charger
New utility transformer, new meter and load center, stubout expansion for 150kw of future level 3 chargers
Design of code-compliant EV spaces
Installation of code-required signage

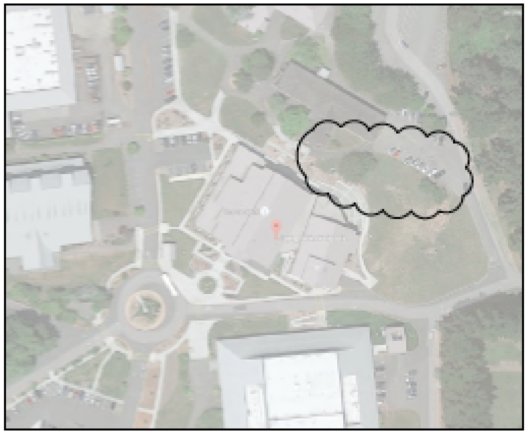
RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	10.7	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 169	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	3.3	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 127	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	61.8	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 66	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	4.9	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 395	$ -
								Divison 2 Subtotal	$ 757	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 4' x 4' x 6" thick	3	EA	$ 69.50	$ 74.00	$ 1.04	$ 191.00	Total with O&P	$ 573	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	146.5	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 3,589	$ -
								Divison 3 Subtotal	$ 4,162	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	3	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 88	$ 1.99
								Division 5 Subtotal	$ 88	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	7	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 722	$ 51.80
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 236	$ 15.94
								Division 10 Subtotal	$ 959	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #4	0.5	CLF	$ 87.50	$ 82.50	$ -	$ 220.00	Total with O&P	$ 103	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.9	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 115	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.5	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 58	$ -
	5" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	15	LF	$ 12.45	$ 12.50	$ -	$ 32.50	Total with O&P	$ 488	$ -
	3" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	85	LF	$ 6.30	$ 7.95	$ -	$ 18.80	Total with O&P	$ 1,598	$ -
	1 1/4" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	68	LF	$ 2.63	$ 3.98	$ -	$ 8.85	Total with O&P	$ 602	$ -
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	2	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 382	$ -
	Meter and load center, 3P, 4W, 480/277V, 400A with 25kVA XFMR to 120/208 (local estimate)	1	EA	$ 25,000.00	$ -	$ -	$ 25,000.00	Total with O&P	$ 25,000	$ -
	Smart metering, in panel, three phase, 277/480V, 400A	1	EA	$ 775.00	$ 93.50	$ -	$ 990.00	Total with O&P	$ 990	$ -
	Enclosed (NEMA 1) circuit breaker, 600V, 3P, 400A	1	EA	$ 2,775.00	$ 545.00	$ -	$ 3,900.00	Total with O&P	$ 3,900	$ -
	Panelboard and load center circuit breakers, 277 volt, 1 pole, 15 - 30A	1	EA	$ 44.00	$ 54.50	$ -	$ 131.00	Total with O&P	$ 131	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 70 - 225 amp	1	EA	$ 780.00	$ 190.00	$ -	$ 1,150.00	Total with O&P	$ 1,150	$ -
	Panelboard and load center circuit breakers, 208Y - 240VAC, 3 pole, 100A (local estimate)	1	EA	$ 370.24	$ 122.00	$ -	$ 569.24	Total with O&P	$ 569	$ -
	Panelboard and load center circuit breakers, 120 volt, 1 pole, 15-50 amp	1	EA	$ 16.50	$ 44.00	$ -	$ 84.00	Total with O&P	$ 84	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 40 amp (local estimate)	1	EA	$ 644.54	$ 190.00	$ -	$ 1,014.54	Total with O&P	$ 1,015	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -
								Division 26 Subtotal	$ 36,429	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	121	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 155	$ -
	Aggregate base for trench backfill	3.4	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 48	$ 3.95
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	3.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 348	$ -
								Division 31 Subtotal	$ 551	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	10.2	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ 486	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3	STALL	--	--	--	$ 120.75	Total with O&P	$ 362	$ -
	Pavement Parking Marking, painted letter, 6"	37	EA	--	--	--	$ 11.50	Total with O&P	$ 426	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	7	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 6,180	$ 468.31
								Divison 32 Subtotal	$ 7,454	
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25
	Level 3 Smart Charger	1	EA	$ 35,000.00	$ -	$ -	--	Unit costs	$ 35,000	$ 2,887.50
								Equipment Subtotal	$ 42,300	
Utility Cost	PG&E: New UG XFMR - Intercept (E) duct and re-pull primary cable. Includes XFMR, cable, labor, estimating, service planning, mapping.	1	EA	$ -	$ -	$ -	$ 51,443.00	Total with O&P	$ 51,443	$ -
								Utility Subtotal	$ 51,443	

Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 144,143
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 11,531
Sales Tax	8.25%	$ 4,032
Subtotal		$ 159,706
Contingency	25%	$ 39,926
Subtotal		$ 199,632
Bonds ($/1000 per RS Means)	$12.00	$ 2,396
Subtotal		$ 202,028
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 16,970
Construction and Equipment Total		$ 218,998

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

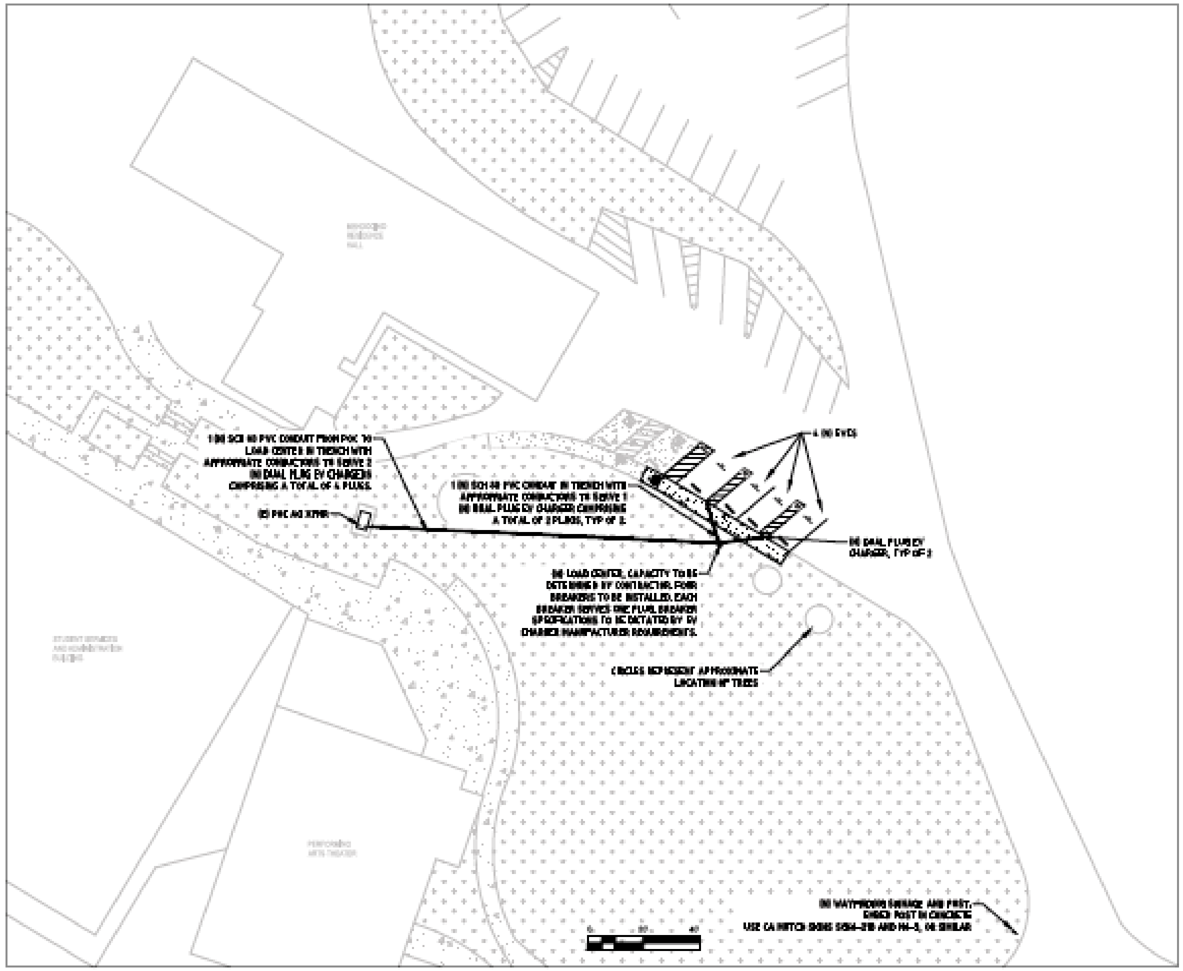
- (E) OR (N) SITE LOAD CENTER TO PROVIDE FOUR (N) 1φ 2P BREAKERS AT 208 - 240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- TWO (N) DUAL PLUG EV CHARGERS, MAKE AND MODEL TO BE DETERMINED
- SEVEN (E) PARKING STALLS CONVERTED TO FOUR (N) 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE.
- INSTALLATION OF CONCRETE SIDEWALK FLUSH WITH ASPHALT TO ENABLE UNOBSTRUCTED MOBILITY BETWEEN EV CHARGERS AND VEHICLES.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- 2016 BUILDING CODE SPECIFIES THAT AN EVCS IS NOT A PARKING SPACE, THIS DESIGN REDUCES THE NUMBER OF EXISTING PARKING SPACES BY 7, CONFIRM THIS DOES NOT IMPACT PERMIT REQUIREMENTS FOR PARKING SPACES.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER



PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

3	3/13/2017	REVISION
2	01/18/2017	REVISION
1	09/30/2016	10% DESIGN
REV	DATE	DESCRIPTION

NORTH COAST EV IMPLEMENTATION PROJECT

COLLEGE OF THE REDWOODS
PARKING AREA NEAR MENDOCINO HALL
PLAN VIEW - VICINITY

PHASE 1
DRAWN: JD CHK: KR
SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

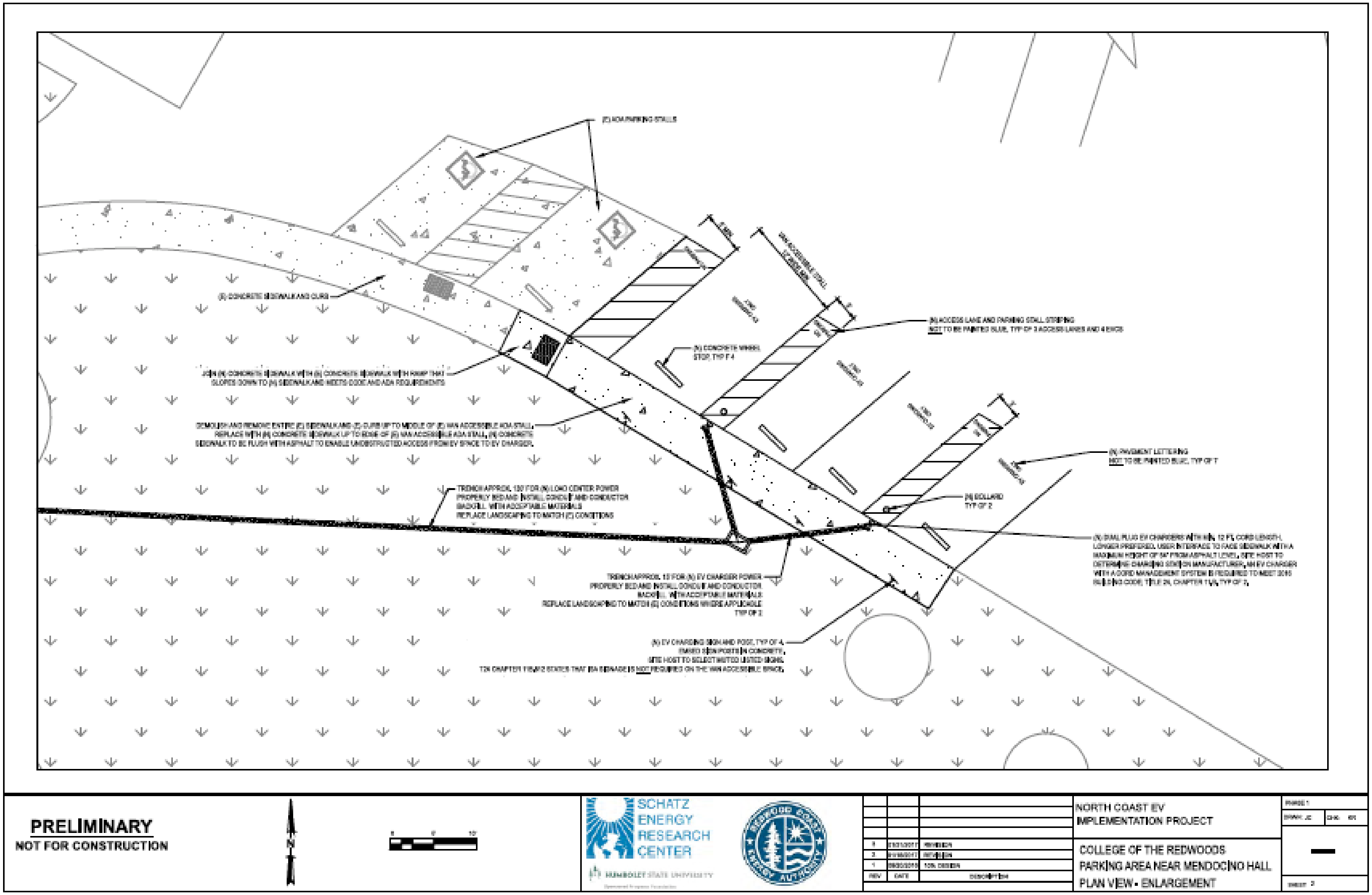


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Site: College of the Redwoods
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Four EV spaces served by two dual head "smart" EV chargers (substitute basic dual chargers to reduce costs)
Installation of new meter and load center supporting four 50A circuits (If new load center not needed this will significantly reduce cost)
Demolition of portion of (E) sidewalk and replace and extend (N) sidewalk flush with asphalt to enable unobstructed mobility
Design of code-compliant EV spaces, and installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	18.0	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 284	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	6.0	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 231	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	96.0	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 103	$ -
	Selective demolition, dump charges, dump charges - local disposal at HWMA rates	8.9	Ton	--	--	--	$ 175.41	Total with O&P	$ 1,563	$ -
								Divison 2 Subtotal	$ 2,180	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	10	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 245	$ -
	Concrete forming, structural cast-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, ob grade, to 6" high	140	LF	$ 0.35	$ 2.38	$ -	$ 4.04	Total with O&P	$ 566	$ -
	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	6.25	CY	$ 102.00	$ -	$ -	$ 112.00	Total with O&P	$ 700	$ -
	Placing concrete, labor and equipmt to place, level and consolidate, Footing, continuous, shallow, direct chute (≥ 1 CY and ≤ 5 CY)	6.25	CY	$ -	$ 15.65	$ 0.52	$ 24.50	Total with O&P	$ 153	$ -
								Divison 3 Subtotal	$ 1,792	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	2	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 59	$ 1.33
								Division 5 Subtotal	$ 59	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	11	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 1,135	$ 81.40
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	5	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 295	$ 19.92
								Division 10 Subtotal	$ 1,431	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded 3/0	2.9	CLF	$ 405.00	$ 175.00	$ -	$ 710.00	Total with O&P	$ 2,059	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #6	1.6	CLF	$ 63.50	$ 67.50	$ -	$ 171.00	Total with O&P	$ 274	$ -
	1 1/2" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	145	LF	$ 2.99	$ 4.38	$ -	$ 9.85	Total with O&P	$ 1,428	$ -
	1" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	41	LF	$ 2.11	$ 3.50	$ -	$ 7.55	Total with O&P	$ 310	$ -
	Meter center and sockets, meter center, main fusible switch, rainproof, 1P, 3W, 120/240 Volt, 400 amp	1	EA	$ 3,000.00	$ 545.00	$ -	$ 3,545.00	Unit costs	$ 3,545	$ 247.50
	Smart metering, in panel, single phase, 120/208V, 200A	1	EA	$ 375.00	$ 50.00	$ -	$ 485.00	Total with O&P	$ 485	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	4	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 488	$ -
								Division 26 Subtotal	$ 8,588	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	165	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 211	$ -
	Aggregate base for trench backfill- based on local pricing from Kernan Construction- supplier of AB	5.0	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 71	$ 5.88
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -
								Division 31 Subtotal	$ 398	
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	5	STALL	--	--	--	$ 120.75	Total with O&P	$ 604	$ -
	Pavement Parking Marking, painted letter, 6"	79	EA	--	--	--	$ 11.50	Total with O&P	$ 909	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4' D hole, 6" DIA	2	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 1,766	$ 133.77
	Precast concrete parking bumpers, Incl dowels, 6" x 10" x 6'0"	4	EA	$ 68.43	$ 13.63	$ -	--	Unit costs	$ 328	$ 22.58
								Divison 32 Subtotal	$ 3,606	
EV Charger	Dual, Level 2 Smart Charger	2	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 14,600	$ 1,204.50
								Equipment Subtotal	$ 14,600	

Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 32,654
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 2,612
Sales Tax	8.25%	$ 1,717
Subtotal		$ 36,984
Contingency	25%	$ 9,246
Subtotal		$ 46,230
Bonds ($/1000 per RS Means)	$12.00	$ 555
Subtotal		$ 46,784
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 3,930
Construction and Equipment Total		$ 50,714
Construction Administration	7%	$ 3,550
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 10,143
Grand Total		$ 64,407

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

PROJECT DESIGN

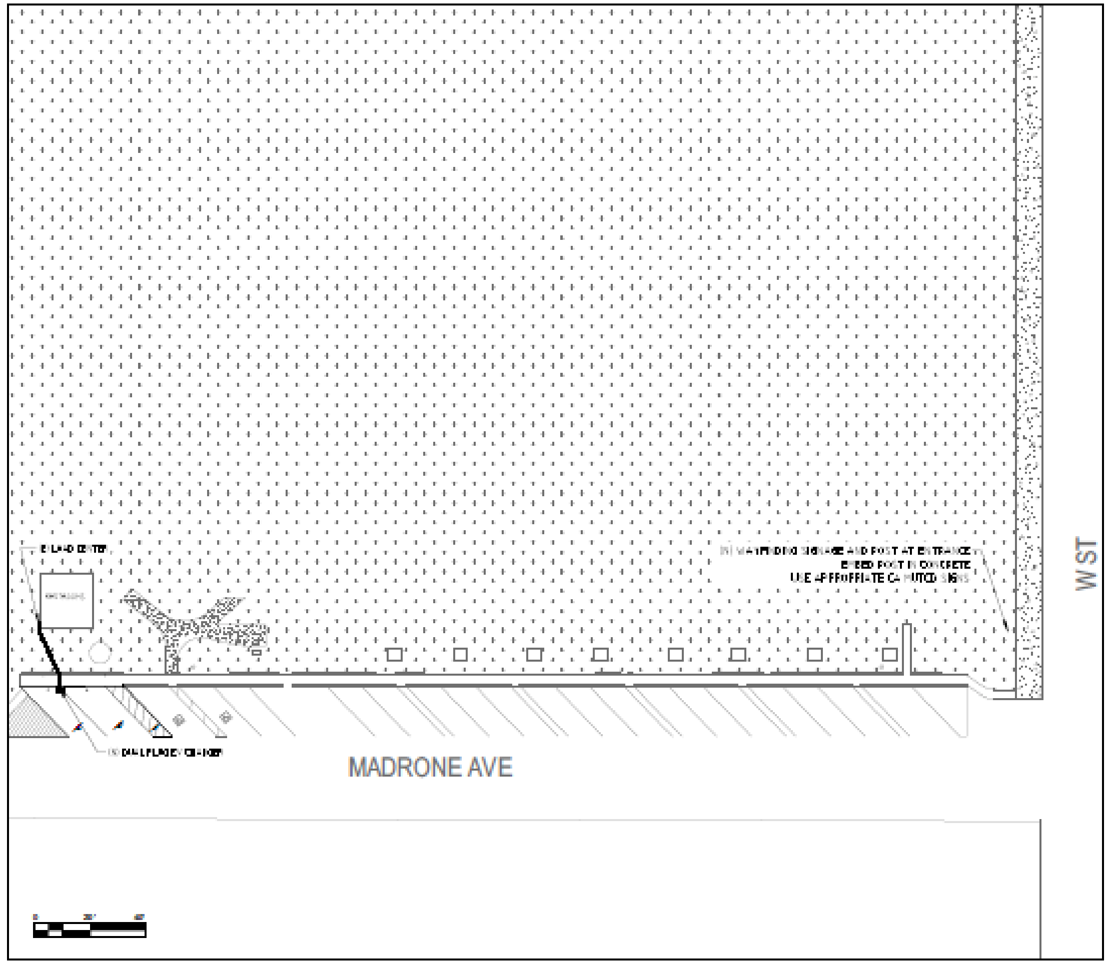
- (E) SITE LOAD CENTER TO PROVIDE TWO (N) 1φ 2P BREAKERS AT 240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- ONE (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED.
- THREE PARKING STALLS CONVERTED TO TWO 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE WITH AN ACCESS AISLE AND ONE OF WHICH IS A STANDARD EV CHARGING SPACE.
- CUT (E) CONCRETE CURB TO MAINTAIN UNOBSTRUCTED SPACE AROUND THE EV CHARGERS FOR MOBILITY.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND		



PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
2		REVISION
1		10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

SEQUOIA PARK
3414 W ST, EUREKA, CA
VICINITY

SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

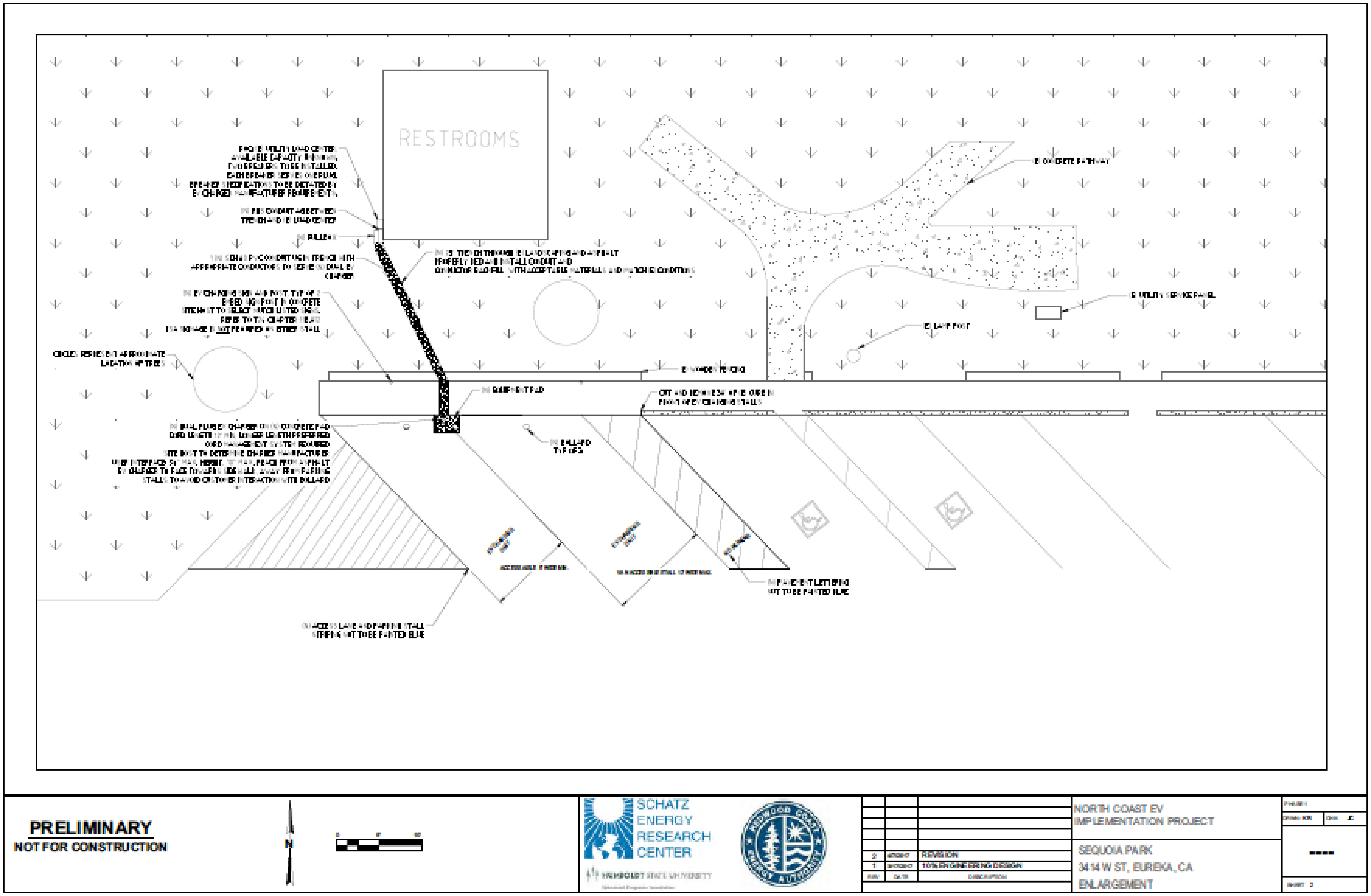


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Client: Sequoia Park
Purpose: Cost estimate for the preliminary design of an electric vehicle charging station install
Project: ARV-14-046 PEV Readiness NorthCoast
Prepared by: Schatz Energy Research Center

Preliminary design costs based on:
Two 50 A circuits for EV charger in existing service panel located outside park's restrooms
Trench from service panel to EV charger
Installation of a smart dual Level 2 EV charger (substitute a basic dual charger to reduce costs, if needed)
Installation of a protective bollards for electrical equipment and to prevent vehicles from rolling into the existing walkway
Installation of code required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax	Notes
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	2.1	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 33	$ -	Existing curb in front of EV charging stalls and access lane
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	0.3	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 13	$ -	Material removal
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	6.9	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 7	$ -	County solid waste transfer station HWMA, 10 miles one way
	Selective demolition, dump charges, dump charges - local disposal at HWMA rates	0.5	Ton	--	--	--	$ 175.41	Total with O&P	$ 90	$ -	Dump charges
								Divison 2 Subtotal	$ 144		
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128	$ -	Charging station
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	5	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 123	$ -	Cutting existing pavement where charging station will go
	Concrete core drilling, reinforced concrete slab, up to 6" thick, incl bit, layout, and setup, 2" diameter hole	5	EA	$ 0.28	$ 42.00	$ 7.00	$ 72.50	Total with O&P	$ 363	$ -	Holes for sign poles (2 EV spots) and 3 bollards
								Divison 3 Subtotal	$ 613		
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29	$ 0.66	Charger mounting hardware
								Division 5 Subtotal	$ 29		
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	7	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 722	$ 51.80	2 way-finding signs, 2 EV charging only signs, 2 parking time limit signs, 1 Van Accessible sign
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	3	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 177	$ 11.95	1 pole for each stall, 1 pole for way-finding sign
								Division 10 Subtotal	$ 900		
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	1.1	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 185	$ -	4x 6 AWG from load center to EV Charger (2 per plug) 28' L x 4
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.3	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 35	$ -	1x 8 AWG from load center to EV Charger (1 ground) 28' L x 1
	1" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	28	LF	$ 2.11	$ 3.50	$ -	$ 7.55	Total with O&P	$ 211	$ -	Underground section of conduit from load center to the charger
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1" diameter	5	LF	$ 3.95	$ 6.75	$ -	$ 14.45	Total with O&P	$ 72	$ -	Above ground section of conduit from load center to the charger (5' is my estimate)
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -	Pull box to be located where conduit comes out from ground at the load center
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -	2 circuits
								Division 26 Subtotal	$ 938		
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	25	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 32	$ -	Trench length estimated to be 25'
	Aggregate base for trench backfill	2.3	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 33	$ 2.72	Trench depth is 20" (bottom 4 inches are sand, but assumed same cost as AB)
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -	For detailed shoveling while trenching
								Division 31 Subtotal	$ 181		
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3	STALL	--	--	--	$ 120.75	Total with O&P	$ 362	$ -	2 EV spaces + access aisle
	Pavement Parking Marking, painted letter, 6"	35	EA	--	--	--	$ 11.50	Total with O&P	$ 403	$ -	EV PARKING ONLY: 13 letters x 2 stalls = 26; NO PARKING: 9 letters; Total: 35 letters
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	3	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 2,649	$ 200.66	2 bollards to prevent cars from rolling (since curb is removed) and 1 bollard to protect charger
	Mechanical turf seeding, hand push spreader, 4.5 lb per 1000 SF (MSF)	0.03	MSF	$ 20.47	$ 1.79	$ -	--	Unit costs	$ 1	$ 0.15	20' of trenching in the landscaping x 1.5' wide trench
								Divison 32 Subtotal	$ 3,414		
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25	
								Equipment Subtotal	$ 7,300		

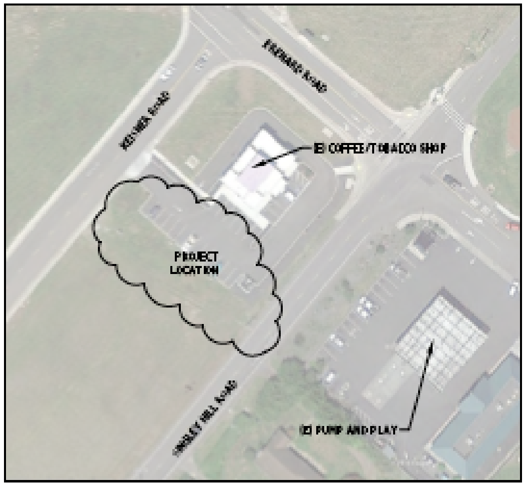
Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups

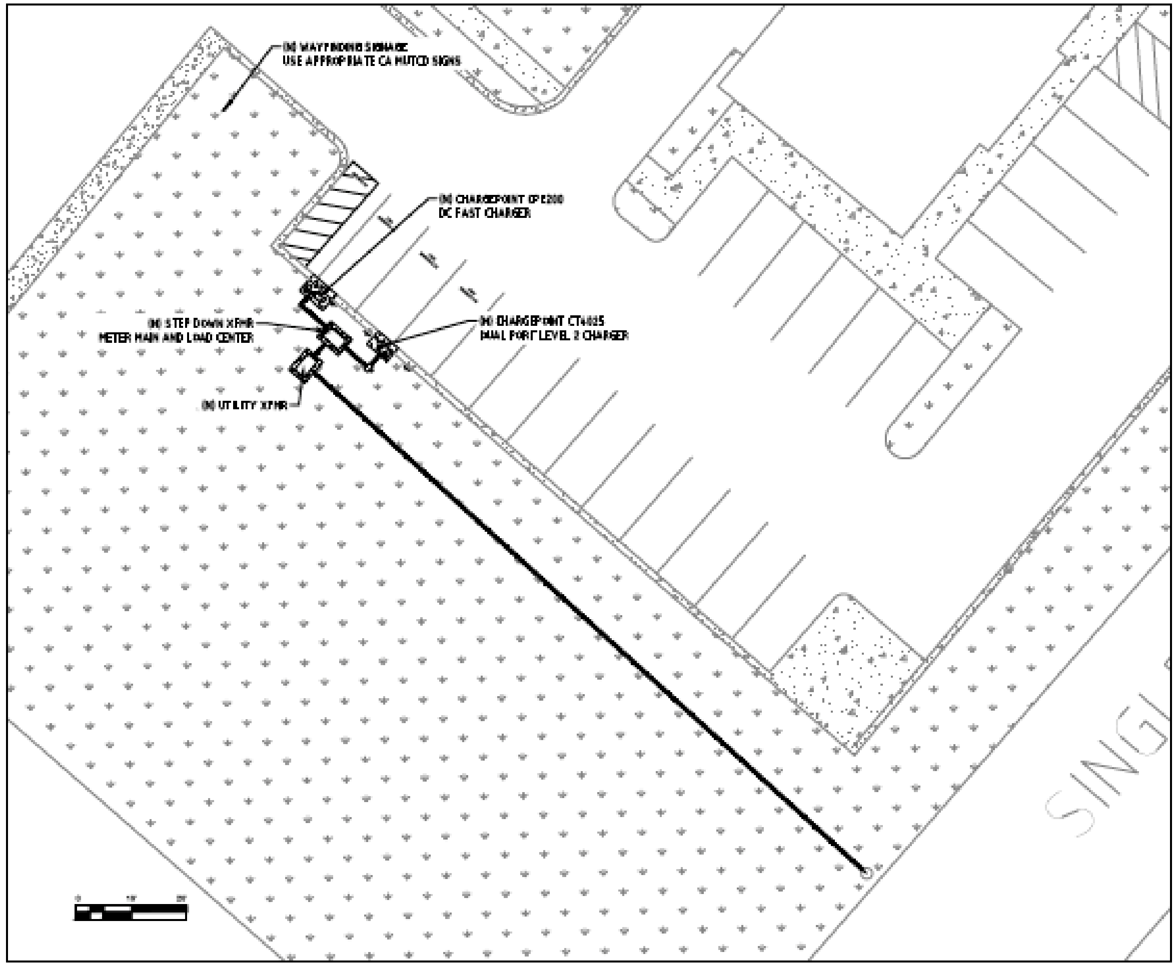
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 13,519
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 1,082
Sales Tax	8.25%	$ 870
Subtotal		$ 15,471
Contingency	25%	$ 3,868
Subtotal		$ 19,339
Bonds ($/1000 per RS Means)	$12.00	$ 232
Subtotal		$ 19,571
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 1,644
Construction and Equipment Total		$ 21,215
Construction Administration	7%	$ 1,485
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 4,243
Grand Total		$ 26,943

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)





PROJECT DESIGN

- RECOMMEND CONTRACTOR UPDATE CURRENT DESIGN TO MEET SPIRIT OF CHAPTER 11B ACCESSIBILITY REQUIREMENTS.
- (N) 480VAC 3ϕ UTILITY XFMR, (N) LOAD CENTER WITH 400A PANEL AND 480V-TO-208/120V STEP DOWN XFMR,
- ONE (N) CHARGEPOINT CPE200 50KW DC FAST CHARGER AND ONE (N) CHARGEPOINT CT4025 DUAL PLUG 7.2KW EV CHARGER, OR EQUIVALENT.
- FOUR (E) PARKING STALLS CONVERTED TO THREE (N) 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS TO BE UPDATED BY CONTRACTOR PENDING FINAL DESIGN,
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK, BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS AND SYMBOLS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER
ϕ	ELECTRICAL PHASE		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
2		REVISION
1		10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

BEAR RIVER CASINO
11 BEAR PAWS WAY, LOLETA
VICINITY

PHASE 1
SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

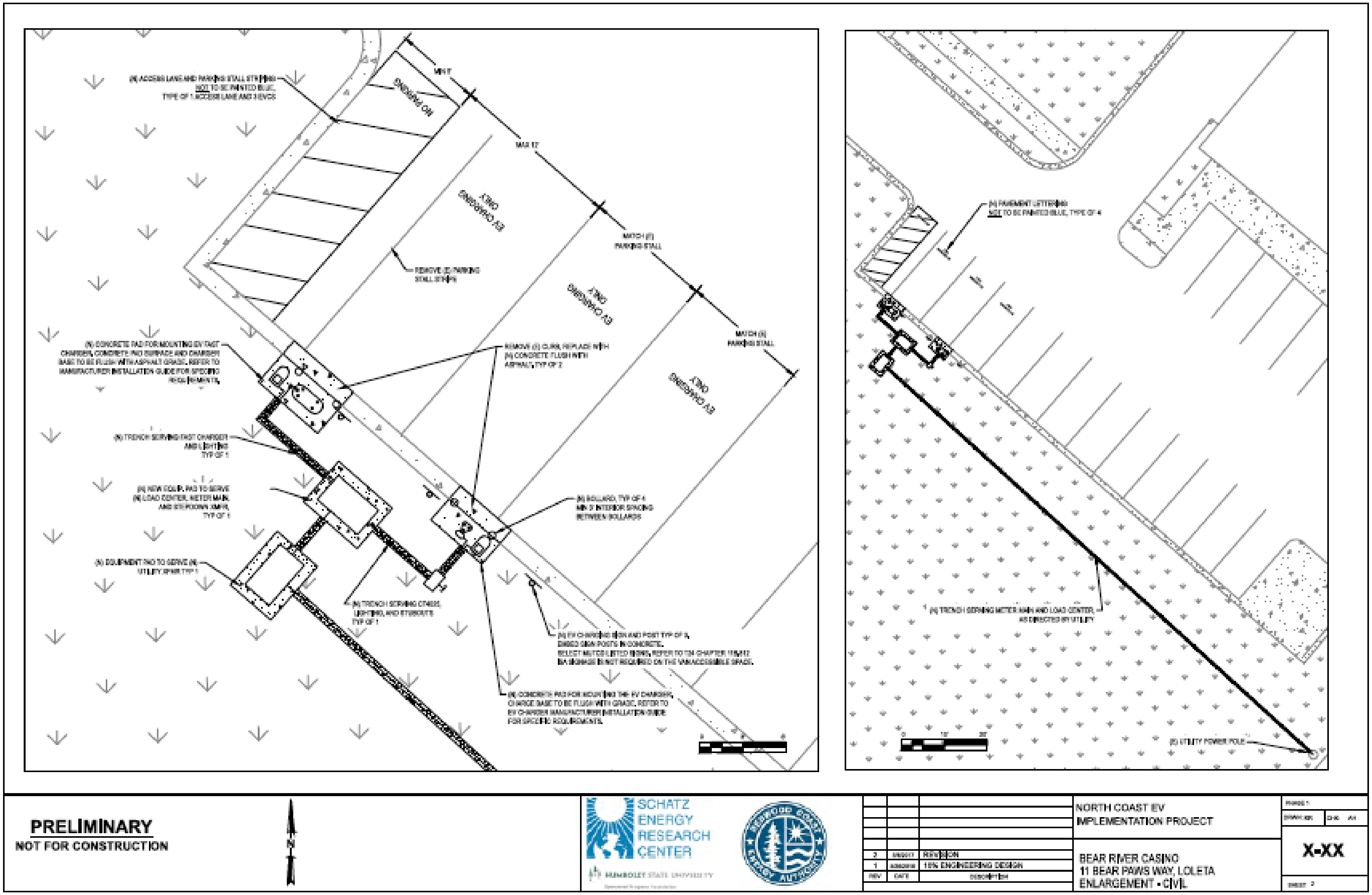


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

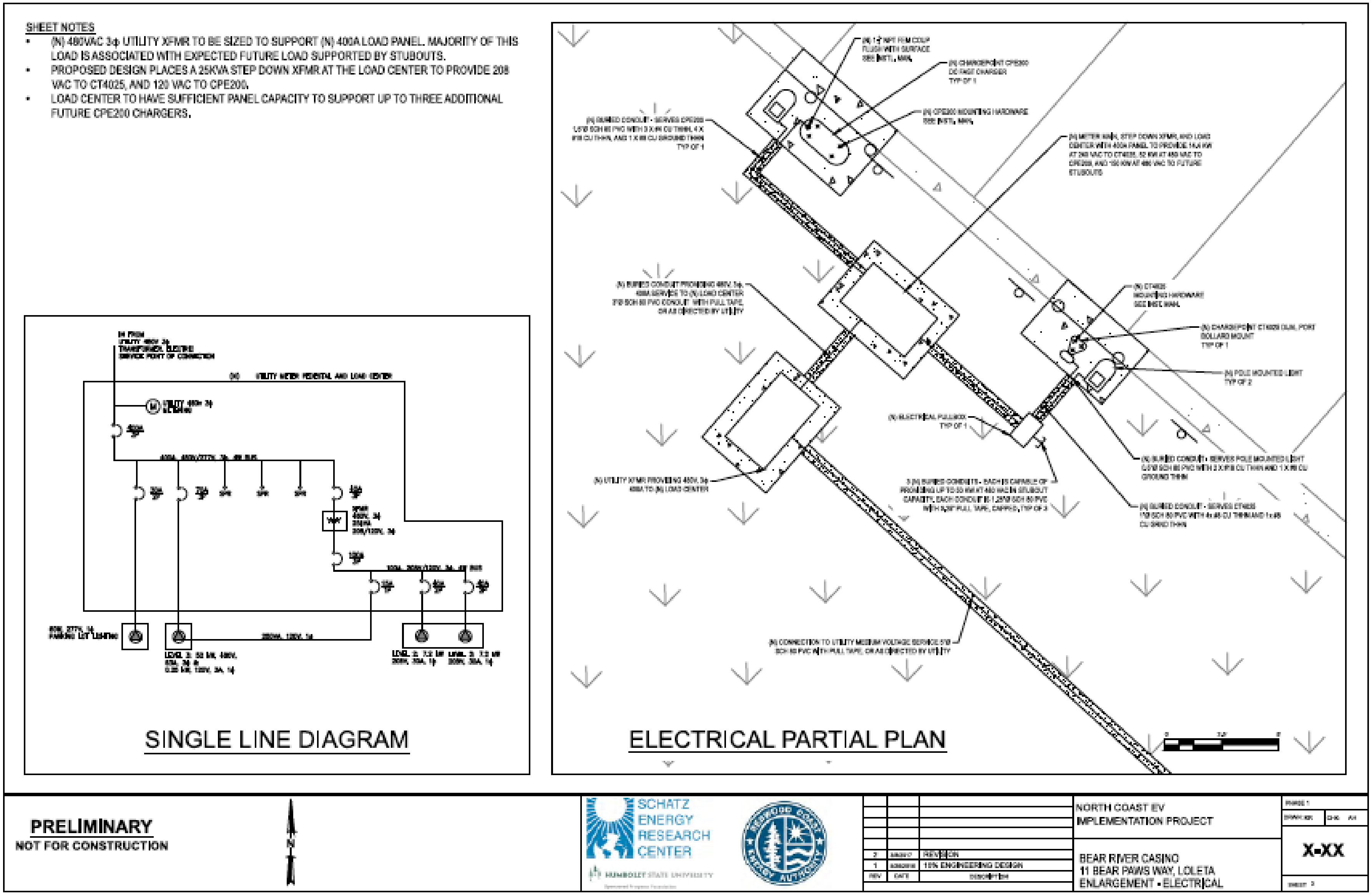


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Bear River Casino
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Three EV spaces, two served by one dual head level 2 charger, and one served by one level 3 charger.
New utility transformer, new meter and load center, stubout expansion for 150kw of future level 3 chargers
Design of code-compliant EV spaces, uses existing access aisle for van accessible EV space
Installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, pavement removal, bitumous roads, 3" thick	1.2	SY	$ -	$ 2.48	$ 1.85	$ 5.80	Total with O&P	$ 7	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	1.3	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 50	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	12.1	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 13	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	1.9	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 155	$ -
								Divison 2 Subtotal	$ 224	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 4' x 4' x 6" thick	3	EA	$ 69.50	$ 74.00	$ 1.04	$ 191.00	Total with O&P	$ 573	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	146.5	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 3,589	$ -
								Divison 3 Subtotal	$ 4,162	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	3	SET	$ 8.05	$ 21.33	$ -	–	Unit costs	$ 88	$ 1.99
								Division 5 Subtotal	$ 88	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	9	EA	$ 89.70	$ 13.51	$ -	–	Unit costs	$ 929	$ 66.60
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.84	–	Unit costs	$ 236	$ 15.94
								Division 10 Subtotal	$ 1,165	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #4	11.5	CLF	$ 87.50	$ 82.50	$ -	$ 220.00	Total with O&P	$ 2,522	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	4.1	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 506	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #14	0.6	CLF	$ 11.05	$ 33.50	$ -	$ 62.50	Total with O&P	$ 35	$ -
	5" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	33	LF	$ 12.45	$ 12.50	$ -	$ 32.50	Total with O&P	$ 1,056	$ -
	1 1/4" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC.	110	LF	$ 2.63	$ 3.98	$ -	$ 8.85	Total with O&P	$ 974	$ -
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -
	Meter and load center, 3P, 4W, 480/277V, 400A with 25kVA XFMR to 120/208 (local estimate)	1	EA	$ 25,000.00	$ -	$ -	$ 25,000.00	Total with O&P	$ 25,000	$ -
	Smart metering, in panel, three phase, 277/480V, 400A	1	EA	$ 775.00	$ 93.50	$ -	$ 990.00	Total with O&P	$ 990	$ -
	Enclosed (NEMA 1) circuit breaker, 600V, 3P, 400A	1	EA	$ 2,775.00	$ 545.00	$ -	$ 3,900.00	Total with O&P	$ 3,900	$ -
	Panelboard and load center circuit breakers, 277 volt, 1 pole, 15 - 30A	1	EA	$ 44.00	$ 54.50	$ -	$ 131.00	Total with O&P	$ 131	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 70 - 225 amp	1	EA	$ 780.00	$ 190.00	$ -	$ 1,150.00	Total with O&P	$ 1,150	$ -
	Panelboard and load center circuit breakers, 208Y - 240VAC, 3 pole, 100A (local estimate)	1	EA	$ 370.24	$ 122.00	$ -	$ 569.24	Total with O&P	$ 569	$ -
	Panelboard and load center circuit breakers, 120 volt, 1 pole, 15-50 amp	1	EA	$ 16.50	$ 44.00	$ -	$ 84.00	Total with O&P	$ 84	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 40 amp (local estimate)	1	EA	$ 644.54	$ 190.00	$ -	$ 1,014.54	Total with O&P	$ 1,015	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -
								Division 26 Subtotal	$ 38,366	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	180	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 230	$ -
	Aggregate base for trench backfill	4.9	CY	$ 14.25	$ -	$ -	–	Unit costs	$ 70	$ 5.78
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	2.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 232	$ -
								Division 31 Subtotal	$ 533	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	5.5	SY	$ 15.87	$ 29.33	$ 2.45	–	Unit costs	$ 264	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	4	STALL	–	–	–	$ 120.75	Total with O&P	$ 483	$ -
	Pavement Parking Marking, painted letter, 6"	51	EA	–	–	–	$ 11.50	Total with O&P	$ 587	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	4	EA	$ 810.75	$ 52.90	$ 19.21	–	Unit costs	$ 3,531	$ 267.55
								Divison 32 Subtotal	$ 4,865	
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	–	Unit costs	$ 7,300	$ 602.25
	Level 3 Smart Charger	1	EA	$ 35,000.00	$ -	$ -	–	Unit costs	$ 35,000	$ 2,887.50
								Equipment Subtotal	$ 42,300	
Utility Cost	PG&E: New UG XFMR - Intercept (E) duct and re-pull primary cable. Includes XFMR, cable, labor, estimating, service planning, mapping.	1	EA	$ -	$ -	$ -	$ 51,443.00	Total with O&P	$ 51,443	$ -
								Utility Subtotal	$ 51,443	

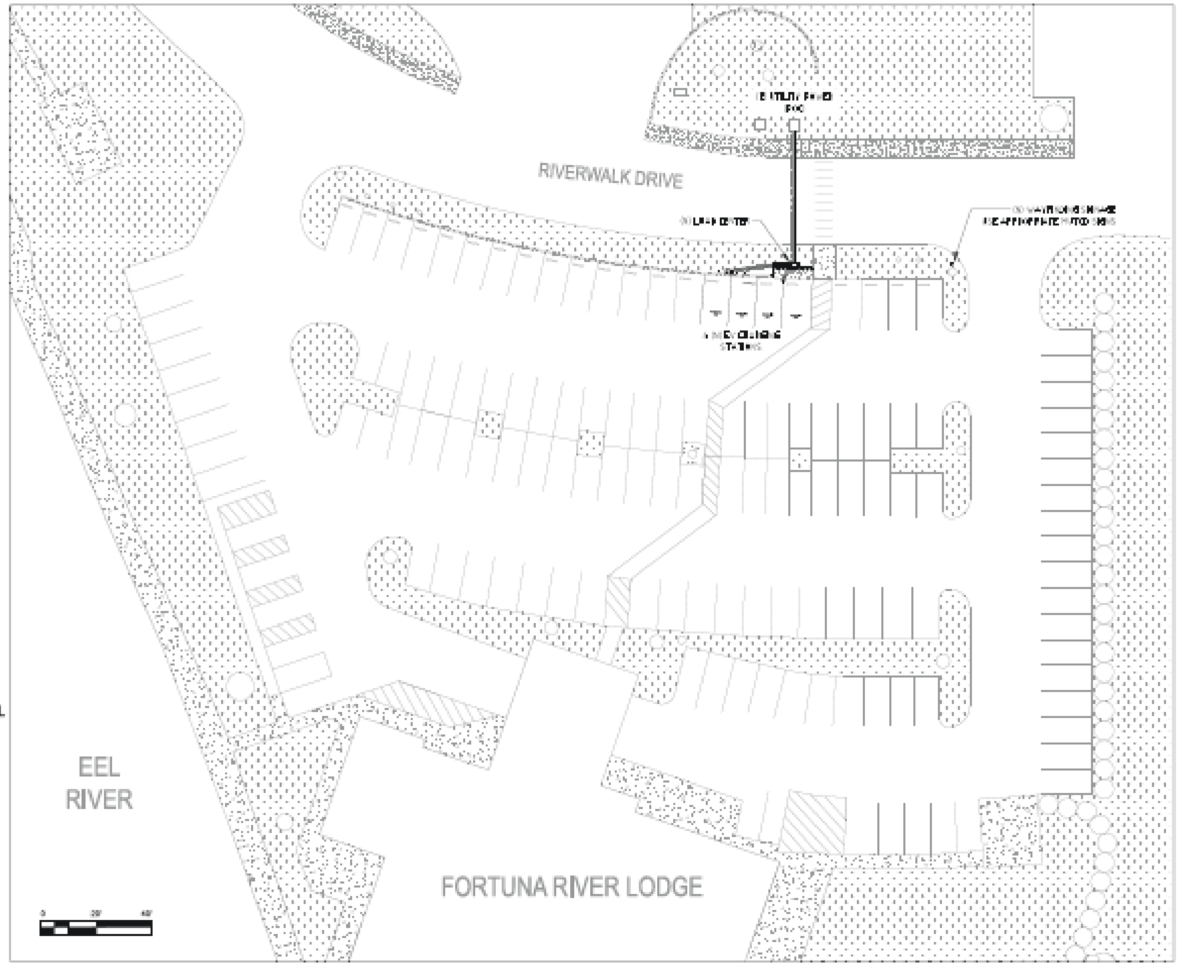
Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
- CLF Hundred linear feet
- MSF Thousand square feet
- LF Linear foot
- EA Each
- SY Square yard
- STALL Parking stall
- BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 143,147
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 11,452
Sales Tax	8.25%	$ 3,848
Subtotal		$ 158,446
Contingency	25%	$ 39,611
Subtotal		$ 198,057
Bonds ($/1000 per RS Means)	$12.00	$ 2,377
Subtotal		$ 200,434
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 16,836
Construction and Equipment Total		$ 217,271

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- UTILITY TO PROVIDE (N) 208 / 240 VAC, 400A, SINGLE PHASE ELECTRIC SERVICE TO (N) METER MAIN AND LOAD CENTER
- (N) LOAD CENTER TO PROVIDE FOUR 208 / 240 VAC, 1φ CIRCUITS TO EVCS, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- TWO (N) DUAL PLUG EV CHARGERS, MAKE AND MODEL TO BE DETERMINED
- STANDARD CHARGING SPACES DESIGNED TO MEET 2016 CODE COMPLIANT EV SPACES, VAN ACCESSIBLE SPACE USES (E) 10'W STALL AND (E) 8' W ACCESS AISLE, CONSULT WITH AHJ TO ENSURE COMBINED WIDTH IS ACCEPTABLE.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK, BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- 2016 BUILDING CODE SPECIFIES THAT AN EVCS IS NOT A PARKING SPACE. CONSULT WITH AHJ FOR AN EXCEPTION. SIGNAGE AND PAVEMENT LETTERING WILL NEED TO BE MODIFIED TO ADDRESS THE PARKING POLICY.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

NORTH COAST EV IMPLEMENTATION PROJECT

FORTUNA RIVER LODGE
1800 RIVERWALK DR, FORTUNA, CA
PLAN VIEW - VICINITY

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

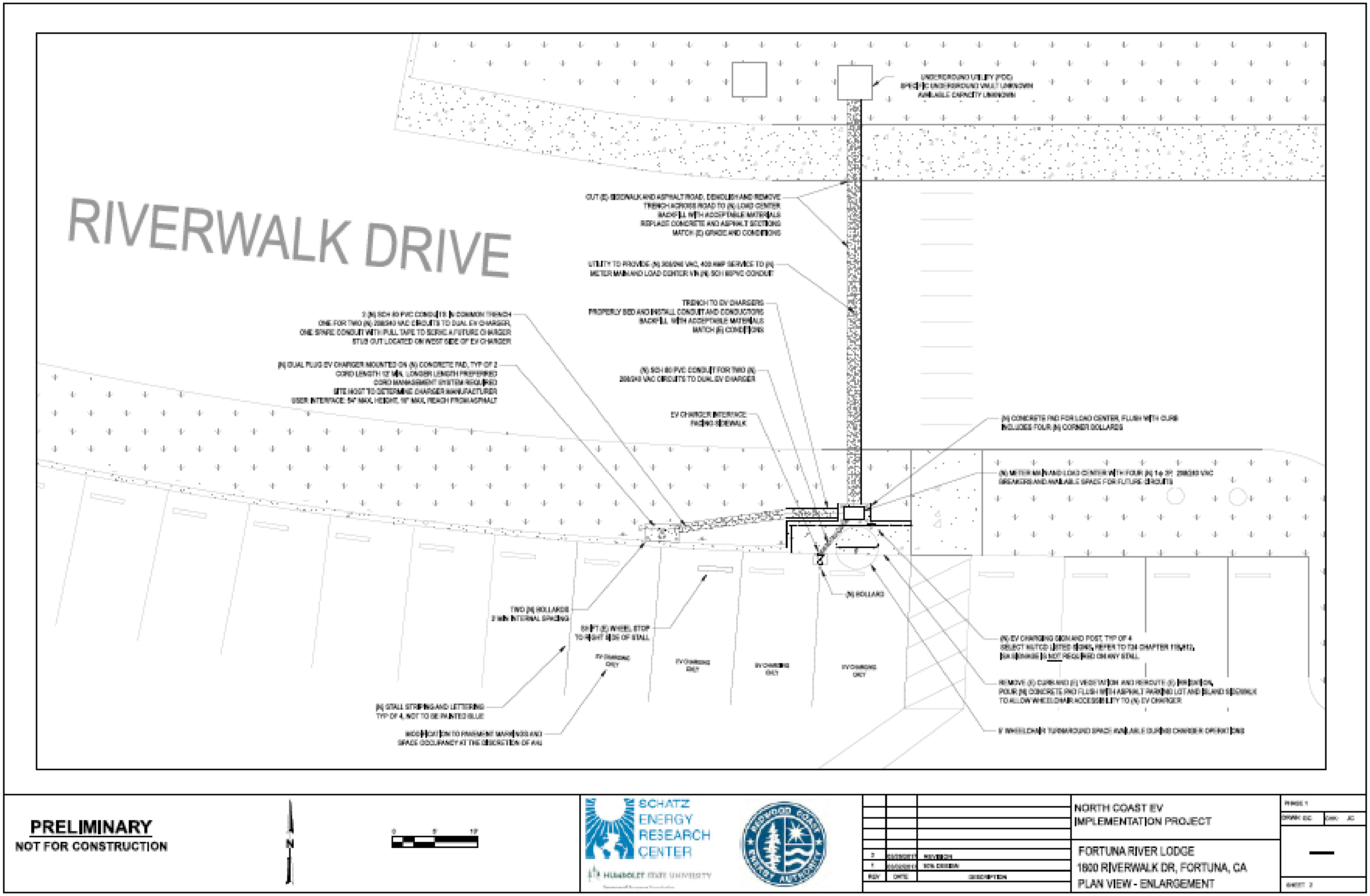


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Fortuna River Lodge
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Four EV spaces served by two dual head "smart" EV chargers (substitute basic dual chargers to reduce costs)
Trenching from POC on north side of road to new meter and load center that supports four new circuits
Design of code-compliant EV spaces, uses existing access aisle for van accessible EV space
Installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	7.9	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 124	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	4.0	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 152	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	4.0	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 40	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	5.9	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 475	$ -
								Divison 2 Subtotal	$ 792	
3: Concrete	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	94	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 2,303	$ -
	Concrete forming, structural cast-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, ob grade, to 6" high	72	LF	$ 0.35	$ 2.38	$ -	$ 4.04	Total with O&P	$ 291	$ -
	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	1.7	CY	$ 102.00	$ -	$ -	$ 112.00	Total with O&P	$ 190	$ -
	Placing concrete, labor and equipmt to place, level and consolidate, Footing, continuous, shallow, direct chute (≥ 1 CY and ≤ 5 CY)	1.7	CY	$ -	$ 34.00	$ 1.13	$ 53.50	Total with O&P	$ 91	$ -
								Divison 3 Subtotal	$ 2,875	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	2	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 59	$ 1.33
								Division 5 Subtotal	$ 59	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	10	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 1,032	$ 74.00
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	5	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 295	$ 19.92
								Division 10 Subtotal	$ 1,328	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	2.3	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 371	$ -
	3" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	56	LF	$ 6.30	$ 7.95	$ -	$ 18.80	Total with O&P	$ 1,053	$ -
	1 1/2" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	76	LF	$ 2.99	$ 4.38	$ -	$ 9.85	Total with O&P	$ 749	$ -
	Meter center and sockets, meter center, main fusible switch, rainproof, 1P, 3W, 120/240 Volt, 400 amp	1	EA	$ 3,000.00	$ 545.00	$ -	$ 3,545.00	Unit costs	$ 3,545	$ 247.50
	Smart metering, in panel, single phase, 120/208V, 200A	1	EA	$ 375.00	$ 50.00	$ -	$ 485.00	Total with O&P	$ 485	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	4	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 488	$ -
								Division 26 Subtotal	$ 6,691	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	68	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 87	$ -
	Aggregate base for trench backfill	3.6	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 51	$ 4.23
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	5.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 580	$ -
								Division 31 Subtotal	$ 718	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	5.3	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ 254	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	4	STALL	--	--	--	$ 120.75	Total with O&P	$ 483	$ -
	Pavement Parking Marking, painted letter, 6"	61	EA	--	--	--	$ 11.50	Total with O&P	$ 702	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	6	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 5,297	$ 401.32
								Divison 32 Subtotal	$ 6,736	
EV Charger	Dual, Level 2 Smart Charger	2	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 14,600	$ 1,204.50
								Equipment Subtotal	$ 14,600	
Utility	PG&E: Electric Service Connection - engineering, tie-in, distribution line installation	1	EA	$ -	$ -	$ -	$ 2,000.00	Total with O&P	$ 2,000	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, aluminum type XLPE, stranded 4/0	1.35	CLF	$ 206.00	$ 141.00	$ -	$ 440.00	Total with O&P	$ 594	$ -
								Utility Subtotal	$ 2,594	

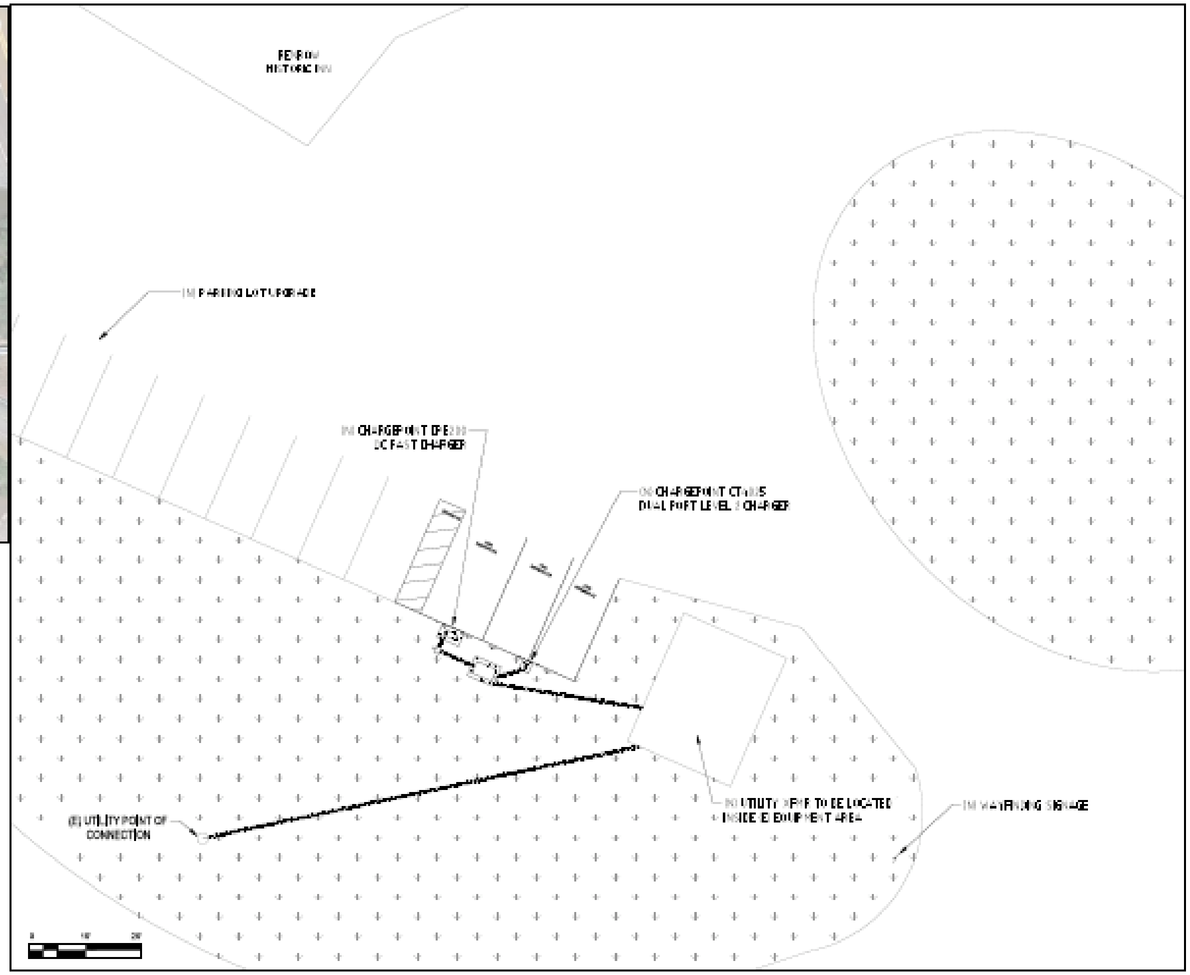
Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 36,392
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 2,911
Sales Tax	8.25%	$ 1,953
Subtotal		$ 41,256
Contingency	25%	$ 10,314
Subtotal		$ 51,570
Bonds ($/1000 per RS Means)	$12.00	$ 619
Subtotal		$ 52,189
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 4,384
Construction and Equipment Total		$ 56,573

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN
- RECOMMEND CONTRACTOR UPDATE CURRENT DESIGN TO MEET SPIRIT OF CHAPTER 11B ACCESSIBILITY REQUIREMENTS.
- (N) 480VAC 3ϕ UTILITY XFMR, (N) LOAD CENTER WITH 400A PANEL AND 480V-TO-208/120V STEP DOWN XFMR.
- ONE (N) CHARGEPOINT CPE200 50KW DC FAST CHARGER AND ONE (N) CHARGEPOINT CT4000 DUAL PLUG 7.2KW EV CHARGER OR EQUIVALENT.
- FOUR (E) PARKING STALLS CONVERTED TO THREE (N) 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE.

GENERAL NOTES
- CONDUCTOR AND CONDUIT SPECIFICATIONS TO BE UPDATED BY CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS AND SYMBOLS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER
ϕ	ELECTRICAL PHASE		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
3	[illegible]	REVISION
2	[illegible]	REVISION
1	[illegible]	10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

BENBOW HISTORIC INN
445 LAKE BENBOW DR
GARBERVILLE, CA
VICINITY

SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

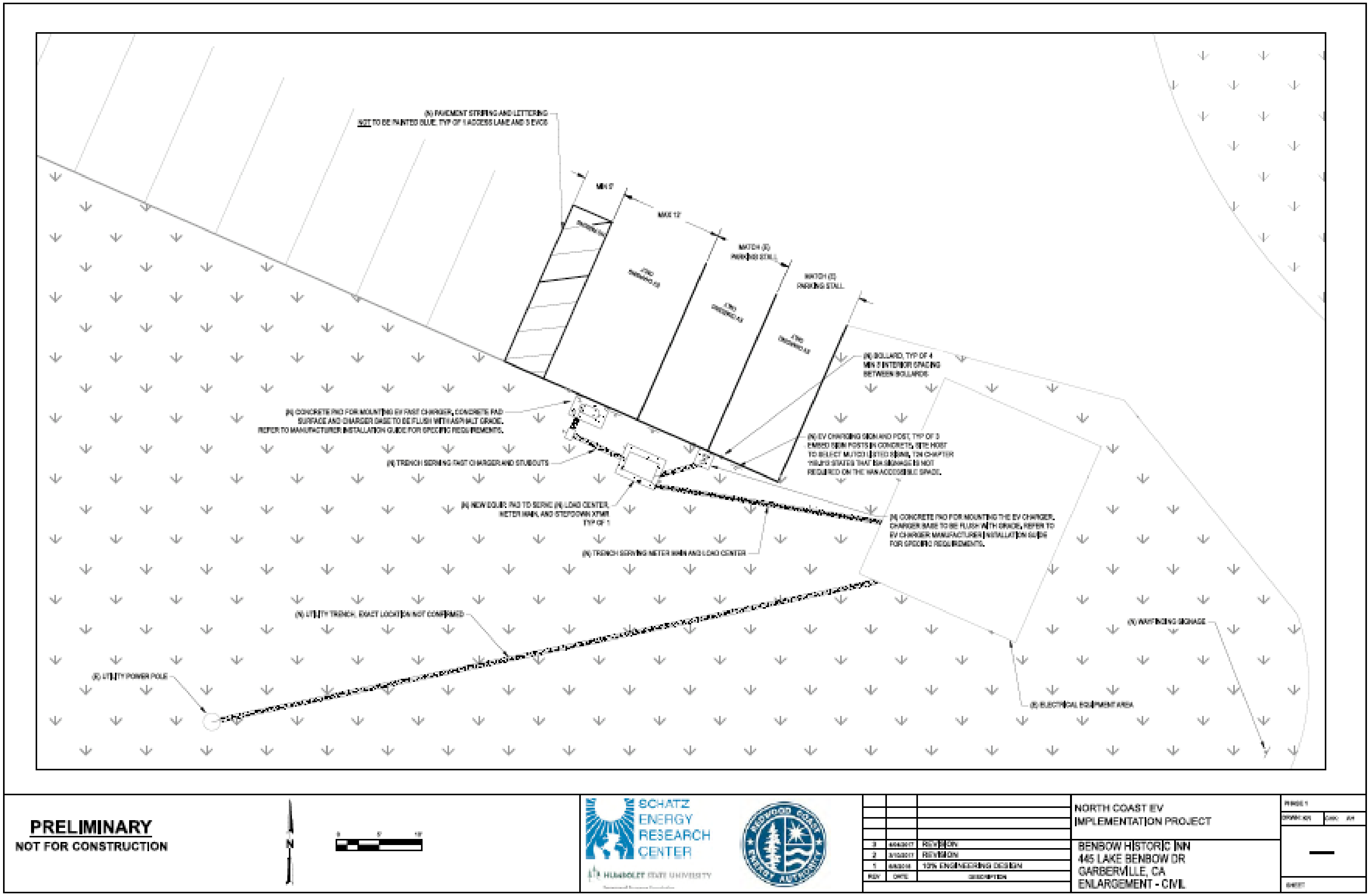


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

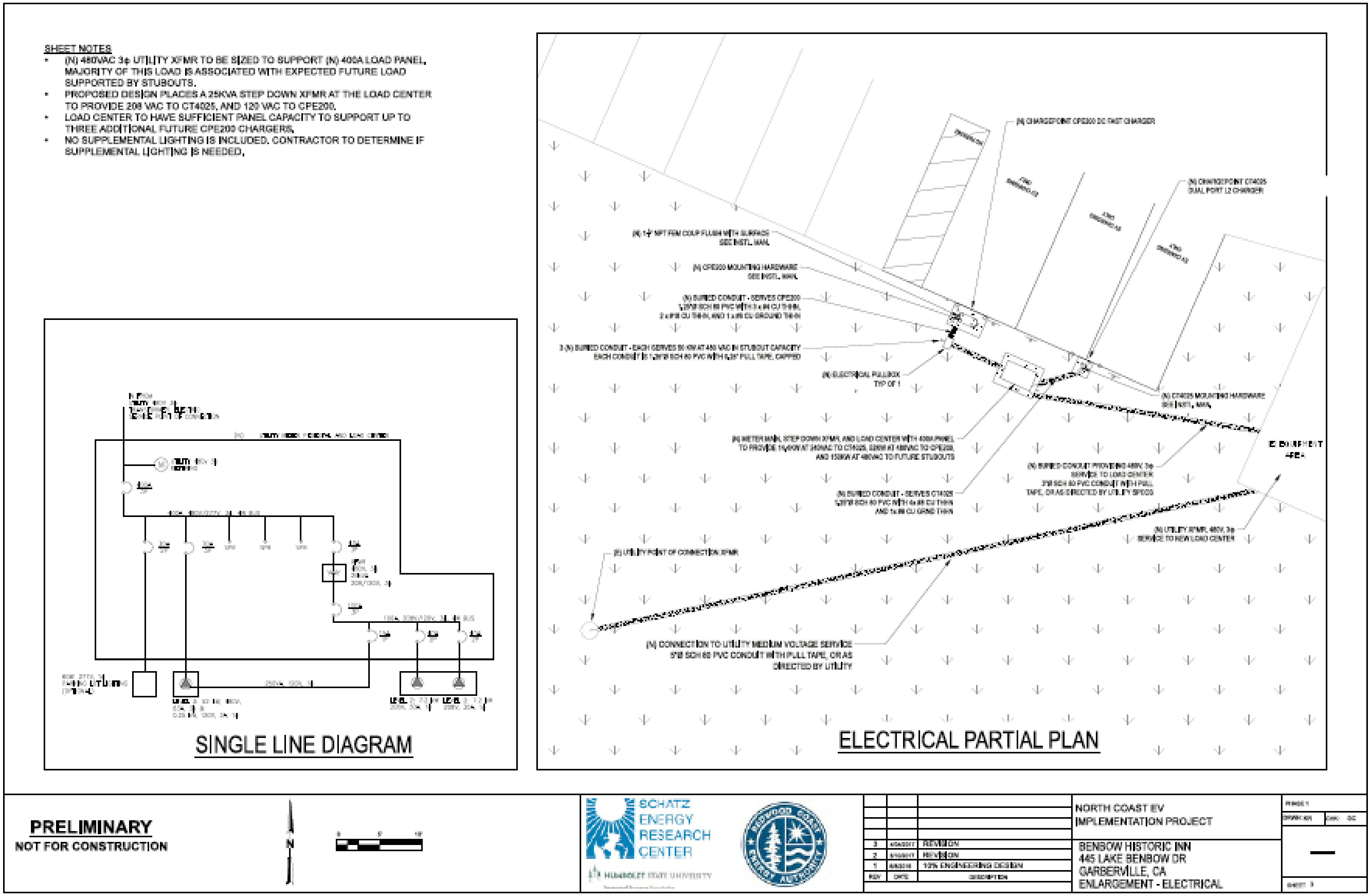


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Garberville Benbow Inn
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Two EV spaces for dual head level 2 charger, and one EV space for level 3 charger
New utility transformer, new meter and load center, stubout expansion for 150kw of future level 3 chargers
Design of code-compliant EV spaces
Installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	0.0	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ -	$ -
	Selective demolition, load, haul, dump and return, 0 - 50 haul, hand carried	0.6	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 24	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	12.5	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 13	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	0.9	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 75	$ -
								Division 2 Subtotal	$ 113	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 4' x 4' x 6" thick	3	EA	$ 69.50	$ 74.00	$ 1.08	$ 191.00	Total with O&P	$ 573	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	20	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 490	$ -
								Division 3 Subtotal	$ 1,063	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	3	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 88	$ 1.99
								Division 5 Subtotal	$ 88	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	9	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 929	$ 66.60
	Traffic signs, steel post, galvanized, 10'0", upright, bolted.	4	EA	$ 48.30	$ 6.96	$ 3.98	--	Unit costs	$ 236	$ 15.94
								Division 10 Subtotal	$ 1,165	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #4	0.5	CLF	$ 87.50	$ 82.50	$ -	$ 220.00	Total with O&P	$ 110	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.6	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 68	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.5	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 62	$ -
	5" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	100	LF	$ 12.65	$ 12.50	$ -	$ 32.50	Total with O&P	$ 3,250	$ -
	3" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	50	LF	$ 6.30	$ 7.95	$ -	$ 18.80	Total with O&P	$ 940	$ -
	1 1/4" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	1	LF	$ 2.63	$ 3.98	$ -	$ 8.85	Total with O&P	$ 9	$ -
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -
	Meter and load center, 3P, 4W, 480/277V, 400A with 25kVA XFMR to 120/208 (local estimate)	1	EA	$ 25,000.00	$ -	$ -	$ 25,000.00	Total with O&P	$ 25,000	$ -
	Smart metering, in panel, three phase, 277/480V, 400A	1	EA	$ 775.00	$ 93.50	$ -	$ 990.00	Total with O&P	$ 990	$ -
	Enclosed (NEMA 1) circuit breaker, 600V, 3P, 400A	1	EA	$ 2,775.00	$ 545.00	$ -	$ 3,900.00	Total with O&P	$ 3,900	$ -
	Panelboard and load center circuit breakers, 277 volt, 1 pole, 15 - 30A	1	EA	$ 44.00	$ 54.50	$ -	$ 131.00	Total with O&P	$ 131	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 70 - 225 amp	1	EA	$ 780.00	$ 190.00	$ -	$ 1,150.00	Total with O&P	$ 1,150	$ -
	Panelboard and load center circuit breakers, 208Y - 240VAC, 3 pole, 100A (local estimate)	1	EA	$ 370.24	$ 122.00	$ -	$ 569.24	Total with O&P	$ 569	$ -
	Panelboard and load center circuit breakers, 120 volt, 1 pole, 15-50 amp	1	EA	$ 16.50	$ 44.00	$ -	$ 84.00	Total with O&P	$ 84	$ -
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 40 amp (local estimate)	1	EA	$ 694.54	$ 190.00	$ -	$ 1,014.54	Total with O&P	$ 1,015	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -
								Division 26 Subtotal	$ 37,713	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	119	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 152	$ -
	Aggregate base for trench backfill	3.3	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 47	$ 3.88
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	2.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 232	$ -
								Division 31 Subtotal	$ 431	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	0.0	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ -	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	4	STALL	--	--	-	$ 120.75	Total with O&P	$ 483	$ -
	Pavement Parking Marking, painted letter, 6"	51	EA	--	--	-	$ 11.50	Total with O&P	$ 587	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x 4" D hole, 6" DIA	4	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 3,531	$ 267.55
								Division 32 Subtotal	$ 4,601	
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25
	Level 3 Smart Charger	1	EA	$ 35,000.00	$ -	$ -	--	Unit costs	$ 35,000	$ 2,887.50
								Equipment Subtotal	$ 42,300	
Utility Cost	PG&E: New UG XFMR - Intercept (E) duct and re-pull primary cable. Includes XFMR, cable, labor, estimating, service planning, mapping.	1	EA	$ -	$ -	$ -	$ 51,443.00	Total with O&P	$ 51,443	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded 4/0	1.5	CLF	$ 510.00	$ 199.00	$ -	$ 860.00	Total with O&P	$ 1,290	$ -
								Utility Subtotal	$ 52,733	

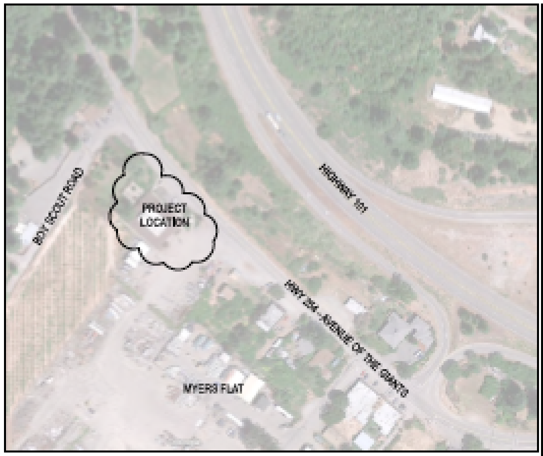
Source: RSMeans, 38th annual edition, 2015

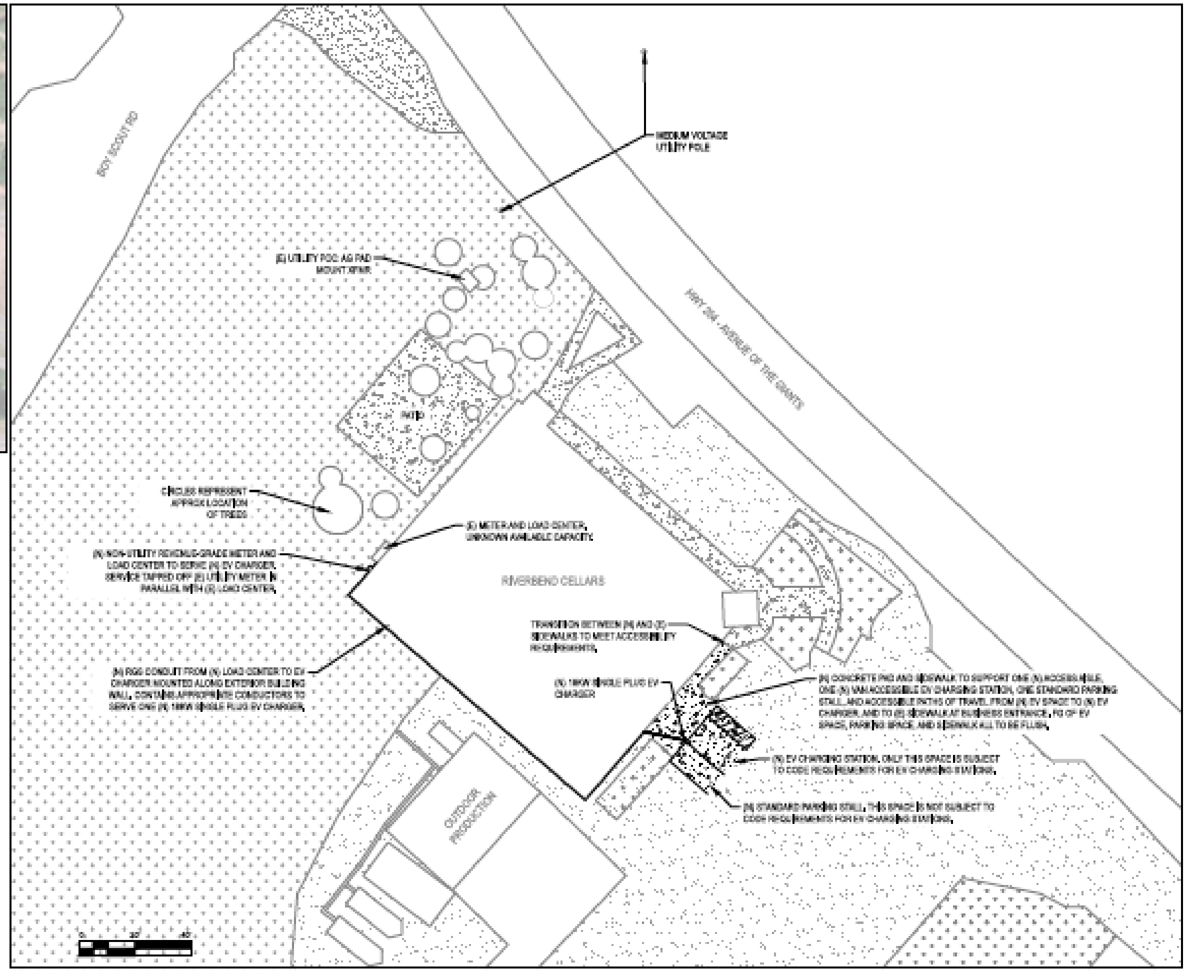
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications.

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 140,207
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 11,217
Sales Tax	8.25%	$ 3,846
Subtotal		$ 155,269
Contingency	25%	$ 38,817
Subtotal		$ 194,087
Bonds ($/1000 per RS Means)	$12.00	$ 2,329
Subtotal		$ 196,416
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 16,499
Construction and Equipment Total		$ 212,915

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)





PROJECT DESIGN

- (N) SITE LOAD CENTER TO PROVIDE ONE (N) 1φ 2P BREAKER AT 208 - 240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER,
- ONE (N) 18KW SINGLE PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED, AN 18KW AC CHARGER IS RECOMMEND FOR "FUTURE-PROOFING" THE SITE RATHER THAN PROVIDING A STUBOUT FOR FUTURE EV CHARGER INSTALLATIONS.
- ONE (N) 2016 CODE COMPLIANT EV SPACE WHICH IS ADA VAN ACCESSIBLE, AND ONE (N) STANDARD PARKING STALL.
- PLACEMENT OF EV CHARGER SUCH THAT IT CAN SERVE EITHER THE (N) EV SPACE OR THE (N) PARKING STALL, BECAUSE (N) EV CHARGER HAS A SINGLE PLUG, (N) PARKING STALL AVOIDS CODE REQUIREMENTS FOR EVCS.
- INSTALLATION OF (N) CONCRETE PAD AND SIDEWALK TO ENABLE UNOBSTRUCTED MOBILITY BETWEEN EV CHARGERS, VEHICLES, AND BUILDING ENTRANCE,

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN,
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK, BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
FG	FINISH GRADE	UG	UNDERGROUND
GALV	GALVANIZED	XFMR	TRANSFORMER
GRD	GROUND		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
1	2018/2017	10% DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

RIVERBEND CELLARS
12990 AVE OF THE GIANTS, MYERS FLAT
CIVIL AND ELECTRICAL: VICINITY

PHASE 1
DRAWN: JD CHK: DD
SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

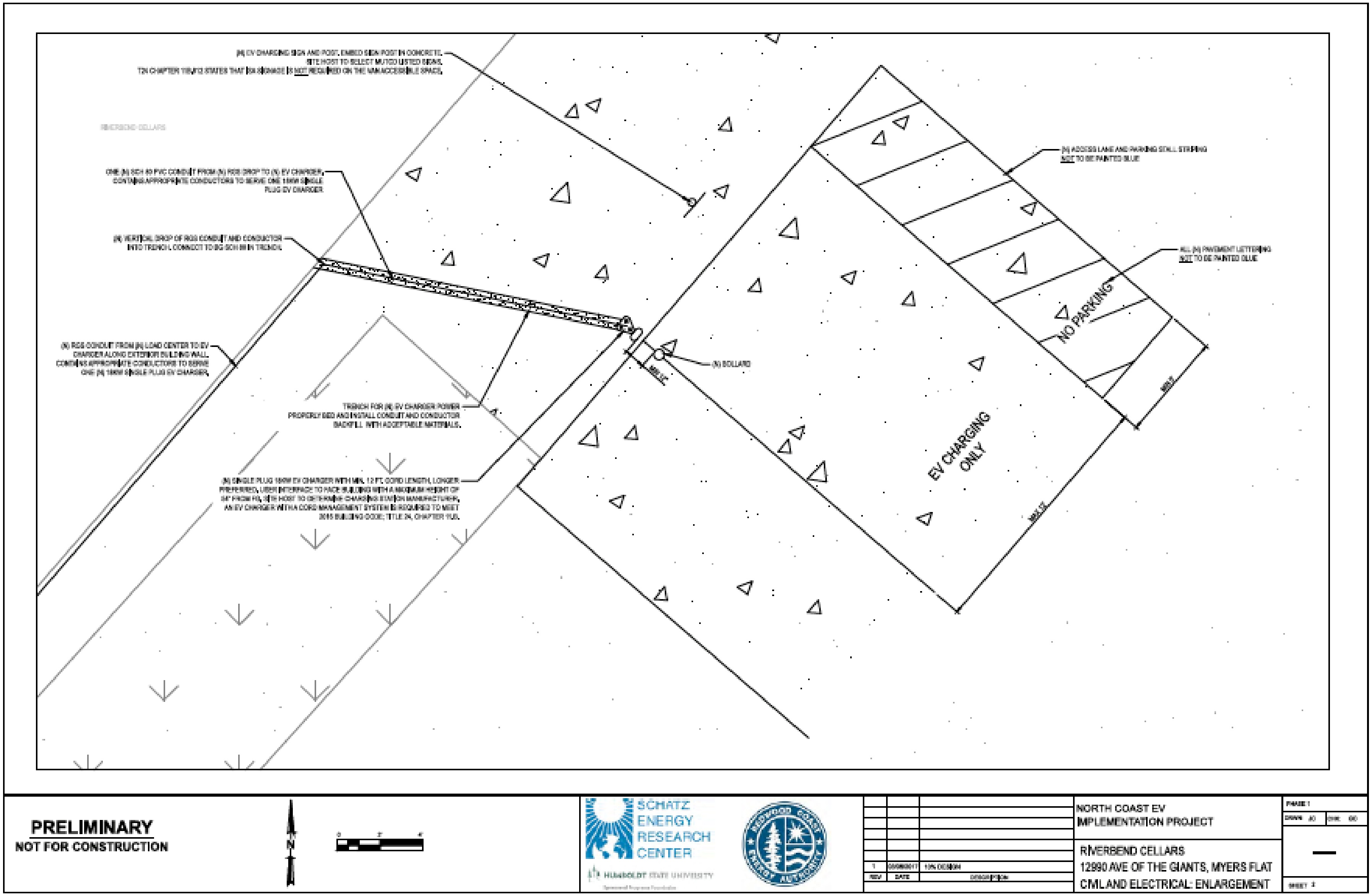


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Site: Myers Flat - Riverbend Cellars
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Two EV spaces served by one dual head "smart" EV chargers (substitute basic dual chargers to reduce costs)
Use of existing load center to keep cost down. Installation of new load center required for separate utility account and metering.
Installation of stubout conduit to enable future expansion.
Design of code-compliant EV spaces, and installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
3: Concrete	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	8.27	CY	$ 102.00	$ -	$ -	$ 112.00	Total with O&P	$ 926	$ -
	Placing concrete, labor and equipmt to place, level and consolidate, Footing, continuous, shallow, direct chute (> 5 CY)	8.27	CY	$ -	$ 15.65	$ 0.52	$ 24.50	Total with O&P	$ 203	$ -
	Concrete forming, structural cost-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, ob grade, to 6" high	190	LF	$ 0.35	$ 2.38	$ -	$ 4.04	Total with O&P	$ 768	$ -
								Divison 3 Subtotal	$ 1,896	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29	$ 0.66
								Division 5 Subtotal	$ 29	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	3	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 310	$ 22.20
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	1	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 59	$ 3.98
								Division 10 Subtotal	$ 369	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #1	4.7	CLF	$ 210.00	$ 109.00	$ -	$ 395.00	Total with O&P	$ 1,842	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #6	2.3	CLF	$ 63.50	$ 67.50	$ -	$ 171.00	Total with O&P	$ 398	$ -
	Meter center and sockets, single position, 4 terminal, 100 amp	1.0	EA	$ 43.00	$ 137.00	$ -	$ 253.00	Total with O&P	$ 253	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 80-100 amp	1.0	EA	$ 93.50	$ 87.50	$ -	$ 234.00	Total with O&P	$ 234	$ -
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1 1/4" diameter	216	LF	$ 5.15	$ 7.30	$ -	$ 16.60	Total with O&P	$ 3,586	$ -
	1 1/4" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	20	LF	$ 2.63	$ 3.98	$ -	$ 8.85	Total with O&P	$ 177	$ -
								Division 26 Subtotal	$ 6,490	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	20	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 26	$ -
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -
								Division 31 Subtotal	$ 142	
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3	STALL	--	--	--	$ 120.75	Total with O&P	$ 362	$ -
	Pavement Parking Marking, painted letter, 6"	22	EA	--	--	--	$ 11.50	Total with O&P	$ 253	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	1	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 883	$ 66.89
								Divison 32 Subtotal	$ 1,498	
EV Charger	Single, Level 2 Smart Charger	1	EA	$ 5,010.00	$ -	$ -	--	Unit costs	$ 5,010	$ 413.33
								Equipment Subtotal	$ 5,010	

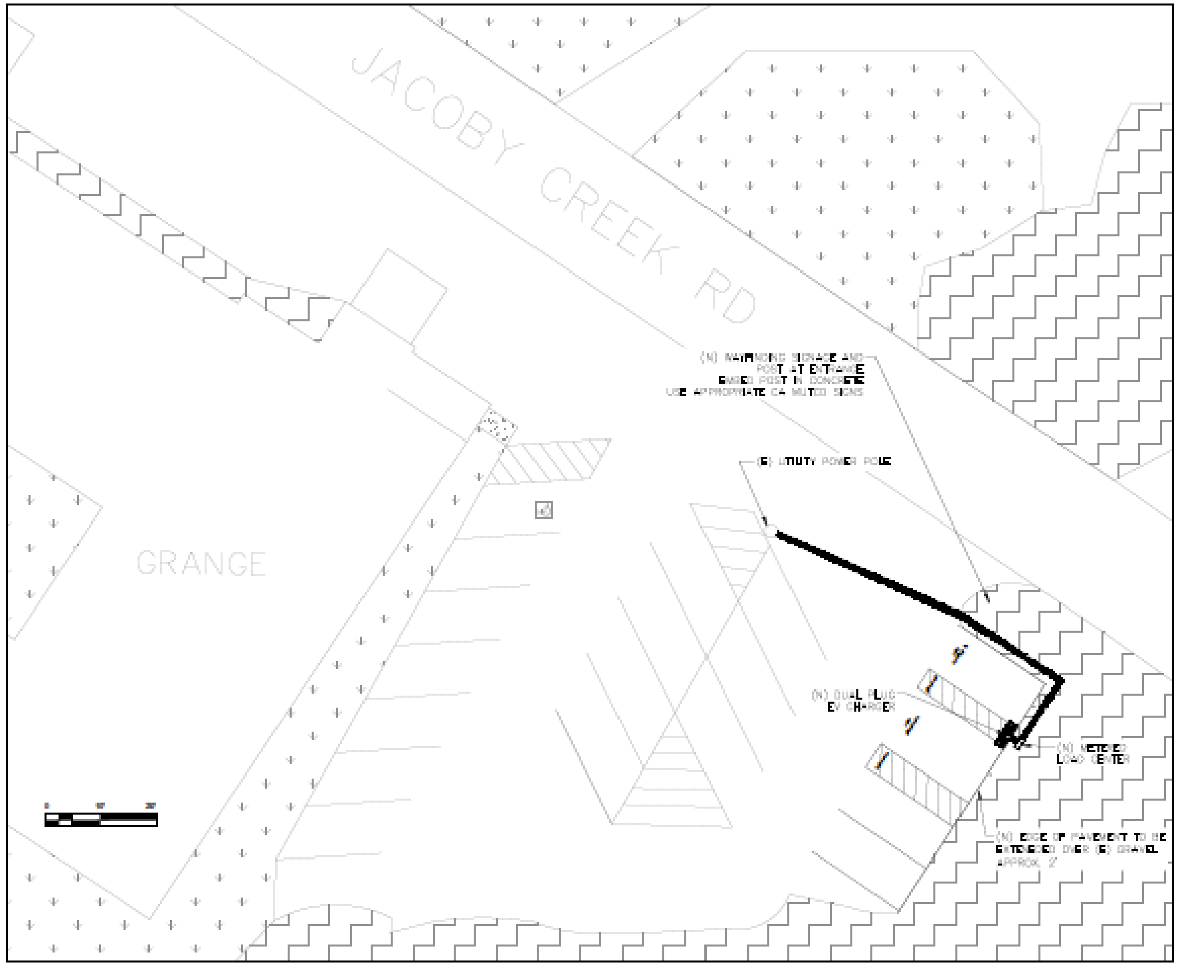
Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 15,435
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 1,235
Sales Tax	8.25%	$ 507
	Subtotal	$ 17,176
Contingency	25%	$ 4,294
	Subtotal	$ 21,471
Bonds ($/1000 per RS Means)	$12.00	$ 258
	Subtotal	$ 21,728
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 1,825
Construction and Equipment Total		$ 23,553
Construction Administration	7%	$ 1,649
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 4,711
Grand Total		$ 29,913

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- (N) SITE LOAD CENTER TO PROVIDE TWO (N) 1φ 2P BREAKERS AT 240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- ONE (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED.
- THREE PARKING STALLS CONVERTED TO TWO 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE WITH AN ACCESS AISLE AND ONE OF WHICH IS A STANDARD EV CHARGING SPACE.
- STALL PAVEMENT TO BE EXTENDED OVER EXISTING GRAVEL APPROX. 2' SO THAT PARKING STALLS CAN BE ORIENTED HORIZONTAL INSTEAD OF ANGLED.
- ONE STUBOUT FOR POTENTIAL FUTURE DUAL PLUG EV CHARGER.
- TWO ACCESS AISLES ARE REQUIRED TO MEET THE SPIRIT OF ACCESSIBILITY: ONE ON THE PASSENGER SIDE OF THE ADA VAN ACCESSIBLE STALL AND A SECOND AT THE LOCATION OF THE CHARGING STATION TO ENABLE UNOBSTRUCTED MOBILITY BETWEEN EV CHARGERS AND VEHICLES.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER

HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
1		10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

BAYSIDE GRANGE
2297 JACOBY CREEK RD, BAYSIDE, CA
VICINITY

SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

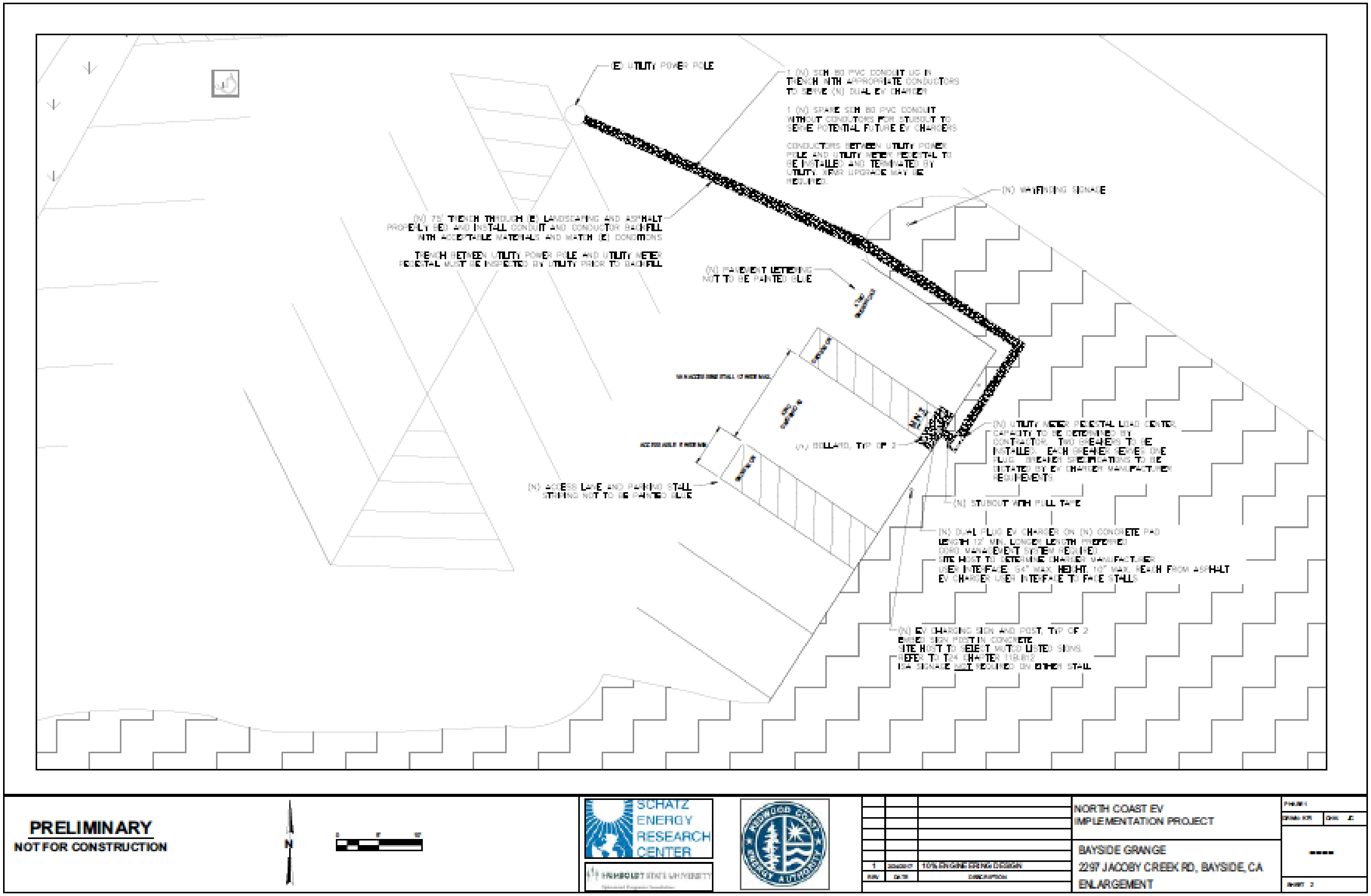


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Bayside Grange
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
New utility provided electrical service to new meter and load center
Two EV spaces served by new dual head "smart" EV charger (substitute basic dual charger to reduce cost)
Design of code-compliant EV spaces, and installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	6.3	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 99	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	3.2	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 121	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	50.4	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 40	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	4.7	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 379	$ -
								Divison 2 Subtotal	$ 639	
3: Concrete	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	78	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 1,911	$ -
	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	2.0	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 256	$ -
								Divison 3 Subtotal	$ 2,167	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29	$ 0.66
								Division 5 Subtotal	$ 29	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	4	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 413	$ 29.60
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	3	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 177	$ 11.95
								Division 10 Subtotal	$ 590	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.5	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 62	$ -
	3" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	71	LF	$ 6.30	$ 7.95	$ -	$ 18.80	Total with O&P	$ 1,335	$ -
	1 1/2" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	20	LF	$ 2.99	$ 4.38	$ -	$ 9.85	Total with O&P	$ 197	$ -
	Meter main load center and sockets, surface mount, rainproof, 1P, 3W, 120/240 Volt, 200 amp (local estimate)	1	EA	$ 1,500.00	$ 545.00	$ -	$ 2,045.00	Unit costs	$ 2,045	$ 123.75
	Smart metering, in panel, single phase, 120/208V, 200A	1	EA	$ 375.00	$ 50.00	$ -	$ 485.00	Total with O&P	$ 485	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -
								Division 26 Subtotal	$ 4,368	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	75	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 96	$ -
	Aggregate base for trench backfill	2.2	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 31	$ 2.59
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -
								Division 31 Subtotal	$ 243	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	12	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ 572	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	4	STALL	--	--	--	$ 120.75	Total with O&P	$ 483	$ -
	Pavement Parking Marking, painted letter, 6"	37	EA	--	--	--	$ 11.50	Total with O&P	$ 426	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	2	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 1,766	$ 133.77
								Divison 32 Subtotal	$ 3,246	
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25
								Equipment Subtotal	$ 7,300	
Utility	PG&E: Electric Service Connection - engineering, tie-in, distribution line installation	1	EA	$ -	$ -	$ -	$ 2,000.00	Total with O&P	$ 2,000	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, aluminum type XLPE, stranded 4/0	2.3	CLF	$ 206.00	$ 141.00	$ -	$ 440.00	Total with O&P	$ 990	$ -
								Utility Subtotal	$ 2,990	

Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 21,313
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 1,705
Sales Tax	8.25%	$ 905
	Subtotal	$ 23,922
Contingency	25%	$ 5,981
	Subtotal	$ 29,903
Bonds ($/1000 per RS Means)	$12.00	$ 359
	Subtotal	$ 30,261
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 2,542
Construction and Equipment Total		$ 32,803

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

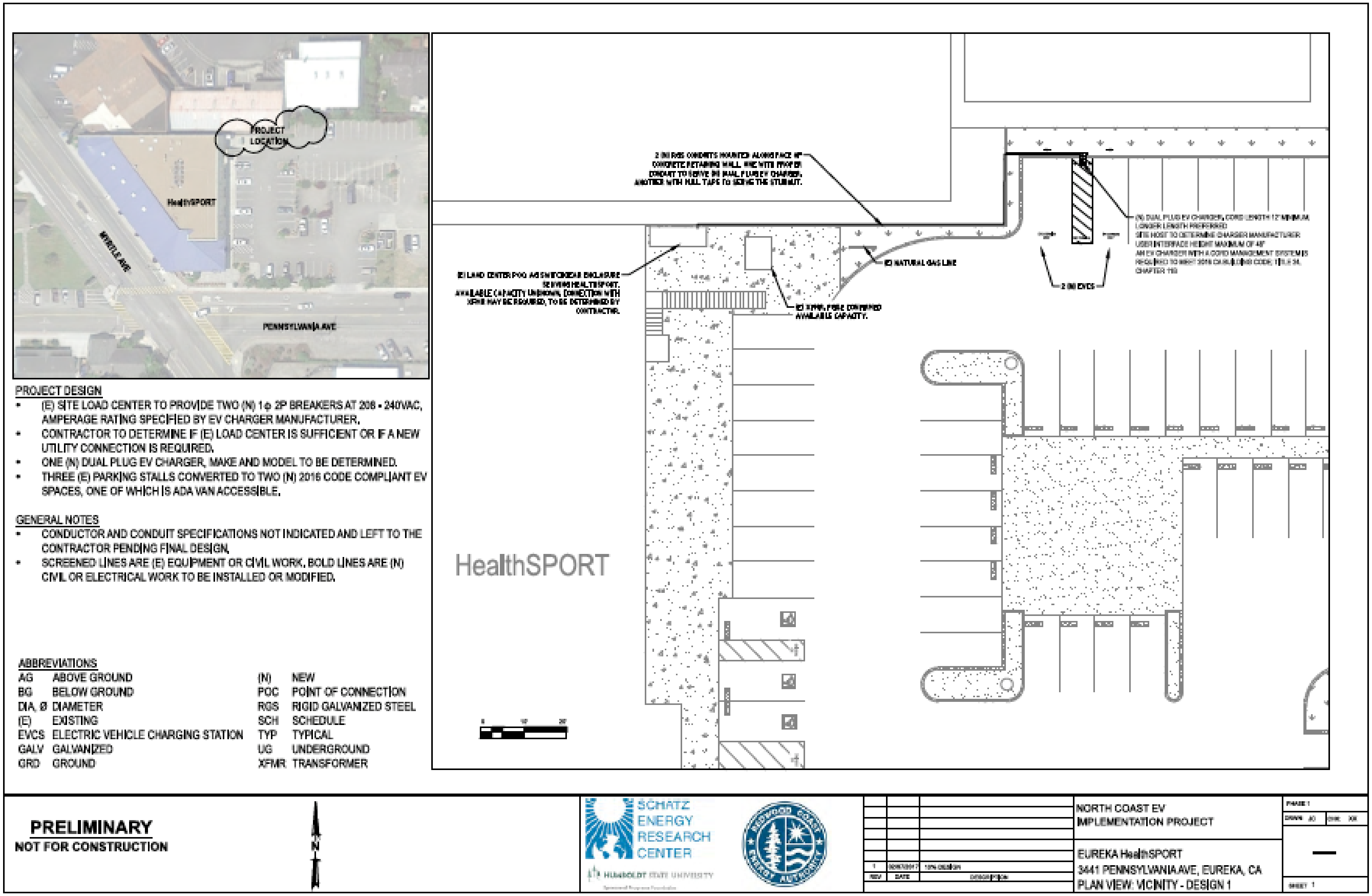


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

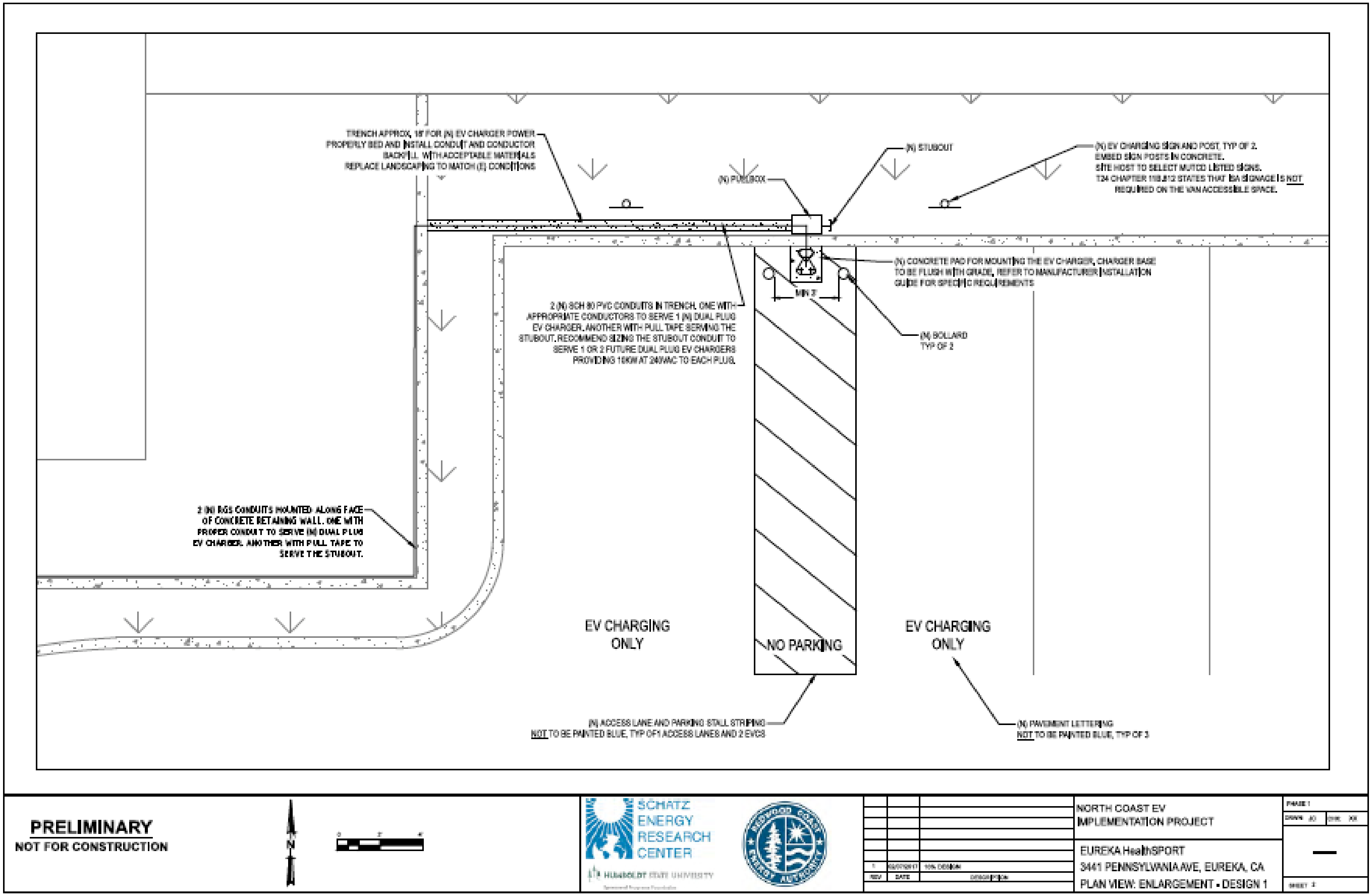


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Site: Eureka HealthSPORT
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Two EV spaces served by one dual head "smart" EV chargers (substitute basic dual chargers to reduce costs)
Use of existing load center to keep cost down. Installation of new load center required for separate utility account and metering.
Installation of stubout conduit to enable future expansion.
Design of code-compliant EV spaces, and installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	0.5	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 8	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	0.1	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 4	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	1.6	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 2	$ -
	Selective demolition, dump charges, dump charges - local disposal at HWMA rates	0.1	Ton	--	--	--	$ 175.41	Total with O&P	$ 26	$ -
								Divison 2 Subtotal	$ 39	
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128	$ -
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	10	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 245	$ -
								Divison 3 Subtotal	$ 373	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	2	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 59	$ 1.33
								Division 5 Subtotal	$ 59	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	5	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 516	$ 37.00
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 118	$ 7.97
								Division 10 Subtotal	$ 634	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #4	5.3	CLF	$ 97.50	$ 82.50	$ -	$ 231.00	Total with O&P	$ 1,229	$ -
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1 1/4" diameter	100	LF	$ 5.15	$ 7.30	$ -	$ 16.60	Total with O&P	$ 1,660	$ -
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 2" diameter	100	LF	$ 7.90	$ 9.70	$ -	$ 23.50	Total with O&P	$ 2,350	$ -
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -
								Division 26 Subtotal	$ 5,430	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	20	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 26	$ -
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -
								Division 31 Subtotal	$ 142	
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	5	STALL	--	--	--	$ 120.75	Total with O&P	$ 604	$ -
	Pavement Parking Marking, painted letter, 6"	35	EA	--	--	--	$ 11.50	Total with O&P	$ 403	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	2	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 1,766	$ 133.77
								Divison 32 Subtotal	$ 2,772	
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	--	Unit costs	$ 7,300	$ 602.25
								Equipment Subtotal	$ 7,300	

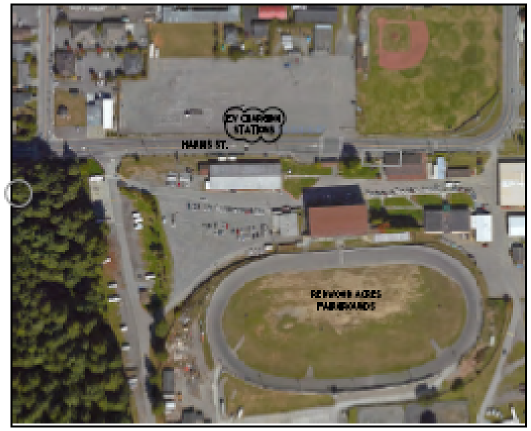
Construction and Equipment Subtotal		$ 16,749
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 1,340
Sales Tax	8.25%	$ 782
Subtotal		$ 18,871
Contingency	25%	$ 4,718
Subtotal		$ 23,589
Bonds ($/1000 per RS Means)	$12.00	$ 283
Subtotal		$ 23,872
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 2,005
Construction and Equipment Total		$ 25,877
Construction Administration	7%	$ 1,811
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 5,175
Grand Total		$ 32,864

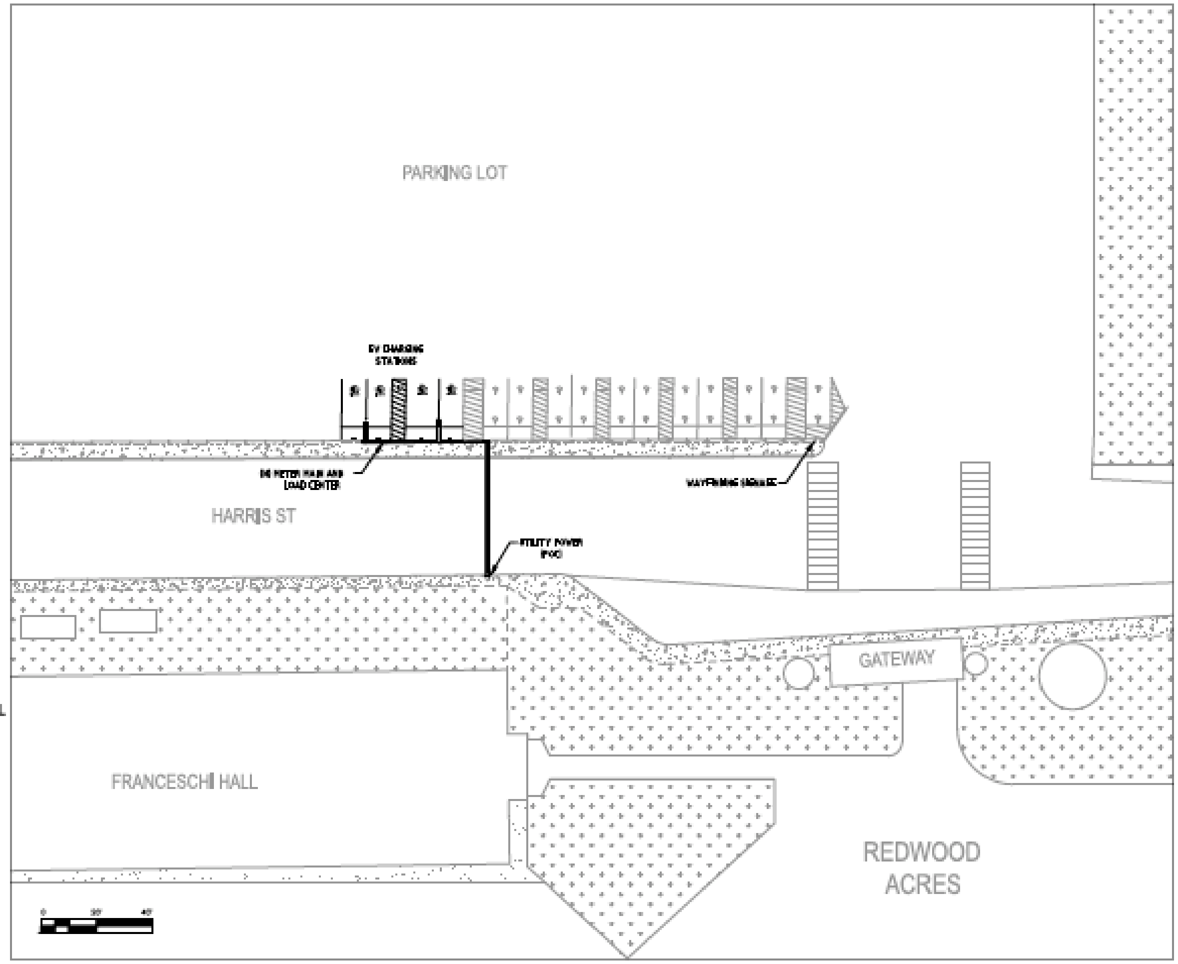
Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)





PROJECT DESIGN

- UTILITY TO PROVIDE (N) 208 / 240 VAC, 200A, SINGLE PHASE ELECTRIC SERVICE TO (N) METER MAIN AND LOAD CENTER
- (N) LOAD CENTER TO PROVIDE FOUR 208 / 240 VAC, 1ϕ CIRCUITS TO EVCS, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- TWO (N) DUAL PLUG EV CHARGERS, MAKE AND MODEL TO BE DETERMINED
- CHARGING SPACES DESIGNED TO MEET 2016 CODE COMPLIANT EV SPACES, ADA VAN ACCESSIBLE SPACE, ACCESS AISLE AND STANDARD EV CHARGING SPACES.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- 2016 BUILDING CODE SPECIFIES THAT AN EVCS IS NOT A PARKING SPACE.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER

PRELIMINARY
NOT FOR CONSTRUCTION

N

NORTH COAST EV
IMPLEMENTATION PROJECT

REDWOOD ACRES
3750 HARRIS ST, EUREKA, CA
PLAN VIEW - VICINITY

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

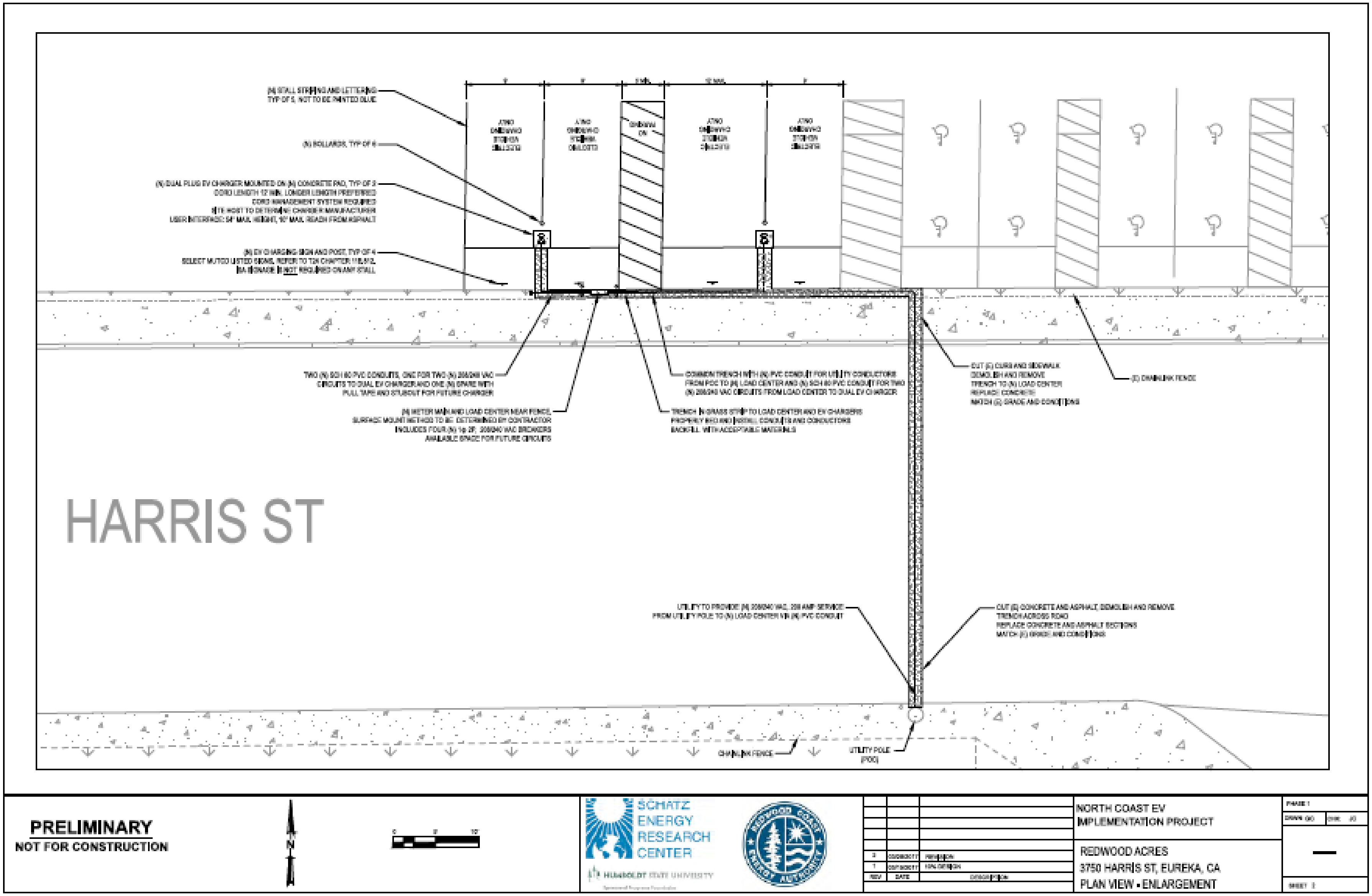


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Redwood Acres
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Four EV spaces served by two dual head "smart" EV chargers (substitute basic dual chargers to reduce costs)
Trenching from POC on south side of road to new meter and load center in parking lot
Design of code-compliant EV spaces and installation of code-required signage
Installation of spare stubout for future high power charger

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	8.3	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 131	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	4.2	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 160	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	33.2	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 40	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	6.2	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 499	$ -
								Divison 2 Subtotal	**$ 830**	
3: Concrete	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	141	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 3,455	$ -
	Concrete forming, structural cast-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, ob grade, to 6" high	34	LF	$ 0.35	$ 2.38	$ -	$ 4.04	Total with O&P	$ 137	$ -
	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	1.0	CY	$ 102.00	$ -	$ -	$ 112.00	Total with O&P	$ 112	$ -
	Placing concrete, labor and equipmt to place, level and consolidate, Footing, continuous, shallow, direct chute (≥ 1 CY and ≤ 5 CY)	1.0	CY	$ -	$ 34.00	$ 1.13	$ 53.50	Total with O&P	$ 54	$ -
								Divison 3 Subtotal	**$ 3,757**	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	2	SET	$ 8.05	$ 21.33	$ -	–	Unit costs	$ 59	$ 1.33
								Division 5 Subtotal	**$ 59**	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	10	EA	$ 89.70	$ 13.51	$ -	–	Unit costs	$ 1,032	$ 74.00
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	5	EA	$ 48.30	$ 6.96	$ 3.84	–	Unit costs	$ 295	$ 19.92
								Division 10 Subtotal	**$ 1,328**	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	1.5	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 252	$ -
	3" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	105	LF	$ 6.30	$ 7.95	$ -	$ 18.80	Total with O&P	$ 1,974	$ -
	1 1/2" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	64	LF	$ 2.99	$ 4.38	$ -	$ 9.85	Total with O&P	$ 630	$ -
	Meter main load center and sockets, surface mount, rainproof, 1P, 3W, 120/240 Volt, 200 amp (local estimate)	1	EA	$ 1,500.00	$ 545.00	$ -	$ 2,045.00	Unit costs	$ 2,045	$ 123.75
	Smart metering, in panel, single phase, 120/208V, 200A	1	EA	$ 375.00	$ 50.00	$ -	$ 485.00	Total with O&P	$ 485	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	4	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 488	$ -
								Division 26 Subtotal	**$ 5,875**	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	102	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 131	$ -
	Aggregate base for trench backfill	2.8	CY	$ 14.25	$ -	$ -	–	Unit costs	$ 40	$ 3.29
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	2.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 232	$ -
								Division 31 Subtotal	**$ 402**	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	8.7	SY	$ 15.87	$ 29.33	$ 2.45	–	Unit costs	$ 415	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	6	STALL	–	–	–	$ 120.75	Total with O&P	$ 725	$ -
	Pavement Parking Marking, painted letter, 6"	65	EA	–	–	–	$ 11.50	Total with O&P	$ 748	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	6	EA	$ 810.75	$ 52.90	$ 19.21	–	Unit costs	$ 5,297	$ 401.32
								Division 32 Subtotal	**$ 7,184**	
EV Charger	Dual, Level 2 Smart Charger	2	EA	$ 7,300.00	$ -	$ -	–	Unit costs	$ 14,600	$ 1,204.50
								Equipment Subtotal	**$ 14,600**	
Utility	PG&E: Electric Service Connection - engineering, tie-in, distribution line installation	1	EA	$ -	$ -	$ -	$ 2,000.00	Total with O&P	$ 2,000	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, aluminum type XLPE, stranded 4/0	3.15	CLF	$ 206.00	$ 141.00	$ -	$ 440.00	Total with O&P	$ 1,386	$ -
								Utility Subtotal	**$ 3,386**	

Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		**$ 37,090**
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 2,967
Sales Tax	8.25%	$ 1,828
Subtotal		**$ 41,885**
Contingency	25%	$ 10,471
Subtotal		**$ 52,356**
Bonds ($/1000 per RS Means)	$12.00	$ 628
Subtotal		**$ 52,985**
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 4,451
Construction and Equipment Total		**$ 57,435**

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

PROJECT DESIGN

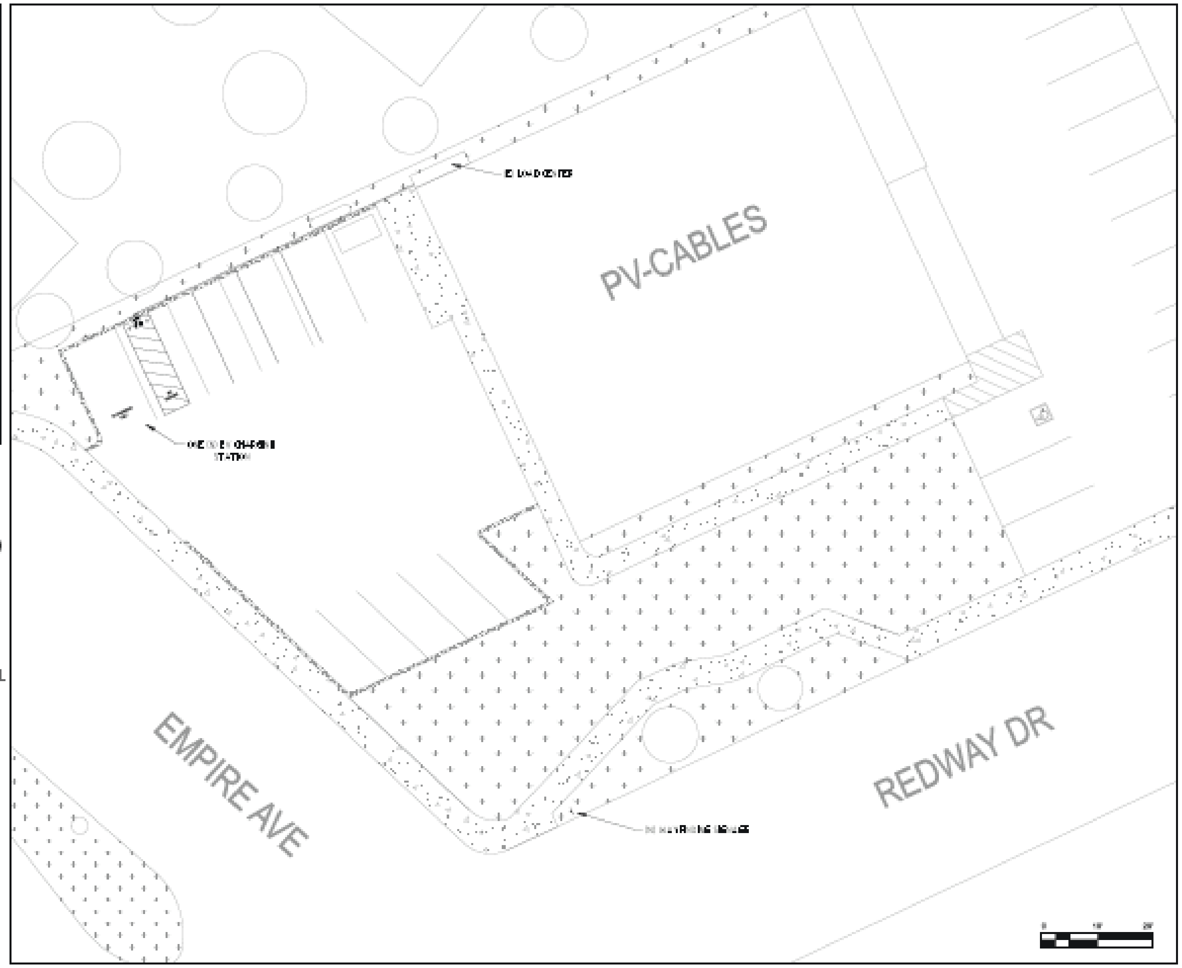
- (E) LOAD CENTER TO PROVIDE ONE 208 / 240 VAC, 1ɸ CIRCUIT TO (N) EVCS, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- ONE (N) SINGLE PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED. RECOMMEND HIGHER POWER 18KW CHARGER IF CAPACITY IS AVAILABLE ON (E) LOAD CENTER.
- (N) EV CHARGING SPACE DESIGNED TO MEET 2016 CODE.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- 2016 BUILDING CODE SPECIFIES THAT AN EVCS IS NOT A PARKING SPACE. CONSULT WITH AHJ REGARDING IMPACT TO PERMIT PARKING SPACE REQUIREMENTS FOR EXISTING FACILITY.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER



PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
2	[illegible]	REVISION
1	[illegible]	10% DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

PV-CABLES BUSINESS AND WAREHOUSE
1155 REDWAY DR., REDWAY, CA
PLAN VIEW - VICINITY

PHASE 1
DRAWN: JC CHK: DC
SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

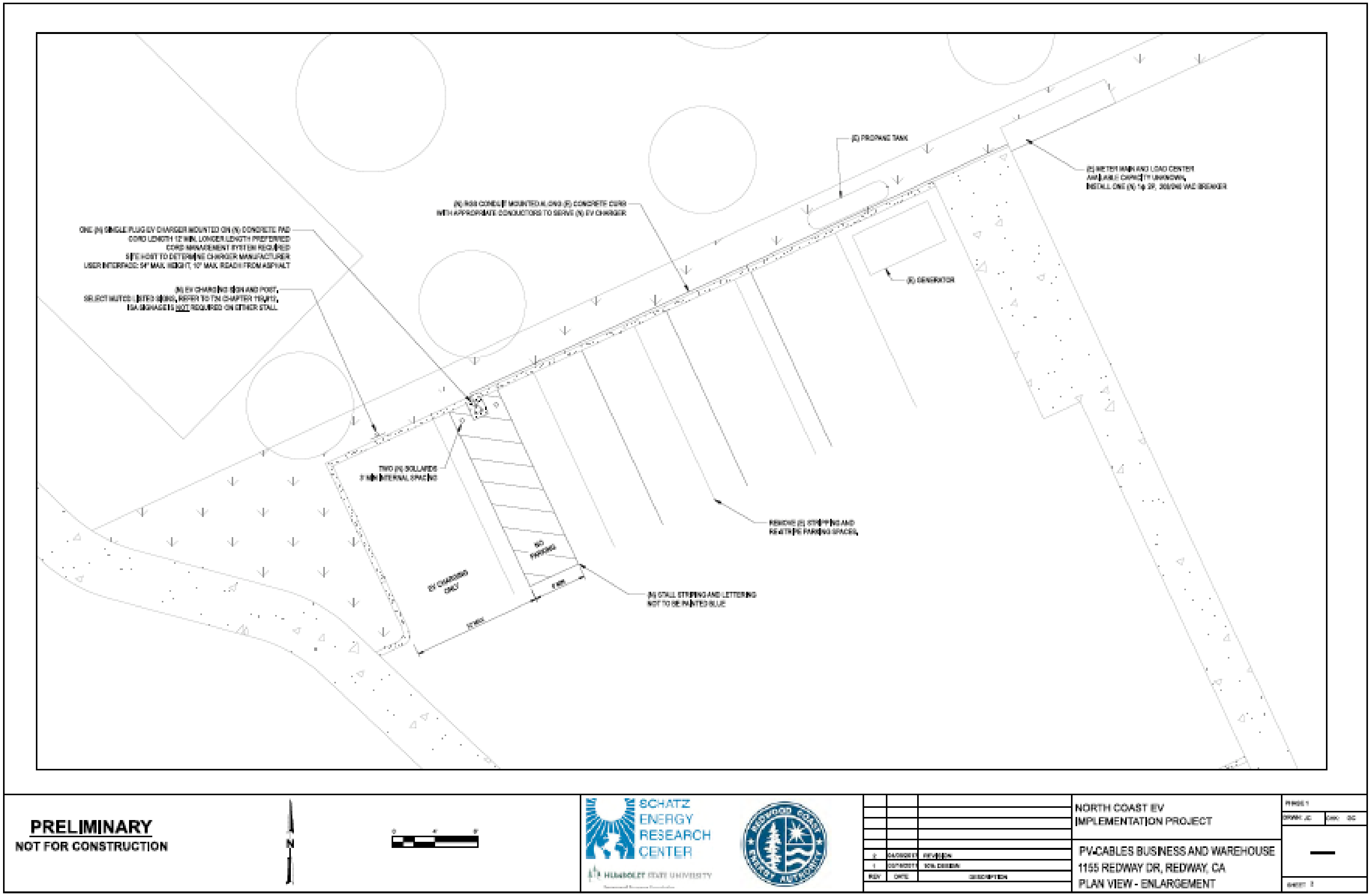


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: PV-Cables
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
One van-accessible EV space served by one single plug "smart" EV charger
Use of existing load center
Above grade rigid conduit run along curb from existing load center to EVCS
Design of code-compliant EV space, and installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	1.0	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 16	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	0.5	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 19	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	2.5	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 3	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	0.7	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 60	$ -
								Divison 2 Subtotal	$ 98	
3: Concrete	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	10	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 245	$ -
	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128	$ -
								Divison 3 Subtotal	$ 373	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29	$ 0.66
								Division 5 Subtotal	$ 29	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	3	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 310	$ 22.20
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 118	$ 7.97
								Division 10 Subtotal	$ 428	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	2.2	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 267	$ -
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1" diameter	65	LF	$ 3.95	$ 6.75	$ -	$ 14.45	Total with O&P	$ 939	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	1	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 122	$ -
								Division 26 Subtotal	$ 1,328	
31: Earthwork	Aggregate base for trench backfill	0.5	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 7	$ 0.59
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -
								Division 31 Subtotal	$ 123	
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	5	STALL	--	--	--	$ 120.75	Total with O&P	$ 604	$ -
	Pavement Parking Marking, painted letter, 6"	23	EA	--	--	--	$ 11.50	Total with O&P	$ 265	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	2	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 1,766	$ 133.77
								Divison 32 Subtotal	$ 2,634	
EV Charger	Single, Level 2 Smart Charger	1	EA	$ 5,010.00	$ -	$ -	--	Unit costs	$ 5,010	$ 413.33
								Equipment Subtotal	$ 5,010	

Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 10,023
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 802
Sales Tax	8.25%	$ 579
Subtotal		$ 11,403
Contingency	25%	$ 2,851
Subtotal		$ 14,254
Bonds ($/1000 per RS Means)	$12.00	$ 171
Subtotal		$ 14,425
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 1,212
Construction and Equipment Total		$ 15,637
Construction Administration	7%	$ 1,095
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 3,127
Grand Total		$ 19,859

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

PROJECT DESIGN

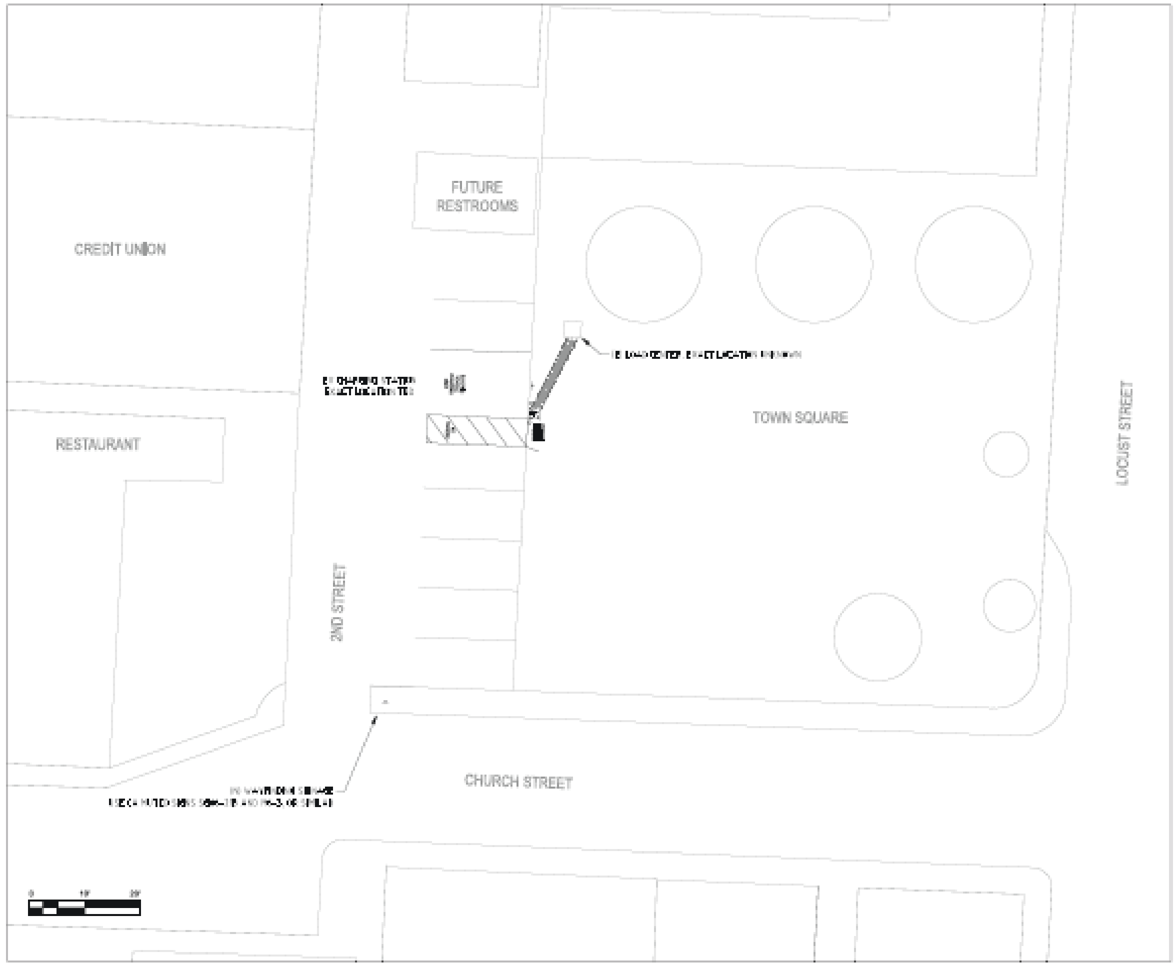
- (E) SITE LOAD CENTER TO INCLUDE A (N) SINGLE PHASE, 2P BREAKER AT 208/240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- ONE (N) SINGLE PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED. AN 18 KW AC CHARGER IS RECOMMENDED IF THE (E) LOAD CENTER CAN MEET THE REQUIRED CURRENT SPECIFICATIONS.
- ADA VAN ACCESSIBLE EV SPACE DESIGNED TO MEET 2016 CODE

GENERAL NOTES

- TOWN SQUARE UNDERGOING SIGNIFICANT REDESIGN
- SPECIFIC EVCS SITE LOCATION TO BE DETERMINED BY LAND OWNER
- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK, BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- 2016 BUILDING CODE SPECIFIES THAT AN EVCS IS NOT A PARKING SPACE. THIS DESIGN REDUCES THE NUMBER OF EXISTING PARKING SPACES BY 2, CONFIRM THIS DOES NOT IMPACT PERMIT REQUIREMENTS FOR PARKING SPACES.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER



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SCHATZ ENERGY RESEARCH CENTER

NORTH COAST EV IMPLEMENTATION PROJECT

GARBERVILLE TOWN SQUARE
GARBERVILLE, CA
PLAN VIEW - VICINITY

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

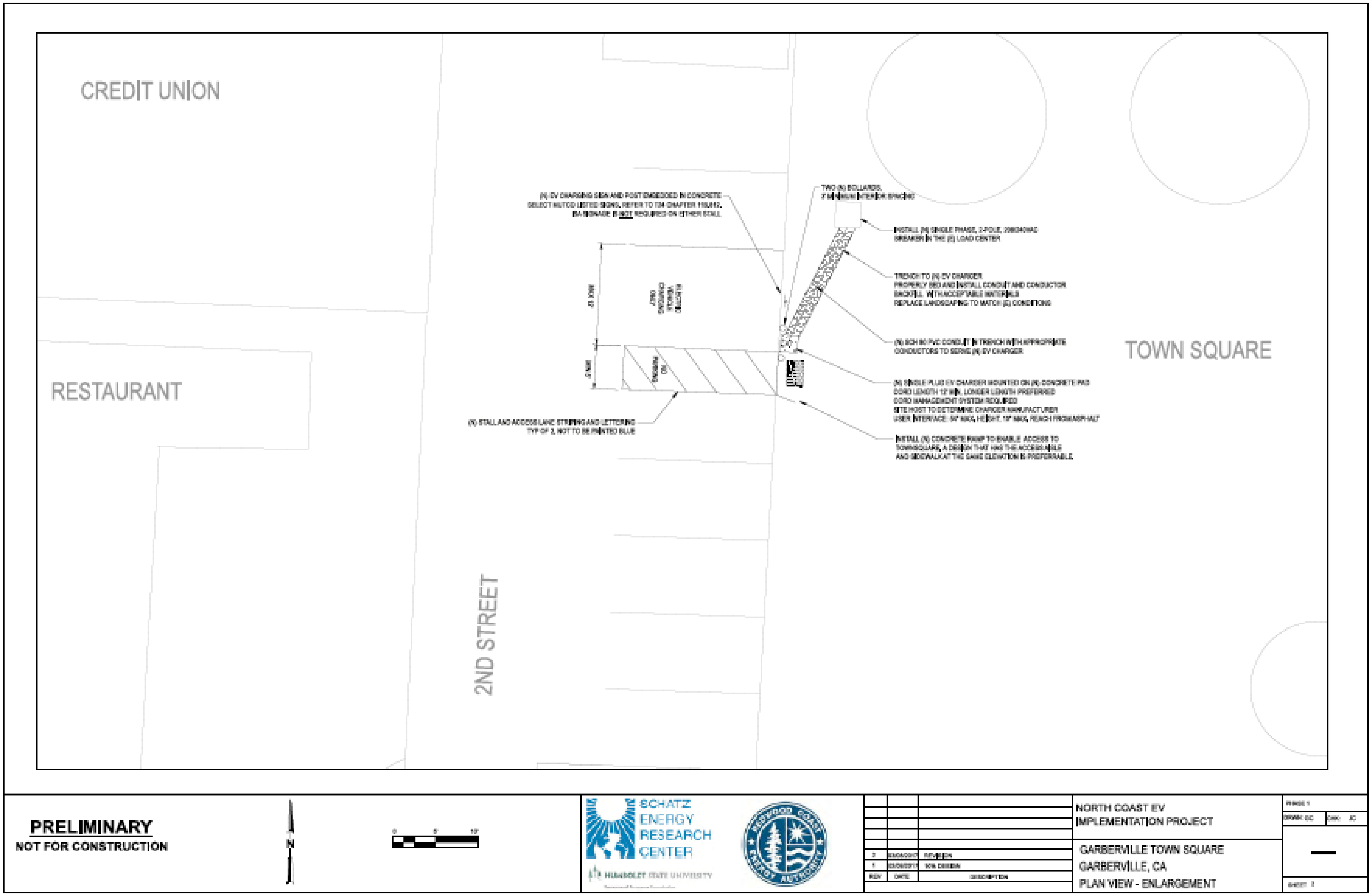


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Garberville Town Square
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
One van-accessible EV space served by a single plug "smart" EV charger
Use of existing load center (assumes existing load center is sufficient)
Demolition of portion of (E) sidewalk and installation of an ADA ramp flush with asphalt to enable unobstructed mobilit
Design of code-compliant EV space, and installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	7.8	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 123
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	3.9	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 150
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	32.8	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 35
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	5.8	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 469
								Divison 2 Subtotal	$ 777
3: Concrete	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	69	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 1,691
	Concrete forming, structural cast-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, ob grade, to 6" high	69	LF	$ 0.35	$ 2.38	$ -	$ 4.04	Total with O&P	$ 279
	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	3.9	CY	$ 102.00	$ -	$ -	$ 112.00	Total with O&P	$ 437
	Placing concrete, labor and equipmt to place, level and consolidate, Footing, continuous, shallow, direct chute (≥ 1 CY and ≤ 5 CY)	3.9	CY	$ -	$ 34.00	$ 1.13	$ 53.50	Total with O&P	$ 209
								Divison 3 Subtotal	$ 2,615
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29
								Division 5 Subtotal	$ 29
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	4	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 413
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.90	$ 6.96	$ 3.84	--	Unit costs	$ 118
								Division 10 Subtotal	$ 531
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #2	0.6	CLF	$ 152.00	$ 97.00	$ -	$ 315.00	Total with O&P	$ 189
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.3	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 37
	1 1/2" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	30	LF	$ 2.99	$ 4.38	$ -	$ 9.85	Total with O&P	$ 296
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	1	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 122
								Division 26 Subtotal	$ 644
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	20	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 26
	Aggregate base for trench backfill	3.9	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 56
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116
								Division 31 Subtotal	$ 197
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL	--	--	--	$ 120.75	Total with O&P	$ 242
	Pavement Parking Marking, painted letter, 6"	22	EA	--	--	--	$ 11.50	Total with O&P	$ 253
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	2	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 1,766
								Divison 32 Subtotal	$ 2,260
EV Charger	Single, Level 2 Smart Charger	1	EA	$ 5,010.00	$ -	$ -	--	Unit costs	$ 5,010
								Equipment Subtotal	$ 5,010

Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 12,063
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 965
Sales Tax	8.25%	$ 590
Subtotal		$ 13,618
Contingency	25%	$ 3,405
Subtotal		$ 17,023
Bonds ($/1000 per RS Means)	$12.00	$ 204
Subtotal		$ 17,227
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 1,447
Construction and Equipment Total		$ 18,674
Construction Administration	7%	$ 1,307
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 3,735
Grand Total		$ 23,716

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

PROJECT DESIGN

- (E) LOAD CENTER TO SUPPLY TWO 208 VAC, 1φ CIRCUITS TO EVCS, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED
- CHARGING SPACES DESIGNED TO MEET 2016 CODE COMPLIANT EV SPACES

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK, BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.
- 2016 CA BUILDING CODE SPECIFIES THAT AN EVCS IS NOT A PARKING SPACE. THIS DESIGN REDUCES THE NUMBER OF EXISTING PARKING SPACES BY 1. CONFIRM THIS DOES NOT IMPACT PERMIT REQUIREMENTS FOR PARKING SPACES.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

NORTH COAST EV IMPLEMENTATION PROJECT

YUROK TRIBE – KLAMATH OFFICE
190 KLAMATH BLVD, KLAMATH, CA
PLAN VIEW – VICINITY

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

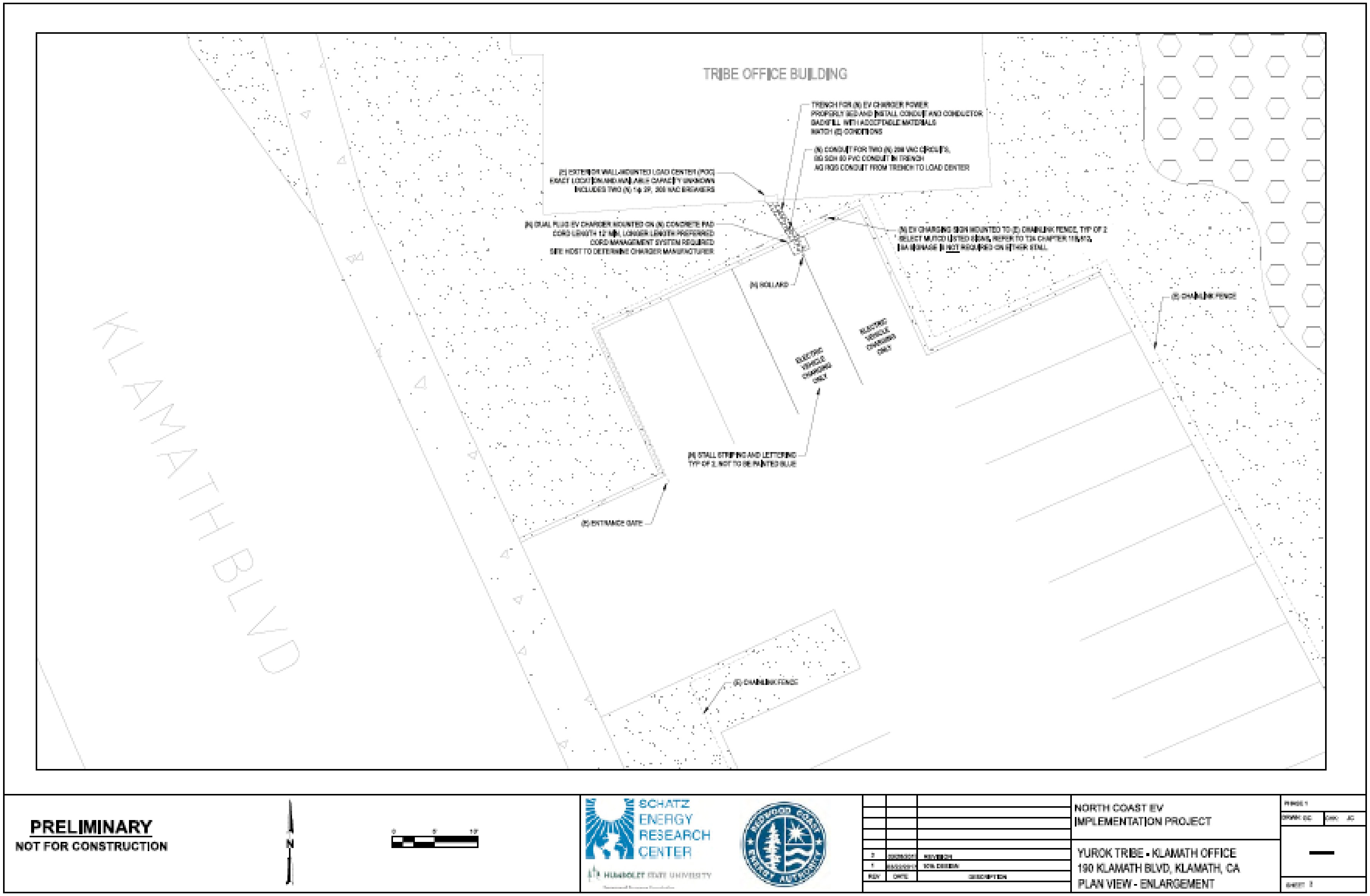


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Yurok Tribe - Klamath Administration Office
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
Use (E) load center (panel review recommended)
Two EV spaces served by new dual head basic EV charger (substitute single charger if power supply limited)
Installation of pavement markings and signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total
3: Concrete	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128
								Divison 3 Subtotal	$ 128
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29
								Divison 5 Subtotal	$ 29
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	2	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 206
								Division 10 Subtotal	$ 206
26: Electrical	1" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	15.0	LF	$ 2.11	$ 3.50	$ -	$ 7.55	Total with O&P	$ 113
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1" diameter	10.0	LF	$ 3.95	$ 6.75	$ -	$ 14.45	Total with O&P	$ 145
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	1	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 93
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244
								Division 26 Subtotal	$ 595
31: Earthwork	Aggregate base for trench backfill	1.0	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 14
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116
								Division 31 Subtotal	$ 130
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL	--	--	--	$ 120.75	Total with O&P	$ 242
	Pavement Parking Marking, painted letter, 6"	26	EA	--	--	--	$ 11.50	Total with O&P	$ 299
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	1	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 883
								Divison 32 Subtotal	$ 1,423
EV Charger	Dual, Level 2 Basic Charger	1	EA	$ 1,200.00	$ -	$ -	--	Unit costs	$ 1,200
								Equipment Subtotal	$ 1,200

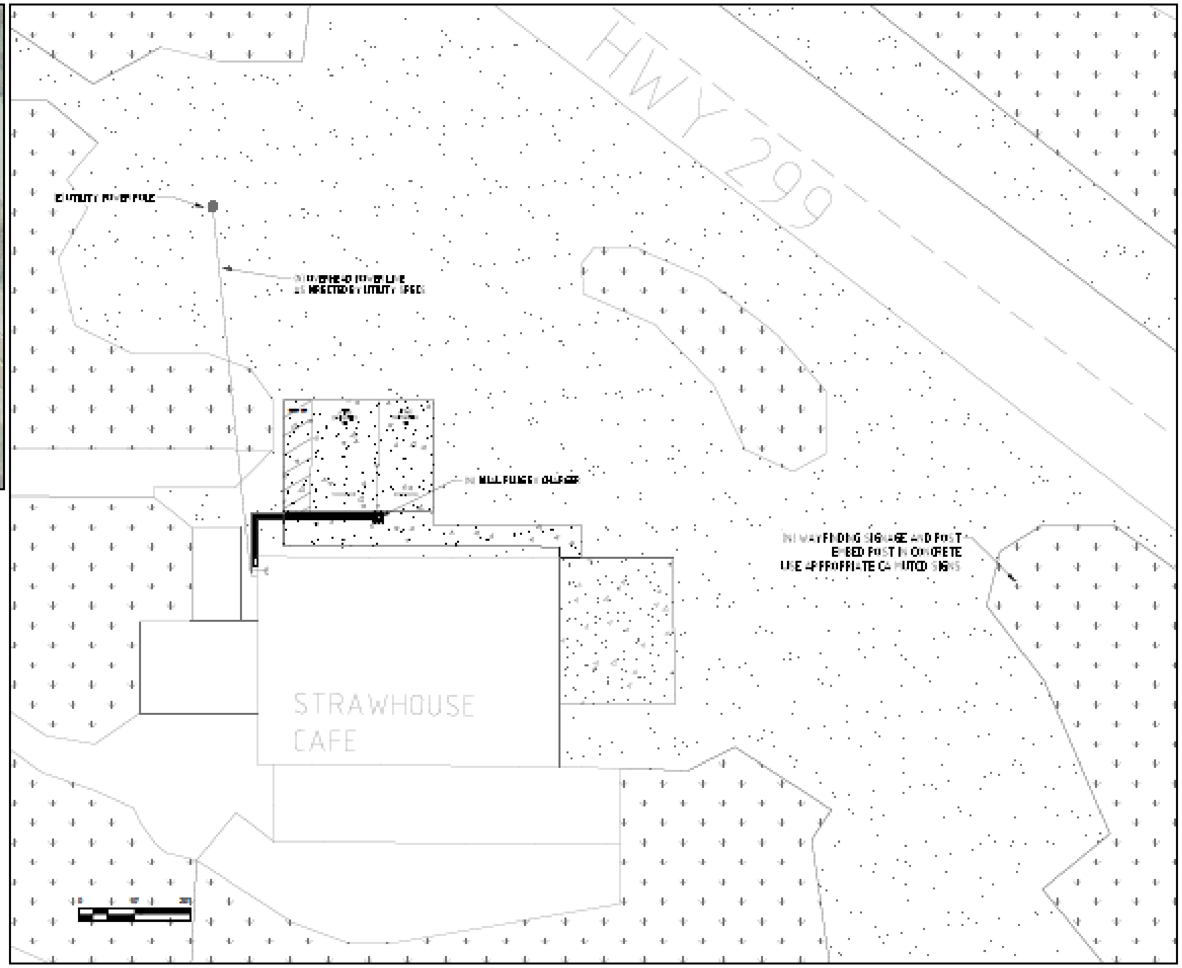
Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups

Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 3,712
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 296.97
Sales Tax	8.25%	$ 183
Subtotal		$ 4,192
Contingency	25%	$ 1,047.92
Subtotal		$ 5,240
Bonds ($/1000 per RS Means)	$12.00	$ 63
Subtotal		$ 5,302
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 445
Construction and Equipment Total		$ 5,748
Construction Administration	7%	$ 402.35
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 1,149.57
Grand Total		$ 7,300

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- (N) SITE LOAD CENTER TO PROVIDE TWO (N) 1φ 2P BREAKERS AT 240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- ONE (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED.
- AREA EQUAL TO APPROX. THREE PARKING STALLS CONVERTED TO TWO 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE WITH AN ACCESS AISLE AND ONE OF WHICH IS A STANDARD EV CHARGING SPACE.
- PATH OF TRAVEL AT HEAD OF PARKING STALLS IS REQUIRED TO MEET THE SPIRIT OF ACCESSIBILITY. ADDITIONAL SIDEWALK EXTENDED FROM ACCESS ISLE IS REQUIRED TO ENABLE PATH OF TRAVEL TO THE LOCATIONS SERVICES.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
1	[illegible]	10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

STRAWHOUSE CAFE
31301 CA-299, JUNCTION CITY, CA
VICINITY

SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

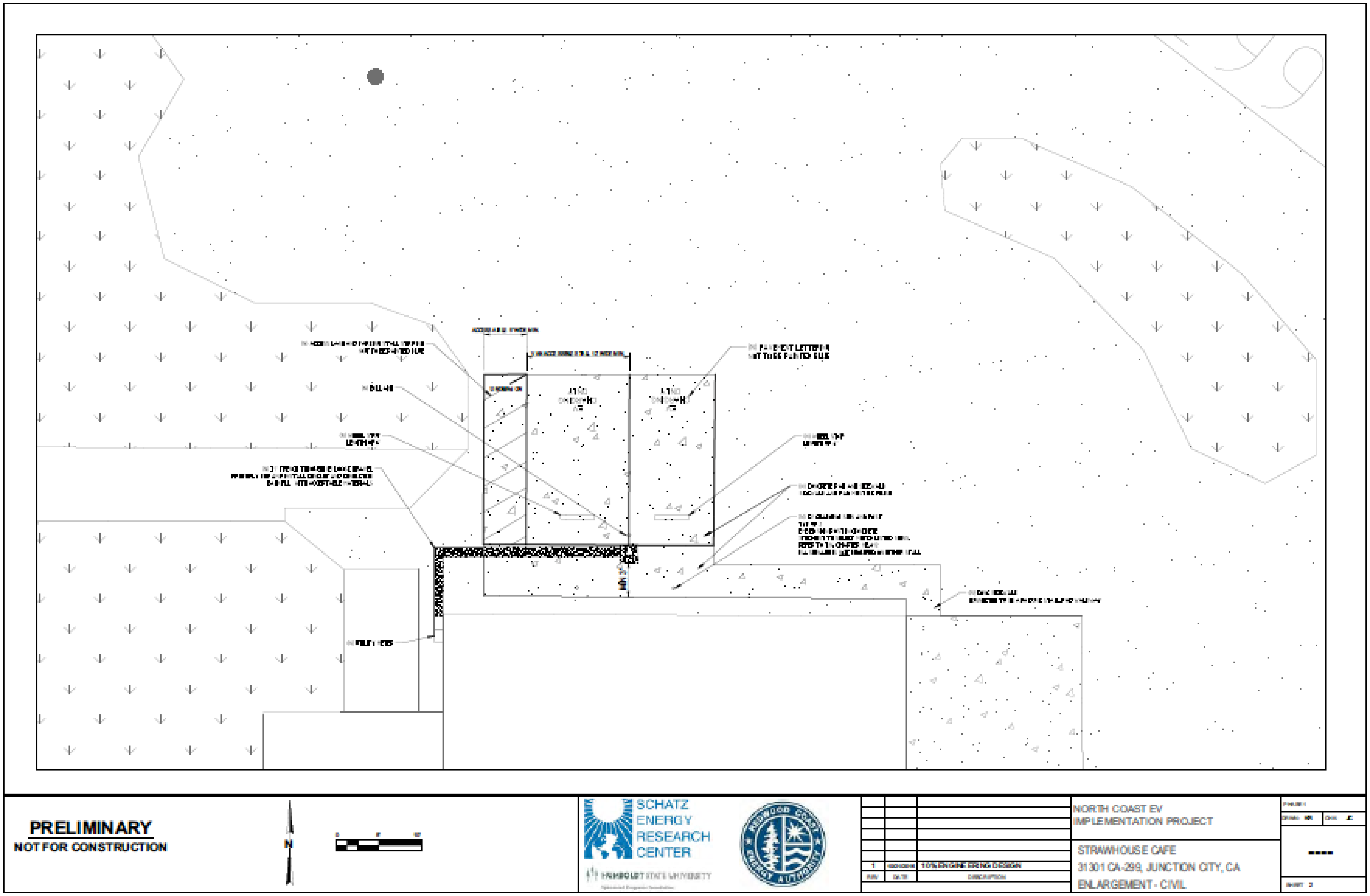


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

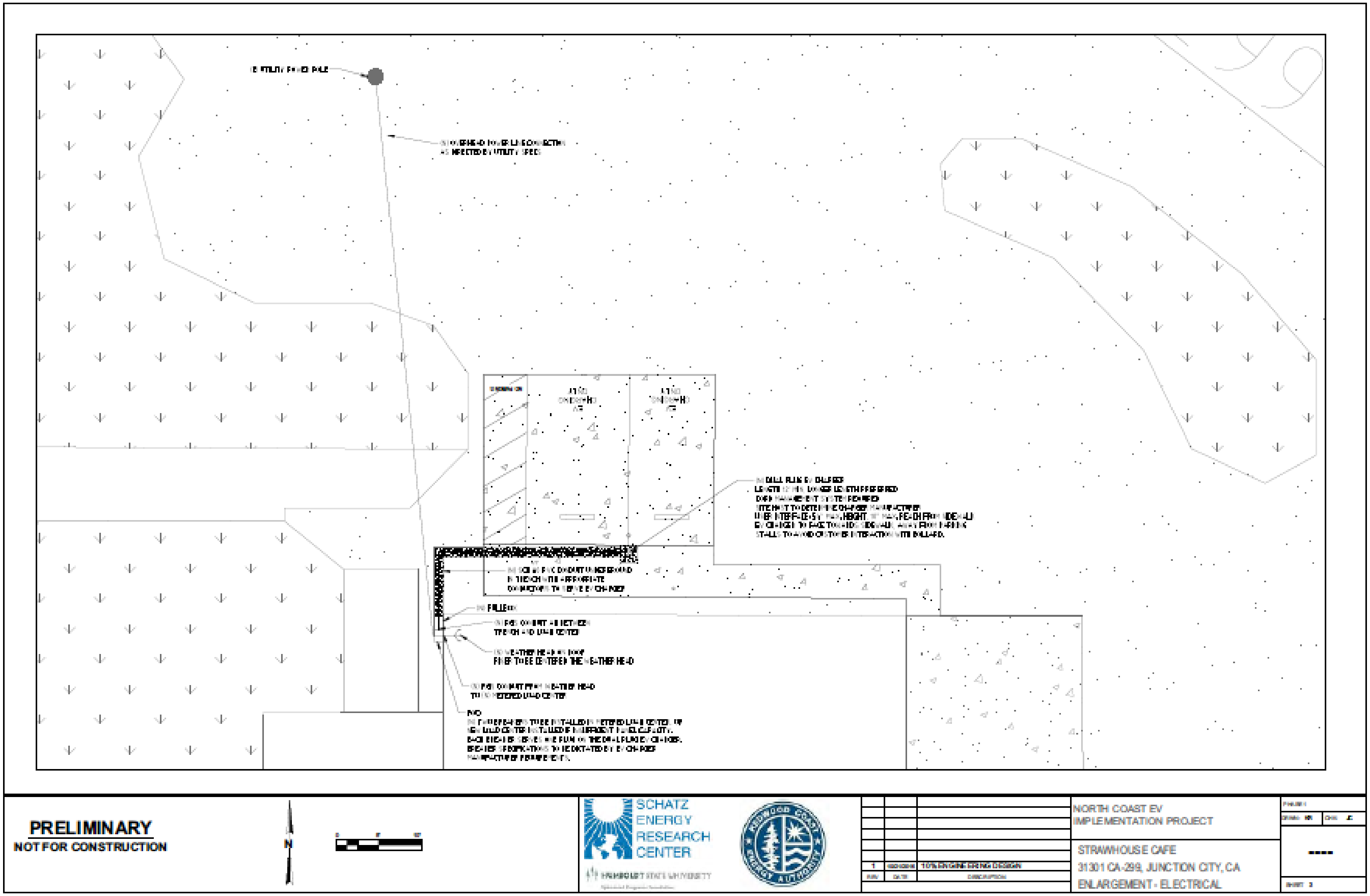


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Client: Strawhouse Café
Purpose: Cost estimate for the preliminary design of an electric vehicle charging station install
Project: ARV-14-046 PEV Readiness NorthCoast
Prepared by: Schatz Energy Research Center

Preliminary design costs based on:
New meter 200 A load center and two 50 A circuits for EV charger
Trench from new meter center to EV charger
Installation of a smart dual Level 2 EV charger (substitute a basic dual charger to reduce costs, if needed)
Installation of a protective bollard for electrical equipment
Installation of code required signage
Utility to install overhead line to new weather head on roof of building
Does not include costs for utility work (connection to utility pole, installing weather head, etc.)

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax	Notes
2: Existing Conditions - Demolition									$ -	$ -	No demolition required for site
									$ -	$ -	
									$ -	$ -	
									$ -	$ -	
								Divison 2 Subtotal	$ -		
3: Concrete	Concrete forming, structural cast-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, ob grade, to 6" high	171	LF	$ 0.35	$ 2.38	$ -	$ 4.04	Total with O&P	$ 691	$ -	Form for sidewalk and slab Perimeter of concrete slab (27' x 26') and sidewalk
	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	15.1	CY	$ 102.00	$ -	$ -	$ 112.00	Total with O&P	$ 1,688	$ -	Concrete for sidewalk and slab
	Placing concrete, labor and equipmt to place, level and consolidate, Footing, continuous, shallow, direct chute (> 5 CY)	15.1	CY	$ -	$ 15.65	$ 0.52	$ 24.50	Total with O&P	$ 369	$ -	Labor for sidewalk and slab
								Divison 3 Subtotal	$ 2,748		
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	–	Unit costs	$ 29	$ 0.66	Charger mounting hardware
								Division 5 Subtotal	$ 29		
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	7	EA	$ 89.70	$ 13.51	$ -	–	Unit costs	$ 722	$ 51.80	2 way-finding signs, 2 EV charging only signs, 2 parking time limit signs, 1 Van Accessible sign
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	3	EA	$ 48.30	$ 6.96	$ 3.84	–	Unit costs	$ 177	$ 11.95	1 pole for each stall, 1 pole for way-finding sign
								Division 10 Subtotal	$ 900		
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	1.4	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 224	$ -	4x 6 AWG from load center to EV Charger (2 per plug) 34' L x 4
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.3	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 42	$ -	1x 8 AWG from load center to EV Charger (1 ground) 34' L x 1
	1 1/2" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	34	LF	$ 2.99	$ 4.38	$ -	$ 9.85	Total with O&P	$ 335	$ -	Underground section of conduit from load center to the charger
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1" diameter	15	LF	$ 3.95	$ 6.75	$ -	$ 14.45	Total with O&P	$ 217	$ -	Above ground section of conduit from load center to the charger (5' estimate) + between weatherhead and load center (10' estimate)
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	1	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 191	$ -	Pull box to be located where conduit comes out from ground at the load center
	Meter center and sockets, single position, 4 terminal, 200 amp	1	EA	$ 92.00	$ 230.00	$ -	$ 322.00	Unit costs	$ 322	$ 7.59	New load center holding circuit breakers, where PG&E line comes in (via weather head), and power goes out to the dual charger
	Smart metering, in panel, single phase, 120/208V, 200A	1	EA	$ 375.00	$ 50.00	$ -	$ 485.00	Unit costs	$ 425	$ 30.94	Meter
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -	2 circuits
								Division 26 Subtotal	$ 2,000		
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	31	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 40	$ -	Trench length 31'
	Aggregate base for trench backfill	2.9	CY	$ 14.25	$ -	$ -	–	Unit costs	$ 41	$ 3.37	Trench depth is 20" (bottom 4 inches are sand, but assumed same cost as AB)
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	1.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 116	$ -	For detailed shoveling while trenching
								Division 31 Subtotal	$ 197		
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	3	STALL	–	–	–	$ 120.75	Total with O&P	$ 362	$ -	2 EV spaces + access aisle
	Pavement Parking Marking, painted letter, 6"	35	EA	–	–	–	$ 11.50	Total with O&P	$ 403	$ -	EV PARKING ONLY: 13 letters x 2 stalls = 26; NO PARKING: 9 letters; Total: 35 letters
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	1	EA	$ 810.75	$ 52.90	$ 19.21	–	Unit costs	$ 883	$ 66.89	
	Precast concrete parking bumpers, incl dowels, 6" x 10" x 6'0"	2	EA	$ 68.43	$ 13.63	$ -	–	Unit costs	$ 164	$ 11.29	One wheel stop per stall
								Divison 32 Subtotal	$ 1,812		
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,300.00	$ -	$ -	–	Unit costs	$ 7,300	$ 602.25	
								Equipment Subtotal	$ 7,300		

Source: RSMeans, 38th annual edition, 2015
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups

RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 14,986
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 1,199
Sales Tax	8.25%	$ 787
Subtotal		$ 16,972
Contingency	25%	$ 4,243
Subtotal		$ 21,215
Bonds ($/1000 per RS Means)	$12.00	$ 255
Subtotal		$ 21,469
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 1,803
Construction and Equipment Total		$ 23,273
Construction Administration	7%	$ 1,629
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 4,655
Grand Total		$ 29,556

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

PROJECT DESIGN

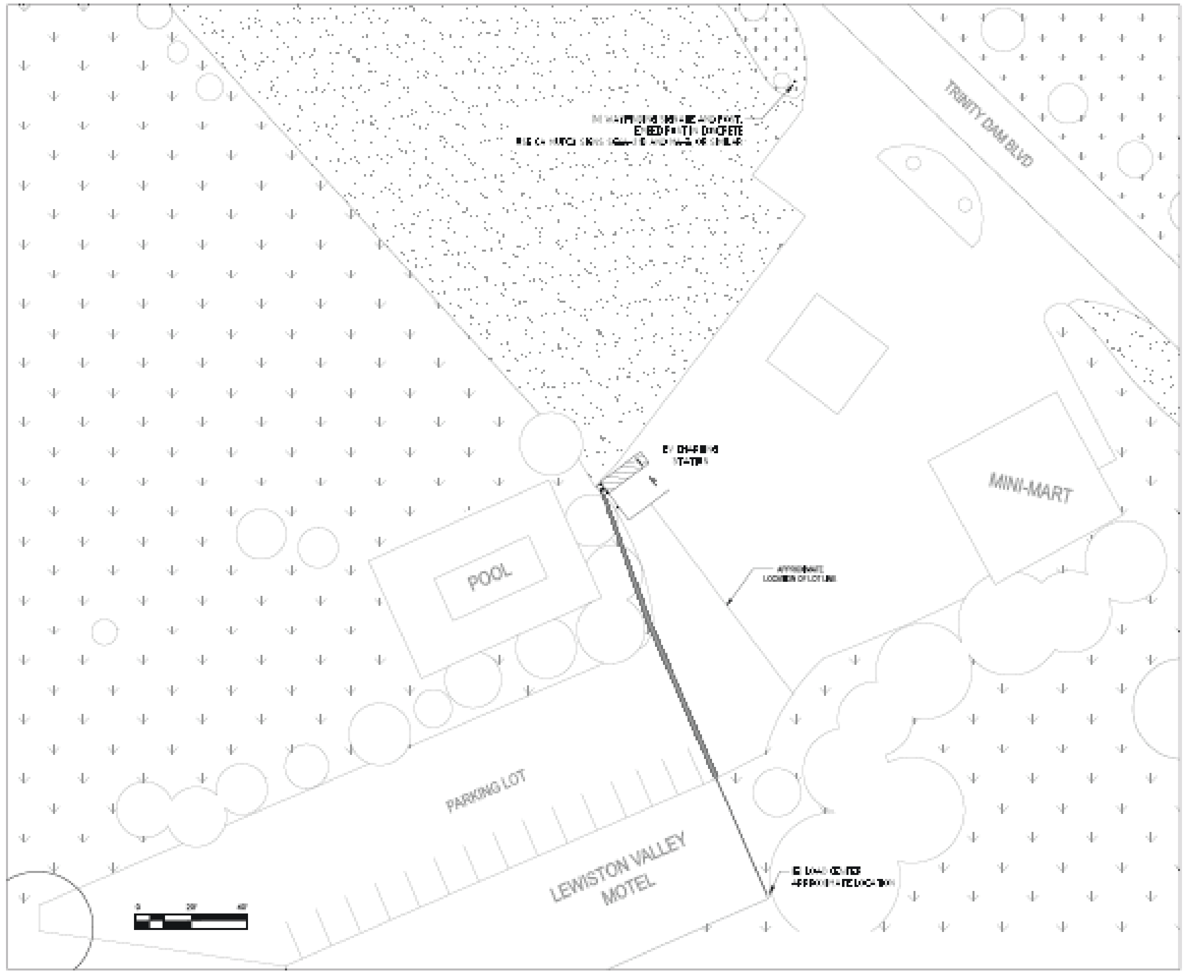
- (E) SITE LOAD CENTER TO INCLUDE (N) 1φ 2P BREAKER AT 208/240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- EVCS POWER SUPPLY OPTIONS:
  1) REPLACE (E) AVAILABLE CIRCUIT TO POOL AREA WITH CONDUCTORS THAT MEET ELECTRICAL SPECIFICATIONS. TRENCH FROM POOL AREA TO EVCS.
  2) TRENCH FROM (E) LOAD CENTER AT MOTEL TO EVCS AND INSTALL (N) ELECTRICAL CIRCUIT (AS SHOWN).
- ONE (N) SINGLE PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED. AN 18 KW AC CHARGER IS RECOMMENDED IF THE (E) LOAD CENTER AND (N) CIRCUIT CAN MEET THE REQUIRED CURRENT SPECIFICATIONS.
- VAN-ACCESSIBLE CHARGING SPACE DESIGNED TO MEET 2016 CODE COMPLIANT EV SPACES.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND	XFMR	TRANSFORMER



PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
2	[illegible]	10% DESIGN
1	[illegible]	CONCEPTUAL DRAWING

NORTH COAST EV IMPLEMENTATION PROJECT

LEWISTON VALLEY MOTEL
4795 TRINITY DAM BLVD, LEWISTON, CA
PLAN VIEW - VICINITY

SHEET 1

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

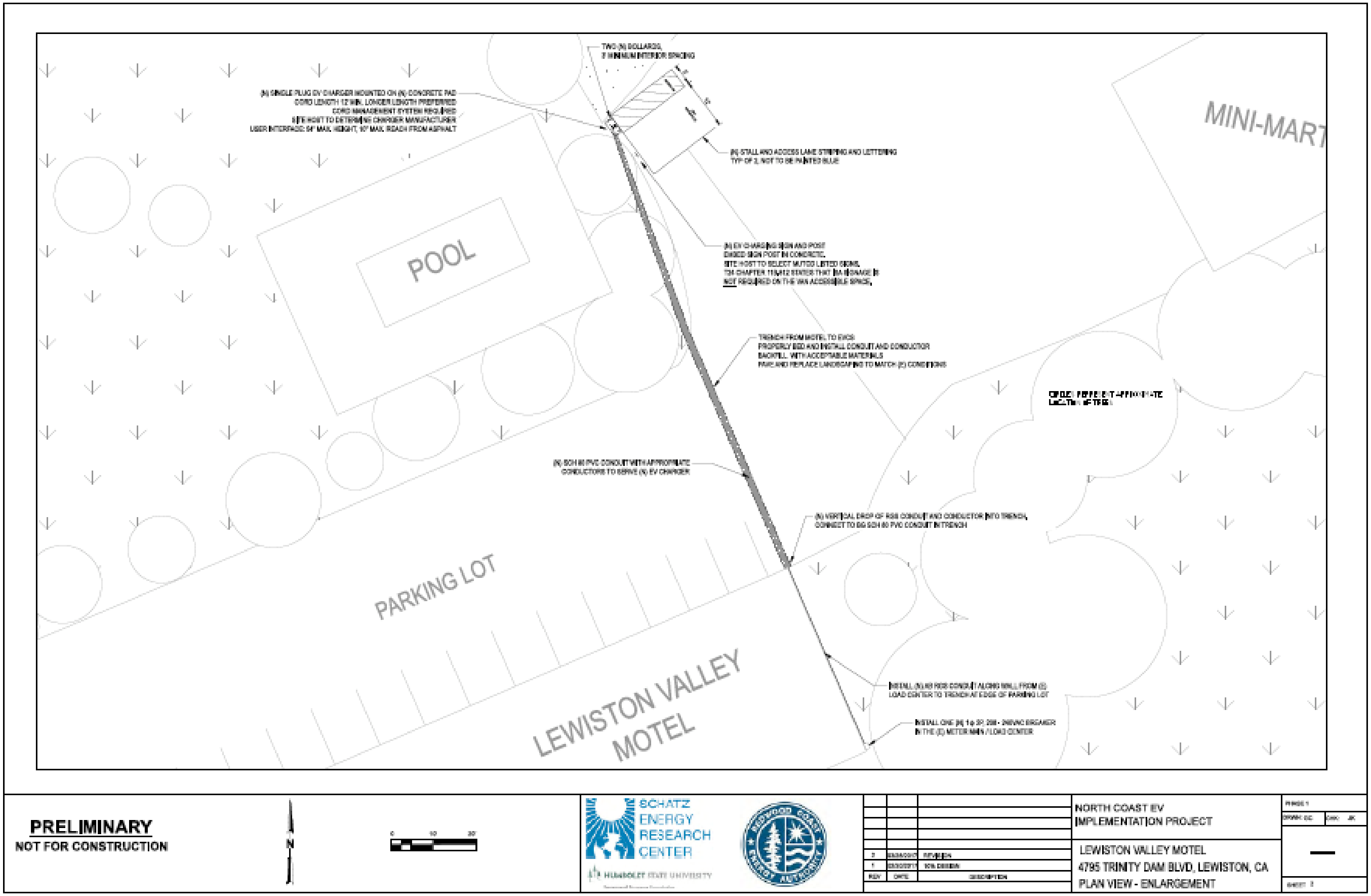


Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Site: Lewiston Valley Motel
Project: ARV-14-046 North Coast PEV Readiness Implementation
Prepared by: Schatz Energy Research Center

Design costs based on:
One van-accessible EV space served by one single plug "smart" EV charger
Use of existing load center
Trench from existing load center across parking lot to EVCS
Design of code-compliant EV space, and installation of code-required signage

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	10	SY	$ -	$ 6.70	$ 5.00	$ 15.75	Total with O&P	$ 158	$ -
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	5	CY	$ -	$ 25.00	$ -	$ 38.50	Total with O&P	$ 193	$ -
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	190	CY	$ -	$ 0.28	$ 0.59	$ 1.07	Total with O&P	$ 203	$ -
	Selective demolition, dump charges, dump charges, typical urban city, tipping fees only, building construction materials	7.4	Ton	$ 74.00	$ -	$ -	$ 81.00	Total with O&P	$ 601	$ -
								Divison 2 Subtotal	$ 1,155	
3: Concrete	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	123	LF	$ 0.14	$ 0.66	$ 0.46	$ 24.50	Total with O&P	$ 3,014	$ -
	Cast-in-place concrete, miscellaneous cast-in-place concrete, concrete in place, equipment pad (3000 psi), 3' x 3' x 6" thick	1	EA	$ 47.00	$ 49.50	$ 0.69	$ 128.00	Total with O&P	$ 128	$ -
								Divison 3 Subtotal	$ 3,142	
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, J type incl nuts and washers, 6" long, 1/2" dia	1	SET	$ 8.05	$ 21.33	$ -	--	Unit costs	$ 29	$ 0.66
								Division 5 Subtotal	$ 29	
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 10"	4	EA	$ 89.70	$ 13.51	$ -	--	Unit costs	$ 413	$ 29.60
	Traffic signs, steel post, galvanized, 10' 0", upright, bolted.	2	EA	$ 48.30	$ 6.96	$ 3.84	--	Unit costs	$ 118	$ 7.97
								Division 10 Subtotal	$ 531	
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type XHHW, stranded, #1	3.2	CLF	$ 210.00	$ 109.00	$ -	$ 395.00	Total with O&P	$ 1,264	$ -
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #6	1.6	CLF	$ 57.50	$ 67.50	$ -	$ 165.00	Total with O&P	$ 264	$ -
	1 1/2" dia conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	120	LF	$ 2.99	$ 4.38	$ -	$ 9.85	Total with O&P	$ 1,182	$ -
	Conduit to 15' high, includes 2 terminators, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 1" diameter	60	LF	$ 3.95	$ 6.75	$ -	$ 14.45	Total with O&P	$ 867	$ -
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	1	EA	$ 36.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 122	$ -
								Division 26 Subtotal	$ 3,699	
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	120	LF	$ 0.52	$ 0.45	$ 0.97	$ 1.28	Total with O&P	$ 154	$ -
	Aggregate base for trench backfill	5.0	CY	$ 14.25	$ -	$ -	--	Unit costs	$ 71	$ 5.88
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	3.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 348	$ -
								Division 31 Subtotal	$ 573	
32: Exterior Improvements	Asphalt Paving- Pavement replacement over trench, 4" thick	10.0	SY	$ 15.87	$ 29.33	$ 2.45	--	Unit costs	$ 476	$ -
	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	2	STALL	--	--	--	$ 120.75	Total with O&P	$ 242	$ -
	Pavement Parking Marking, painted letter, 6"	22	EA	--	--	--	$ 11.50	Total with O&P	$ 253	$ -
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x4" D hole, 6" DIA	2	EA	$ 810.75	$ 52.90	$ 19.21	--	Unit costs	$ 1,766	$ 133.77
								Divison 32 Subtotal	$ 2,737	
EV Charger	Single, Level 2 Smart Charger	1	EA	$ 5,010.00	$ -	$ -	--	Unit costs	$ 5,010	$ 413.33
								Equipment Subtotal	$ 5,010	

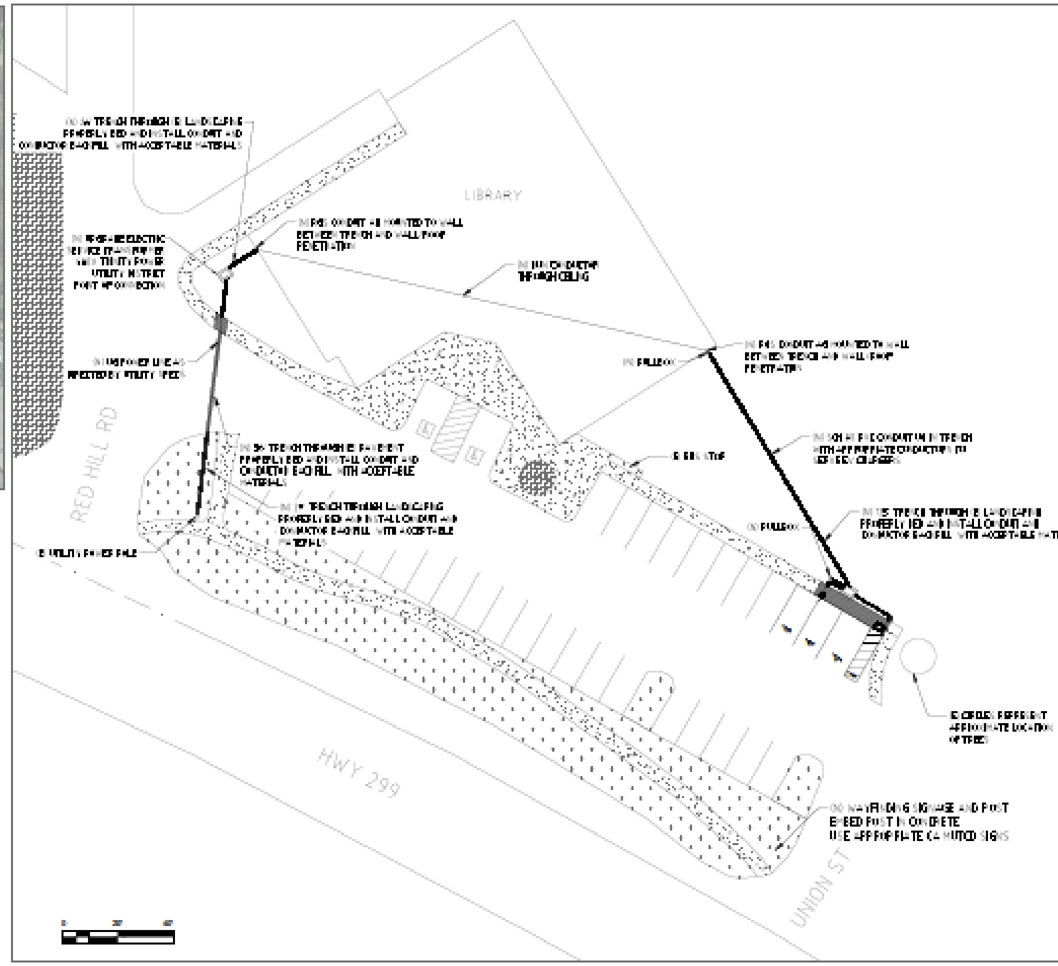
Construction and Equipment Subtotal		$ 16,875
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 1,350
Sales Tax	8.25%	$ 591
Subtotal		$ 18,816
Contingency	25%	$ 4,704
Subtotal		$ 23,520
Bonds ($/1000 per RS Means)	$12.00	$ 282
Subtotal		$ 23,803
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 1,999
Construction and Equipment Total		$ 25,802
Construction Administration	7%	$ 1,806
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 5,160
Grand Total		$ 32,769

Source: RSMeans, 38th annual edition, 2015

Notes: Material, Labor and Equipment Costs are for General Contractor, no markups
RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)



PROJECT DESIGN

- (N) SITE LOAD CENTER TO PROVIDE TWO (N) 1φ 2P BREAKERS AT 240VAC, AMPERAGE RATING SPECIFIED BY EV CHARGER MANUFACTURER.
- ONE (N) DUAL PLUG EV CHARGER, MAKE AND MODEL TO BE DETERMINED.
- THREE PARKING STALLS CONVERTED TO THREE (N) 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE.
- THREE PARKING STALLS CONVERTED TO TWO 2016 CODE COMPLIANT EV SPACES, ONE OF WHICH IS ADA VAN ACCESSIBLE WITH AN ACCESS AISLE AND TWO OF WHICH ARE STANDARD EV CHARGING SPACES.
- THREE STUB OUT FOR POTENTIAL FUTURE DUAL PLUG EV CHARGER.

GENERAL NOTES

- CONDUCTOR AND CONDUIT SPECIFICATIONS NOT INDICATED AND LEFT TO THE CONTRACTOR PENDING FINAL DESIGN.
- SCREENED LINES ARE (E) EQUIPMENT OR CIVIL WORK. BOLD LINES ARE (N) CIVIL OR ELECTRICAL WORK TO BE INSTALLED OR MODIFIED.

ABBREVIATIONS

AG	ABOVE GROUND	(N)	NEW
BG	BELOW GROUND	POC	POINT OF CONNECTION
DIA, Ø	DIAMETER	RGS	RIGID GALVANIZED STEEL
(E)	EXISTING	SCH	SCHEDULE
EVCS	ELECTRIC VEHICLE CHARGING STATION	TYP	TYPICAL
GALV	GALVANIZED	UG	UNDERGROUND
GRD	GROUND		

PRELIMINARY
NOT FOR CONSTRUCTION

N

SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
3	[illegible]	REVISION
2	[illegible]	REVISION
1	[illegible]	10% ENGINEERING DESIGN

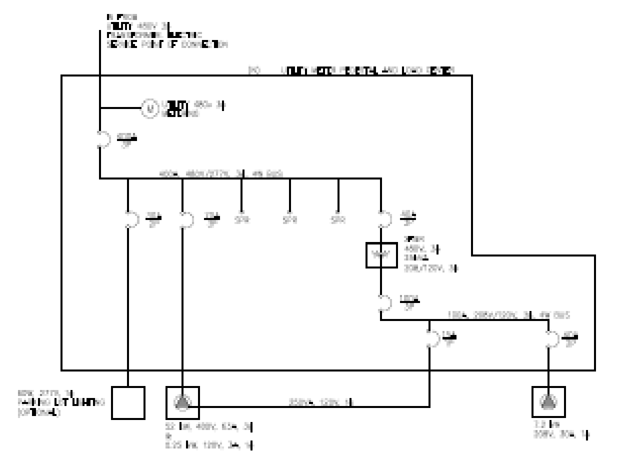
NORTH COAST EV IMPLEMENTATION PROJECT

LIBRARY
351 MAIN ST, WEAVERVILLE, CA
VICINITY

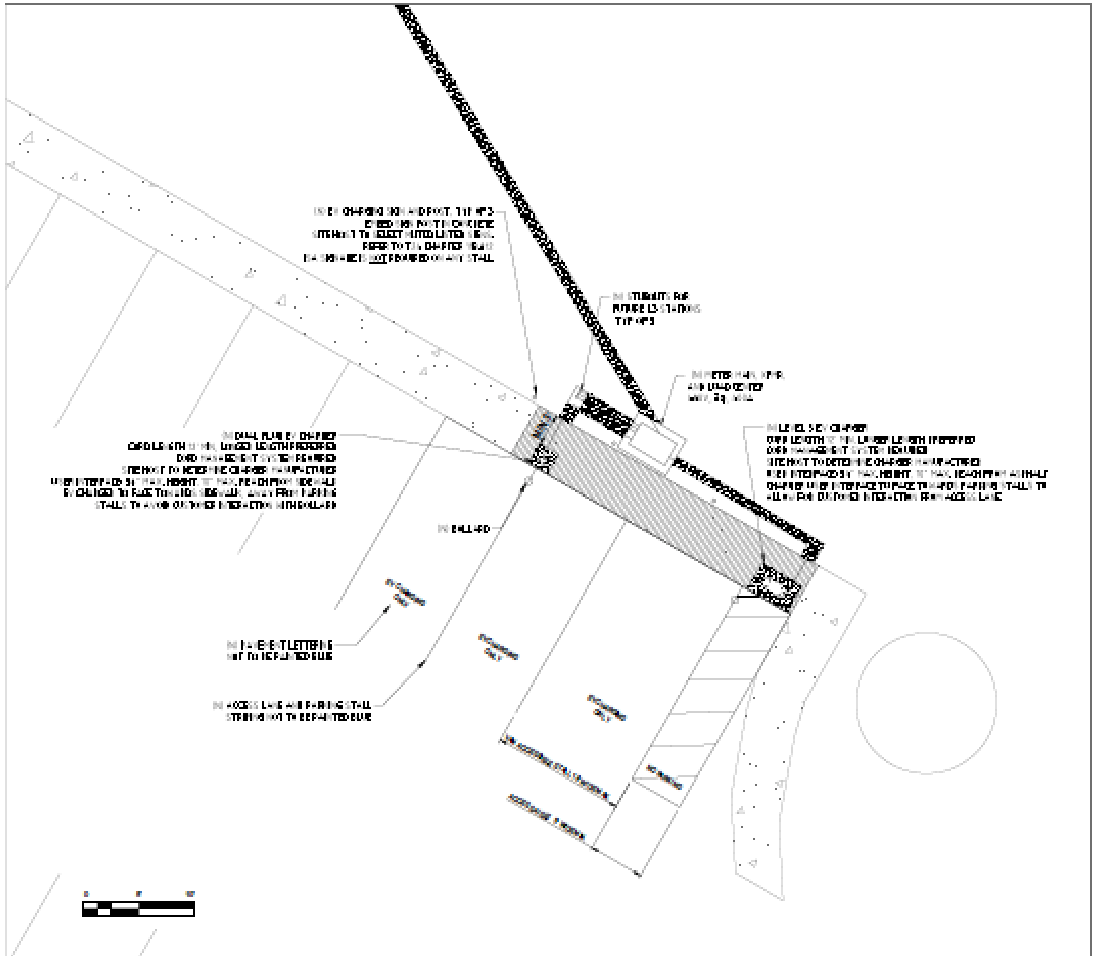
Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

SHEET NOTES

- (N) 480VAC 3ϕ UTILITY XFMR TO BE SIZED TO SUPPORT (N) 400A LOAD PANEL. MAJORITY OF THIS LOAD IS ASSOCIATED WITH EXPECTED FUTURE LOAD SUPPORTED BY STUBOUTS.
- PROPOSED DESIGN PLACES A 25KVA STEP DOWN XFMR AT THE LOAD CENTER TO PROVIDE 208 VAC OR 240 VAC TO LEVEL 2 CHARGER AND 120 VAC TO LEVEL 3 CHARGER'S PAYMENT MODULE.
- LOAD CENTER TO HAVE SUFFICIENT PANEL CAPACITY TO SUPPORT UP TO THREE ADDITIONAL FUTURE LEVEL 3 CHARGERS.
- NO SUPPLEMENTAL LIGHTING IS INCLUDED. CONTRACTOR TO DETERMINE IF SUPPLEMENTAL LIGHTING IS NEEDED.



EXAMPLE SINGLE LINE DIAGRAM
(DEPENDENT ON SELECTED CHARGER MANUFACTURER)



PRELIMINARY
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SCHATZ ENERGY RESEARCH CENTER
HUMBOLDT STATE UNIVERSITY

REV	DATE	DESCRIPTION
3	[illegible]	REVISION
2	[illegible]	REVISION
1	[illegible]	10% ENGINEERING DESIGN

NORTH COAST EV IMPLEMENTATION PROJECT

LIBRARY
351 MAIN ST, WEAVERVILLE, CA
ENLARGEMENT

Figure 9: Ten Percent Engineering Designs and Probable Costs (cont'd)

Opinion of Probable Costs

Client: Trinity County Library in Weaverville
Purpose: Cost estimate for the preliminary design of an electric vehicle charging station install
Project: ARV-16-066 PEV Readiness NorthCoast
Prepared by: Schatz Energy Research Center

Preliminary design costs based on:
New meter 400 A load center
Trench from power pole to new metered load center, except for when running conduit through library ceiling
Trench from new metered load center to EV charger
Installation of a smart dual level 2 EV charger (substitute a basic dual charger to reduce costs, if needed)
Installation of a smart single Level 3 EV charger (substitute a basic dual charger to reduce costs, if needed)
Installation of two protective bollard for electrical equipment, while allowing for easily accessing station by user
Installation of code required signage
Utility to install cable between power pole and load center

RS Means Division	Description	Qty	Unit	Material	Labor	Equipment	Subcontract (Total + O&P)	Which pricing to use?	Total	Sales Tax	Notes
2: Existing Conditions - Demolition	Demolish, remove pavement and curb, concrete to 6" thick, hydraulic hammer, mesh reinforced	23.0	SY	$ -	$ 6.70	$ 5.00	$ 16.75		$ 382	$ -	Existing sidewalk
	Selective demolition, load, haul, dump and return, 0 - 50' haul, hand carried	11.5	CY	$ -	$ 28.00	$ -	$ 56.50		$ 643	$ -	Material removal
	Selective demolition, haul, per mile, up to 8 C.Y. truck (CY times round trip miles)	34.5	CY	$ -	$ 0.28	$ 0.09	$ 1.07		$ 37	$ -	County solid waste transfer station in Weaverville, 1.5 miles one way
	Selective demolition, dump charges, dump charges - load disposal at HWMA rates	17.3	Ton	—	—	—	$ 275.41		$ 2,953	$ -	Dump charges
								Division 2 Subtotal	$ 4,015		
3: Concrete	Concrete forming, structural cast-in-place concrete forming, forms in place, slab on grade, edge forms, wood, 4 use, on grade, to 6" high	88	LF	$ 0.85	$ 3.88	$ -	$ 4.04	Total with O&P	$ 356	$ -	Form for sidewalk sections Perimeter of west section of sidewalk (8.5' x 4.5') and east section of sidewalk (28' x 8')
	Heavyweight concrete, Ready mix, delivered, local aggregate, sand, Portland cement (Type I), 3000 psi	3.3	CY	$ 102.00	$ -	$ -	$ 113.00	Total with O&P	$ 353	$ -	Concrete for sidewalk sections
	Placing concrete, labor and equipment to place, level and consolidate, Footing, continuous, shallow, direct chute (> 5 CY)	3.3	CY	$ -	$ 18.65	$ 0.62	$ 24.50	Total with O&P	$ 77	$ -	Labor for sidewalk sections
	Concrete cutting, flat concrete/asphalt sawing, saw cut concrete slabs, plain, up to 3" deep	166	LF	$ 0.14	$ 3.88	$ 0.68	$ 24.50	Total with O&P	$ 4,018	$ -	Cutting existing pavement and concrete where needed
	Concrete core drilling, reinforced concrete slab, up to 6" thick, incl bit, layout, and setup, 2" diameter hole	2	EA	$ 0.28	$ 43.00	$ 7.00	$ 72.50	Total with O&P	$ 145	$ -	Holes in asphalt for 2 bollards
								Division 3 Subtotal	$ 4,848		
5: Metals	Cast in place anchor bolts, 4 bolt pattern set, job built, L type incl nuts and washers, 6" long, 1/2" dia	2	SET	$ 8.20	$ 21.33	$ -	—	Unit costs	$ 59	$ 1.33	Charger mounting hardware
								Division 5 Subtotal	$ 59		
10: Specialties	Exterior signs, 24 ga. Alum. Bracket mounted, double face, 12" x 30"	9	EA	$ 85.70	$ 18.82	$ -	—	Unit costs	$ 929	$ 66.60	2 way-finding signs, 3 EV charging only signs, 3 parking time limit signs, 1 Van Accessible sign
	Traffic signs, steel post, galvanized, 10'0", upright, bolted.	4	EA	$ 48.80	$ 6.98	$ 3.84	—	Unit costs	$ 238	$ 15.94	1 pole for each stall, 1 pole for way-finding sign
								Division 10 Subtotal	$ 1,248		
26: Electrical	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded, #8	0.93	CLF	$ 38.50	$ 54.50	$ -	$ 124.00	Total with O&P	$ 115	$ -	4 x 8 AWG: load center to L2 = 14' x 4 = 56' (2 plugs, 2 wires each); ground wires = 12 + 13 + 14' + 28' = 37', total = 93'
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, aluminum type THHN stranded 750 kcmil	6.9	CLF	$ 695.00	$ 274.00	$ -	$ 1,175.00	Total with O&P	$ 8,084	$ -	4x 750 kcmil from utility 480V transformer to load center 344' x 2 = 688'
	Common work results for electrical, low-voltage electrical power conductor and cables, Wire, 600 volt, copper type THWN-THHN, stranded #8	0.69	CLF	$ 37.50	$ 47.50	$ -	$ 165.00	Total with O&P	$ 114	$ -	3 x 6 AWG for 480V service load center to L3 = 23' * 3 = 69'
	3" dia. conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	90	LF	$ 12.45	$ 13.50	$ -	$ 32.50	Total with O&P	$ 2,925	$ -	Conduit for utility's wires from power pole base to transformer = 90' (includes 18" in and out of trench)
	3" dia. conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	284	LF	$ 12.45	$ 13.50	$ -	$ 32.50	Total with O&P	$ 9,230	$ -	Underground conduit for utility's wires from 480V transformer to load center = 284' (includes 18" in and out of trench)
	Conduit to 15' high, includes 2 terminations, 2 elbows, 11 beam clamps and 11 couplings per 100LF: rigid galvanized steel (RGS) 3" diameter	60	LF	$ 46.00	$ 29.00	$ -	$ 96.00	Total with O&P	$ 5,760	$ -	Outdoor above ground conduit for utility's wires from up and down building = 60' (assumed building has 30' height)
	1" dia. conduit, in trench, including terminations, fittings, supports, Sched 40 PVC	64.0	LF	$ 2.11	$ 3.50	$ -	$ 7.55	Total with O&P	$ 483	$ -	Conduit from meter center to the charger, including stubouts
	Pull Boxes, NEMA 3R, Type SC, raintight & weatherproof, 12" L x 12" W x 6" D	2	EA	$ 54.50	$ 87.50	$ -	$ 191.00	Total with O&P	$ 382	$ -	Pull boxes
	Meter center and sockets, meter center, main fusible switch, 3P, 3W, 120/240 Volt, 400 amp	1	EA	$ 3,300.00	$ 545.00	$ -	$ 3,845.00	Unit costs	$ 3,845	$ 247.50	New load center
	Smart metering, in panel, three phase, 120/208V, 400A	1	EA	$ 690.00	$ 93.50	$ -	$ 900.00	Unit costs	$ 784	$ 56.93	Meter
	Enclosed (NEMA 1) circuit breaker, 600V, 3P, 400A	1	EA	$ 2,775.00	$ 545.00	$ -	$ 3,800.00	Total with O&P	$ 3,800	$ -	Main load center breaker
	Panelboard and load center circuit breakers, 277 volt, 1 pole, 15 - 50A	1	EA	$ 44.00	$ 54.50	$ -	$ 131.00	Total with O&P	$ 131	$ -	Optional lighting
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 70 - 225 amp	1	EA	$ 780.00	$ 190.00	$ -	$ 1,150.00	Total with O&P	$ 1,150	$ -	Breaker for L3
	Panelboard and load center circuit breakers, 208Y - 240VAC, 3 pole, 100A (local estimate)	1	EA	$ 375.24	$ 122.00	$ -	$ 565.24	Total with O&P	$ 565	$ -	Step-down after breaker
	Panelboard and load center circuit breakers, 120 volt, 1 pole, 15-50 amp	1	EA	$ 16.50	$ 44.00	$ -	$ 84.00	Total with O&P	$ 84	$ -	Breaker for 120V service to L3
	Panelboard and load center circuit breakers, 480 volt, 3 pole, 40 amp (local estimate)	1	EA	$ 666.54	$ 190.00	$ -	$ 1,024.54	Total with O&P	$ 1,025	$ -	step-down after breaker
	Panelboard and load center circuit breakers, 240 volt, 2 pole, 15-50 amp	2	EA	$ 86.00	$ 54.50	$ -	$ 122.00	Total with O&P	$ 244	$ -	Breakers for 12 plugs.
								Division 26 Subtotal	$ [illegible]		
31: Earthwork	Excavating Utility Trench, common earth, chain trencher and backfill by hand including compaction, 16" wide, 18" deep	216	LF	$ 0.52	$ 0.48	$ 0.87	$ 1.28	Total with O&P	$ 276	$ -	Trench length = 29'+66'+16'+125'=216'
	Aggregate base for trench backfill	20.0	CY	$ 14.25	$ -	$ -	—	Unit costs	$ 285	$ 20.31	Trench depth is 20" (bottom 4 inches are sand, but assumed same cost as AB)
	Structural excavation for minor structures, hand pits to 6' deep, heavy soil or clay	2.0	BCY	$ -	$ 75.00	$ -	$ 116.00	Total with O&P	$ 232	$ -	For detailed shoveling while trenching
								Division 31 Subtotal	$ 793		
32: Exterior Improvements	Pavement Parking Markings, lines on pavement, parking stall, paint white, 4" wide, small quantities	4	STALL	—	—	—	$ 120.75	Total with O&P	$ 483	$ -	3 EV spaces + access aisle
	Pavement Parking Marking, painted letter, 6"	48	EA	—	—	—	$ 11.50	Total with O&P	$ 552	$ -	EV PARKING ONLY: 11 letters x 3 stalls = 33; NO PARKING: 9 letters; Total: 48 letters
	Metal Parking Bumpers, Pipe Bollards, conc filled, paint, 8' L x 4' D hole, 6" DIA	2	EA	$ 322.75	$ 52.50	$ 18.21	—	Unit costs	$ 1,786	$ 130.77	
								Division 32 Subtotal	$ 2,821		
EV Charger	Dual, Level 2 Smart Charger	1	EA	$ 7,500.00	$ -	$ -	—	Unit costs	$ 7,500	$ 602.21	
	Level 3 Smart Charger	1	EA	$ 35,000.00	$ -	$ -	—	Unit costs	$ 35,000	$ 2,887.50	
								Equipment Subtotal	$ 7,500		
Utility Cost	PG&E: Electric Service Connection - engineering, tie-in, distribution line installation	1	EA	$ -	$ -	$ -	$ 2,000.00	Total with O&P	$ 2,000	$ -	Assumed that Trinity Power Authority will cover the costs for the transformer upgrade Assumed that Trinity PUD costs are similar to PG&E
								Utility Subtotal	$ 2,000		

Source: RSMeans, 58th annual edition, 2018
Notes: Material, Labor and Equipment Costs are for General Contractor, no markups

RS Means descriptions of work to be performed is limited, not all line item specifications are exact for this level of cost estimate.
Refer to design drawings and general or electrical contractor for final design specifications

Abbreviations:
CLF Hundred linear feet
MSF Thousand square feet
LF Linear foot
EA Each
SY Square yard
STALL Parking stall
BCY Bank Cubic Yards

Construction and Equipment Subtotal		$ 61,361
General Contractor General Requirement (access, project clean up, testing, etc.)	8%	$ 4,905
Sales Tax	8.25%	$ 4,085
Subtotal		$ 70,352
Contingency	25%	$ 17,588
Subtotal		$ 87,750
Bonds ($/1000 per RS Means)	$13.00	$ 1,153
Subtotal		$ 88,944
Weighted Average Total Location Adjustment Factor for Eureka CA (%)	108.4	$ 7,463
Construction and Equipment Total		$ 96,307
Construction Administration	7%	$ 6,741
Design Bidding, Construction Admin Assistance (consultant)	20%	$ 19,261
Grand Total		$ 122,309

Source: Redwood Coast Energy Authority

Appendix G:
Pictures of EVCS Trailblazing Signs

Figure 10 shows pictures of electric vehicle charging station trailblazing signs.

Figure 10: EVCS Trailblazing Signs

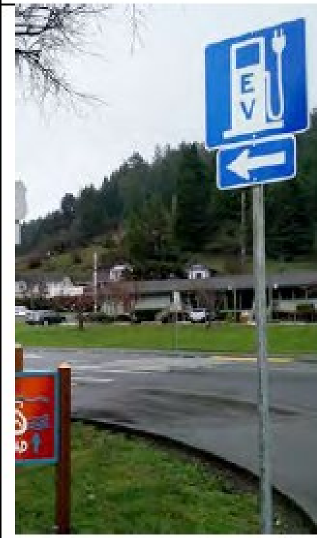
Rio Dell

Main and Berkeley

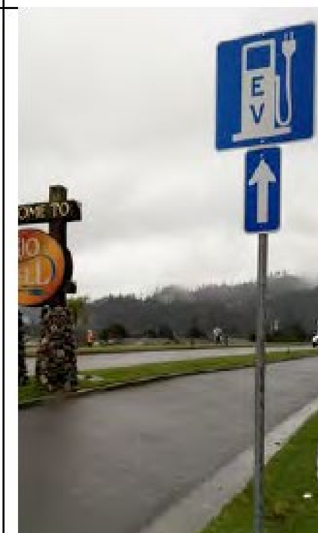
Main

Main and Ash

Main and Davis



Main and Belleview



Fortuna

11th

Main and 11th

Main and 7th

Figure 10: EVCS Trailblazing Signs (cont'd)

Loleta

Singley Rd

Eureka

C St.

Arcata F St.

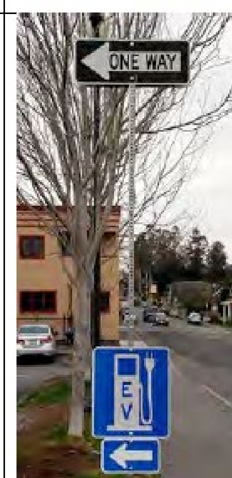
Sunset and H St.

H St. and 11th St.

8th and H St.

F St.

Entrance to Lot



F St. Parking Lot

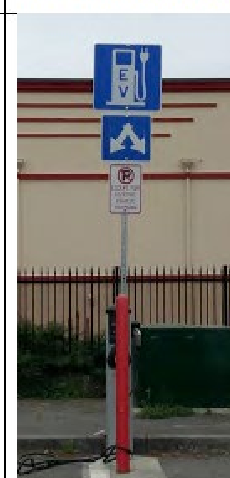


Figure 10: EVCS Trailblazing Signs (cont'd)

Arcata Technology Center			
K St.	K St.	H St. and 9th	K St.
			

McKinleyville			
School Rd.	School Rd. and Central Ave.	Central Ave.	Central Ave and City Center
			

Source: Redwood Coast Energy Authority

Appendix H: Media Reports

Figure 11 shows various media reports promoting the awareness and adoption of PEVs.

Figure 11: Media Reports

REDWOOD COAST
EnergyAuthority

County of Humboldt • Arcata • Blue Lake • Eureka • Ferndale • Fortuna • Rio Dell • Trinidad • Humboldt Bay Municipal Water District

September 8, 2016

To: Lindsee Tanimoto
From: Dana Boudreau
Subject: ARV-14-046 Task 2.5 Media Report

This memo serves as the summary for ARV-14-046, Task 2.5 "PEV Awareness". The goal of Task 2.5 is to promote PEV adoption through public and fleet operator outreach and education campaigns. The subtasks included:

- Conduct 5+ public ride and drive events with local auto dealers
- Conduct PEV education and outreach through tabling at public events and festivals
- Public periodic newsletters that include PEV consumer info; local PEV owner testimonials, local successes such as fleet adoption or new EVCS, etc.
- Leverage established media relationships to garner TV, radio, print, and online earned-media coverage
- Maintain an online presence through the RCEA webpage and social media
- Prepare and submit presentations to community organizations (i.e. Chambers of Commerce, Rotary Clubs, etc.)
- Make presentations to elected officials and city staff
- Provide technical assistance to municipal and commercial fleet operators to evaluate vehicle operations using the PEV Fleet Evaluation Tool
- Work with municipalities to adopt green fleet policies and include green fleet activities in their climate action plans
- Publicize and promote local green fleet activities

A timeline of PEV Awareness activities and publicity can be found in the next section.

Please contact the following with any questions regarding this matter:

Dana Boudreau, Operations Manager
707-269-1700, dboudreau@redwoodenergy.org

Reference: California Energy Commission Agreement #: ARV-14-046

www.redwoodenergy.org
633 3rd Street – Eureka, CA 95501
707.269.1700 (local) – 800.931-RCEA (toll-free) – 707.269.1777 (fax)

Figure 11: Media Reports (cont'd)

Events

2014

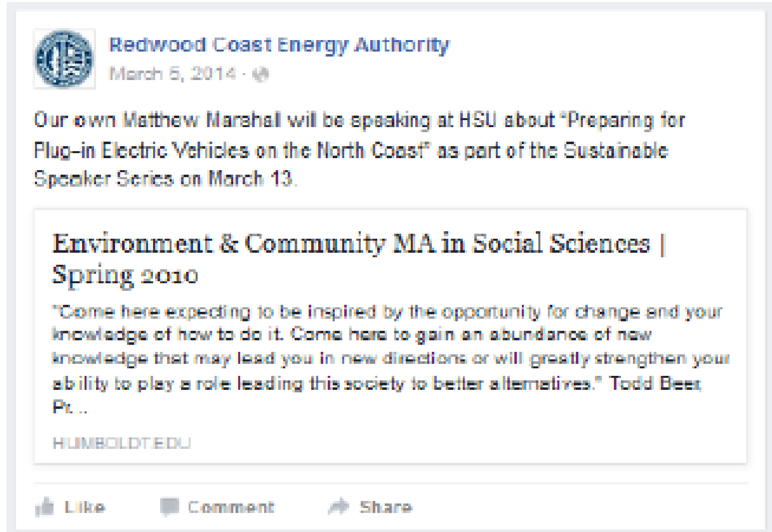
March 13, 2014: Sustainable Future Speaker Series

Redwood Coast Energy Authority presented at Humboldt State University as a part of the Spring Sustainable Future Speaker Series.

Link:

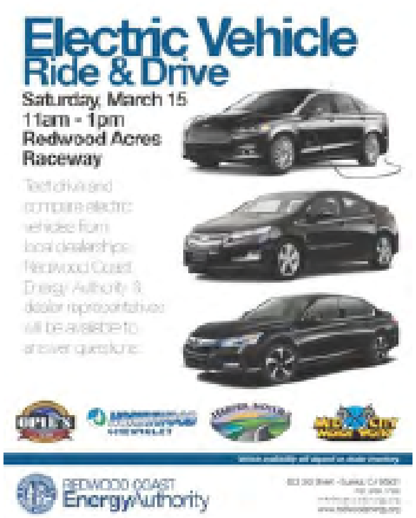
http://www2.humboldt.edu/envcomm/speaker_series/spring_2014/

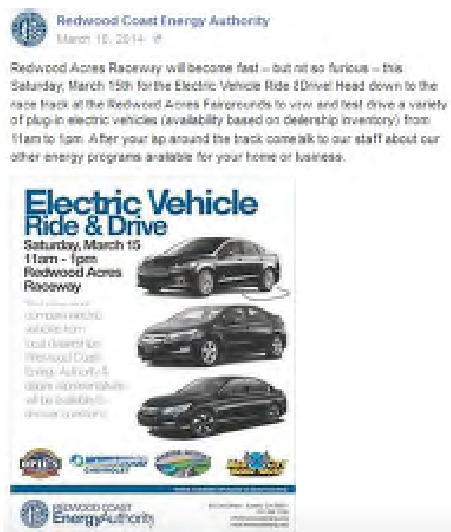
"Preparing for Plug-in Electric Vehicles on the North Coast"



March 15, 2014: Electric Vehicle Ride & Drive

This event allowed members of the public to test-drive electric vehicles at Redwood Acres. It was successful, with over 100 attendees.





https://lostcoastoutpost.com/2014/mar/14/you-absolutely-want-drive-all-electric-cars/
https://lostcoastoutpost.com/lowdown/events/electric-vehicle-ride-drive/

Figure 11: Media Reports (cont'd)

April 26, 2014: Earth Day Celebration at the Eel River Brewing Company

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Eel River Brewing Company Earth Day Celebration.

Link:
http://redwoodenergy.org/events/community-events

April 27, 2014: Earth Day Celebration at Sequoia Park Zoo, Eureka Natural foods, and Humboldt Electric Vehicle Association's 7th Annual All Electric Vehicle Show

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Sequoia Park Zoo and Eureka Natural Foods Earth Day Celebrations as well as Humboldt Electric Vehicle Association's 7th Annual All Electric Vehicle Show.

June 5, 2014: Drive the Future Now Event at BMW of Humboldt Bay

The Redwood Coast Energy Authority partnered with BMW of Humboldt Bay to give community members the opportunity to sign up to drive the BMW i3. RCEA was also invited to table and present alternative transportation outreach material and interaction at the event.

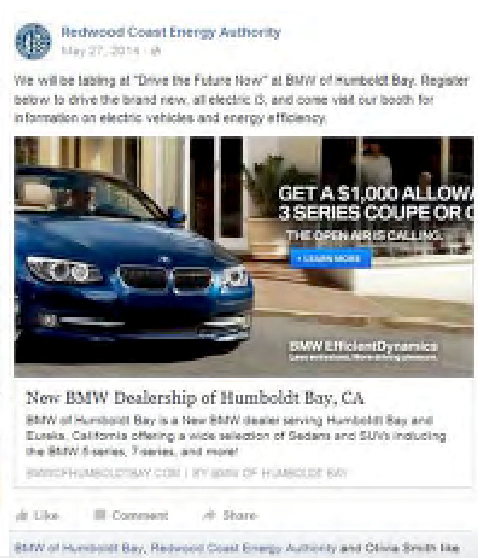


Figure 11: Media Reports (cont'd)

June 7, 2014: Sustainable Living Exposition

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Sustainable Living Exposition.

Links:

http://www.planitgreenhumboldt.org/2014-sustainable-living-expo-building-green-communities.html

http://www.eventbrite.com/e/sustainable-living-expo-2014-building-green-communities-tickets-8486620711#

http://www.northcoastjournal.com/humboldt/sustainable-living-expo/Event?oid=2607448

http://www.redwoods.info/printrecord.asp?id=6314http://www.meetup.com/The-North-Bay-Intentional-Communities-Meetup-Group/events/181986842/

June 15, 2014: Trinidad Fish Festival

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Trinidad Fish Festival.

http://eventful.com/trinidad_ca/events/trinidad-fish-festival-/E0-001-064485706-9

https://www.facebook.com/events/677717992277562/

https://allevents.in/trinidad/trinidad-fish-festival-2014/677717992277562#

http://www.trinidadwatersheds.org/wp-content/uploads/2015/01/June-2014-TBWC-News.pdf

June 19, 2014: Electric Vehicle Ride and Drive

The Redwood Coast Energy Authority hosted an electric vehicle Ride and Drive and invited local electric vehicle owners and dealerships to help spread the word about EVs. People were able to come to the event and drive EVs around the Redwood Acres race track as part of the Redwood Acres Fair.

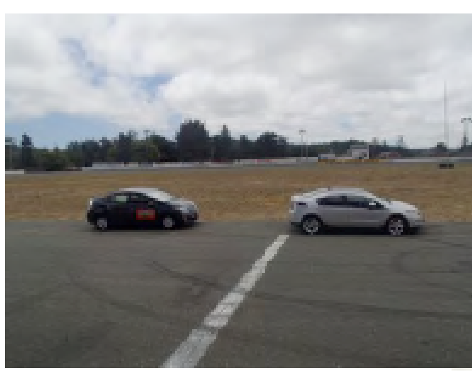
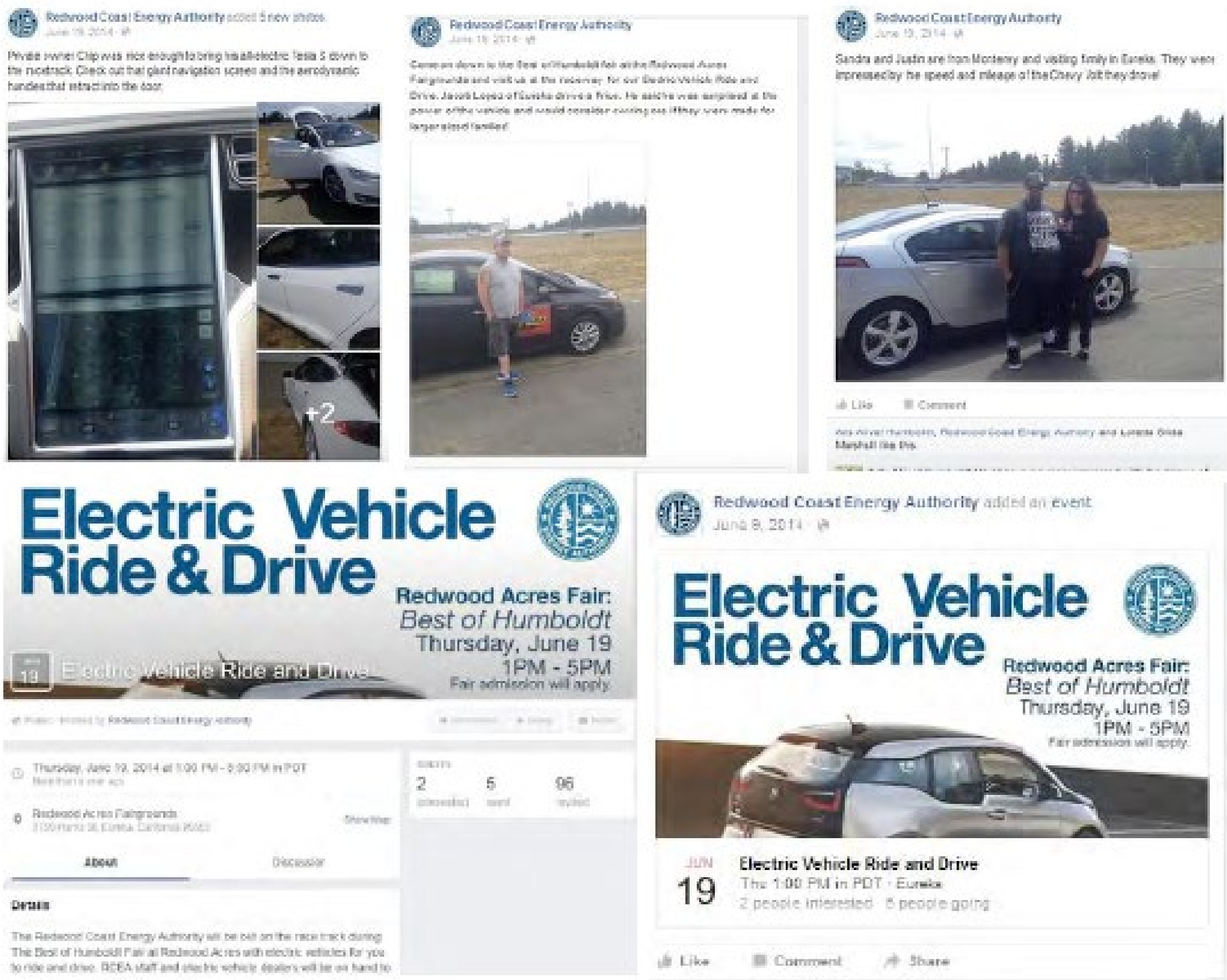


Figure 11: Media Reports (cont'd)



http://www.northcoastjournal.com/humboldt/electric-vehicle-ride-and-drive/Event?oid=2634612

July 13, 2014: Annie and Mary Day

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Annie and Mary Day celebration.

Links:

https://www.facebook.com/events/590940224360684/

http://www.momsacrossamerica.com/nongmolaurieo/annie _mary_day_celebration

Figure 11: Media Reports (cont'd)

July 19, 2014: Humboldt Folklife Festival

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Humboldt Folklife Festival.

http://www.humboldtfolklife.org/content/humboldt-folklife-festival-2014

November 9, 2014: Intertribal Gathering and Elders Dinner

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Intertribal Gathering and Elders Dinner.

https://ncidc.org/events/intertribal-gathering-and-elders-dinner-2014

http://www.redlakenationnews.com/story/2014/11/03/news/33rd-annual-northwest-intertribal-gathering-and-elders-dinner-scheduled-for-november-8th-2014/28606.html

http://www.redwoods.info/showrecord.asp?id=3862

http://discovertheredwoods.com/events/intertribal-gathering-and-elders-dinner

October 4, 2014: Apple Harvest Festival

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Apple Harvest Festival.

http://redwoodenergy.org/events/community-events

September 20 and 21, 2014: North Country Fair

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the North Country Fair.

http://www.sameoldpeople.org/entertainment-2014.html

August 30, 2014: Bigfoot Days

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Bigfoot Days.

http://bigfootevidence.blogspot.com/2014/06/willow-creeks-bigfoot-festival.html

Figure 11: Media Reports (cont'd)

2015

April 25, 2015: Anniversary and Earth Day Celebration

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Anniversary and Earth Day Celebration at Eureka Natural Foods.

http://www.northcoastjournal.com/humboldt/anniversary-and-earth-day-celebration/Event?oid=2875831

April 26, 2015: Sequoia Park Zoo Party for the Planet

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Party for the Planet event at Sequoia Park Zoo.

http://www.northcoastjournal.com/humboldt/party-for-the-planet/Event?oid=2877952

http://www.times-standard.com/article/NJ/20150423/FEATURES/150429936

http://humguide.com/pipermail/norcan_humguide.com/2015-April/002735.html

May 16, 2015: Redwood Acres Home, Sports and Recreation Show

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Redwood Acres Home, Sports, and Recreation Show.

http://www.northcoastjournal.com/humboldt/home-sports-and-recreation-show/Event?oid=2925086

June 6, 2015: Pony Express Days Festival

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Pony Express Days Festival.

http://mckinleyvillechamber.com/pony-express-days

June 14, 2015: Electric Vehicle Car Show

The Redwood Coast Energy Authority partnered with the Mad River Brewing Company and Blue Lake Climate Action Team to put on an Electric Vehicle Car Show at the Mad River Brewing Company and Tap Room.

Figure 11: Media Reports (cont'd)

Links:

https://www.facebook.com/events/117222541942381/

https://issuu.com/ncjournal/docs/issuu_061115

July 4, 2015: Old Town Fourth of July Celebration

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Eureka Main Street's Old Town 4th of July Celebration.

http://eurekamainstreet.org/node/862

http://www.times-standard.com/article/NJ/20150629/FEATURES/150629858

July 11, 2015: Humboldt Roller Derby - July Bout

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Humboldt Roller Derby's July Bout.

http://www.redwoodenergy.org/events/community-events

July 12, 2015: Annie and Mary Days

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Annie and Mary Days celebration.

http://sunnybluelake.com/annie-and-mary-days/

Figure 11: Media Reports (cont'd)

August 7, 2015: Hoopa Valley Tribe Sovereign Days

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Hoopa Sovereign Days.

Link:

https://www.hoopa-nsn.gov/wp-content/uploads/2015/07/2015SovereignDaysFlyer.pdf

August 22, 2015: Klamath Salmon Festival

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Klamath Salmon Festival.

http://www.times-standard.com/article/NJ/20150819/FEATURES/150819823

https://www.facebook.com/events/120203388318369

http://redwoodhotelcasino.com/2015/05/01/2015-klamath-salmon-festival/

http://visityurokcountry.com/the-yurok-tribe-presents-the-2015-klamath-salmon-festival/

August 21-23, 2015: Humboldt County Fair

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Humboldt County Fair.

http://www.times-standard.com/article/NJ/20150729/SPORTS/150729826

http://www.redwoodtimes.com/article/NK/20150518/NEWS/150519927

Figure 11: Media Reports (cont'd)

September 3, 2015: Sustainable Future Speaker Series

Redwood Coast Energy Authority presented at Humboldt State University as a part of the Fall Sustainable Future Speaker Series.

http://www2.humboldt.edu/envcomm/speaker_series/fall_2015/

"RePowering Humboldt: Progress Toward Implementing A Local Community Choice Aggregation Program"

September 5, 2015: Bigfoot Days

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at Bigfoot Days.

http://ww2.kqed.org/news/2015/10/20/small-town-big-legend-willow-creek-celebrates-bigfoot/

September 19, 2015: Electric Vehicle Ride & Drive

The Redwood Coast Energy Authority hosted an electric vehicle Ride and Drive and invited local dealerships to bring electric vehicles and help spread the word about EVs. People were able to come to the event and drive EVs at the Arcata Community Center, as well as ride a Zero Emission Vehicle Shuttle providing transport from the North Country Fair event.

http://www.northcoastjournal.com/humboldt/electric-vehicle-ride-and-drive/Event?oid=3293401

September 20-21, 2015: North Country Fair

The North Country Fair is an annual two-day festival held in Arcata annually, and featured alternative fuel vehicles from dealerships. The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public.

http://sameoldpeople.org/index.html

Figure 11: Media Reports (cont'd)

October 3, 2015: Apple Harvest Festival

The Redwood Coast Energy Authority provided alternative transportation outreach material and interacted with the public at the Apple Harvest Festival.

http://clendenensciderworks.com/apple-harvest-festival/

http://fortunachamber.com/2015-apple-harvest-festival-schedule-events

October 24, 2015: Electric Vehicle Ride & Drive

This event was originally scheduled as a ride and drive and expo, but owing to lack of dealer participation it became exclusively an expo. Private parties provided a good diversity of alternative vehicles.

Figure 11: Media Reports (cont'd)

October 24-25, 2015: Sustainable Living Expo

The Redwood Coast Energy Authority partnered with Plan It Green to showcase electric, hydrogen, and biofuel vehicles at the Sustainable Living Expo at Redwood Acres.

Link:

http://www.planitgreenhumboldt.org/2015-sustainable-living-expo.html

2016

February 26, 2016: Alternative Fuels Symposium

The Redwood Coast Energy Authority partnered with Schatz Energy Research Center and Caltrans to host an alternative fuels symposium and clean energy coalition meeting held in Eureka and featuring fleet electric vehicles from Caltrans.

http://www.krcrtv.com/north-coast-news/news/symposium-on-clean-energy-coalition-held-in-eureka/38200620

April 23, 2016: Eureka Natural Foods EV Expo, Eureka, CA

The Redwood Coast Energy Authority partnered with Eureka Natural Foods for their annual Earth Day celebration. Local electric vehicle owners were invited to showcase their EVs. This event provided three Teslas, including the new Model X, for attendees to discuss with private owners.

Figure 11: Media Reports (cont'd)

April 23 & 24, 2016: Home, Garden, and Recreation Show EV Expo, Eureka, CA

The Redwood Coast Energy Authority invited local dealerships to showcase their electric vehicles at the Home, Garden, and Recreation Show at Redwood Acres.

April 28, 2016: Sustainable Future Speaker Series

The Redwood Coast Energy Authority presented at Humboldt State University as a part of the Spring Sustainable Future Speaker Series.

http://www2.humboldt.edu/envcomm/speaker_series/spring_2016/

"Guiding Northwest California Towards Alternative Transportation Fuels: A Roadmap to 2020 and Beyond"

Figure 11: Media Reports (cont'd)

April 28, 2016: St. Joseph's Hospital EV Charging Ribbon Cutting Ceremony, Eureka, CA

The Redwood Coast Energy Authority conducted *a ribbon cutting ceremony at St. Joseph's Hospital in celebration of the electric vehicle charging stations (EVCS) installed, as well as the growth of the RCEA charging network. Several media outlets covered the event.*

http://calenergycommission.blogspot.com/2016/05/electric-vehicle-chargers-installed-in.html

http://www.times-standard.com/article/NJ/20160428/NEWS/160429855

http://ngtnews.com/ev-charging-network-grows-on-north-california-coast-with-nine-new-stations/

http://kiem-tv.com/video/st-joseph-hospital-unveils-new-charging-station

June 4, 2016: Pony Express Days Electric Vehicle Expo, McKinleyville Chevrolet and Buick

The Redwood Coast Energy Authority partnered with McKinleyville Chevrolet and Buick dealership to provide information about electric vehicles at Pony Express Days event. On display were 1 BMW i3, 1 BMW i8, 2 Volts, and 1 Nissan Leaf.

Figure 11: Media Reports (cont'd)

July 4, 2016: Eureka Main Street 4th of July Festival Electric Vehicle Car Show

The Redwood Coast Energy Authority invited local electric vehicle owners to showcase their EVs at Eureka Main Street's annual 4th of July Festival. An estimated 1450 impressions were made during this expo-style event. On display and changing throughout the day were a Ford Focus EV, 2016 Nissan Leaf, 2 Tesla Model Xs, 1 Tesla Model S, 1 Chevy Spark EV.

http://www.northcoastjournal.com/humboldt/fourth-of-july-electric-vehicle-car-show/Event?oid=3850805

http://www.northcoastjournal.com/AEBlog/archives/2016/07/05/two-parties-on-the-fourth

Figure 11: Media Reports (cont'd)

Newsletter

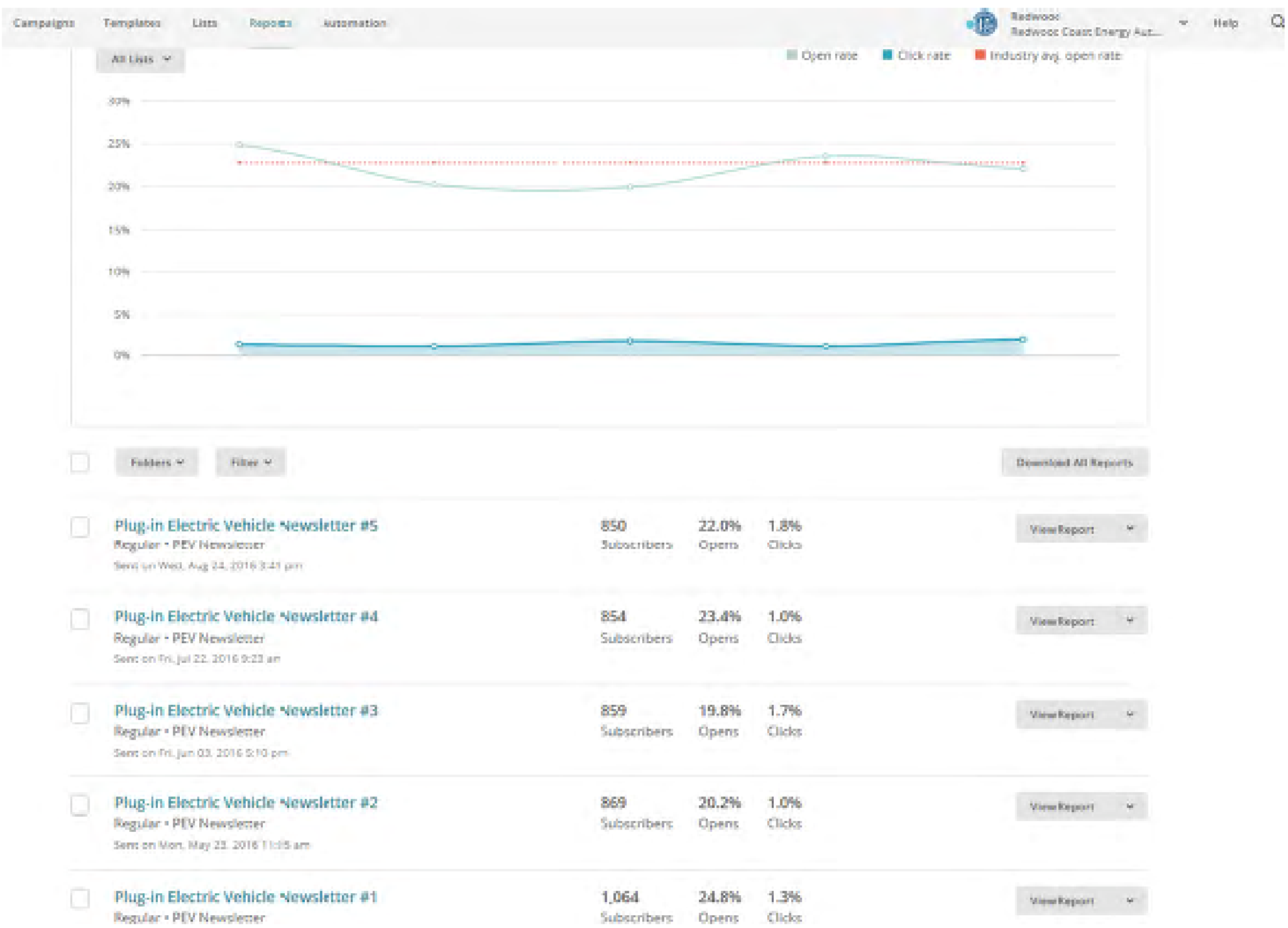
RCEA continued development and distribution of the North Coast PEV Awareness Newsletter series to the general public. Distribution methods included:

- Email- MailChimp
- RCEA website- http://redwoodenergy.org/transportation/ev-readiness-planning
- Printed at outreach and tabling events

Number of MailChimp subscribers: 852

Progress: 5 out of 6 total newsletters distributed as of August 2016. The final newsletter will be released in October to coincide with the National Energy Awareness Month.

The main distribution method is by email using MailChimp. Based on analytics provided by MailChimp, our average open rate is about 22%, which compares favorably with industry averages.



Data retrieved 09/01/16

Figure 11: Media Reports (cont'd)

General Publicity

California Energy Commission

May 14, 2014: news release

News Release: California Awards Millions for Transportation, Environmental Research and School Energy Efficiency Projects

http://www.energy.ca.gov/releases/2014_releases/2014-05-14_funding_awards.html

April 28, 2016: California Energy Commission Facebook posting of St. Joseph Hospital EVCS ribbon cutting event.

California Energy Commission
April 28

The Redwood Coast Energy Authority dedicated 10 Level 2 electric vehicle charging stations today at nine sites in the North Coast region. The California Energy Commission awarded $300,000 for the chargers, including two at St. Joseph Hospital in Eureka where officials gathered for the dedication. The Energy Commission has funded more than 7,490 chargers throughout California, including rural areas to help the state reach its goal of 1.5 million zero-emission cars on roads by 2025. California is on the path to meet its climate change goals and air quality standards.

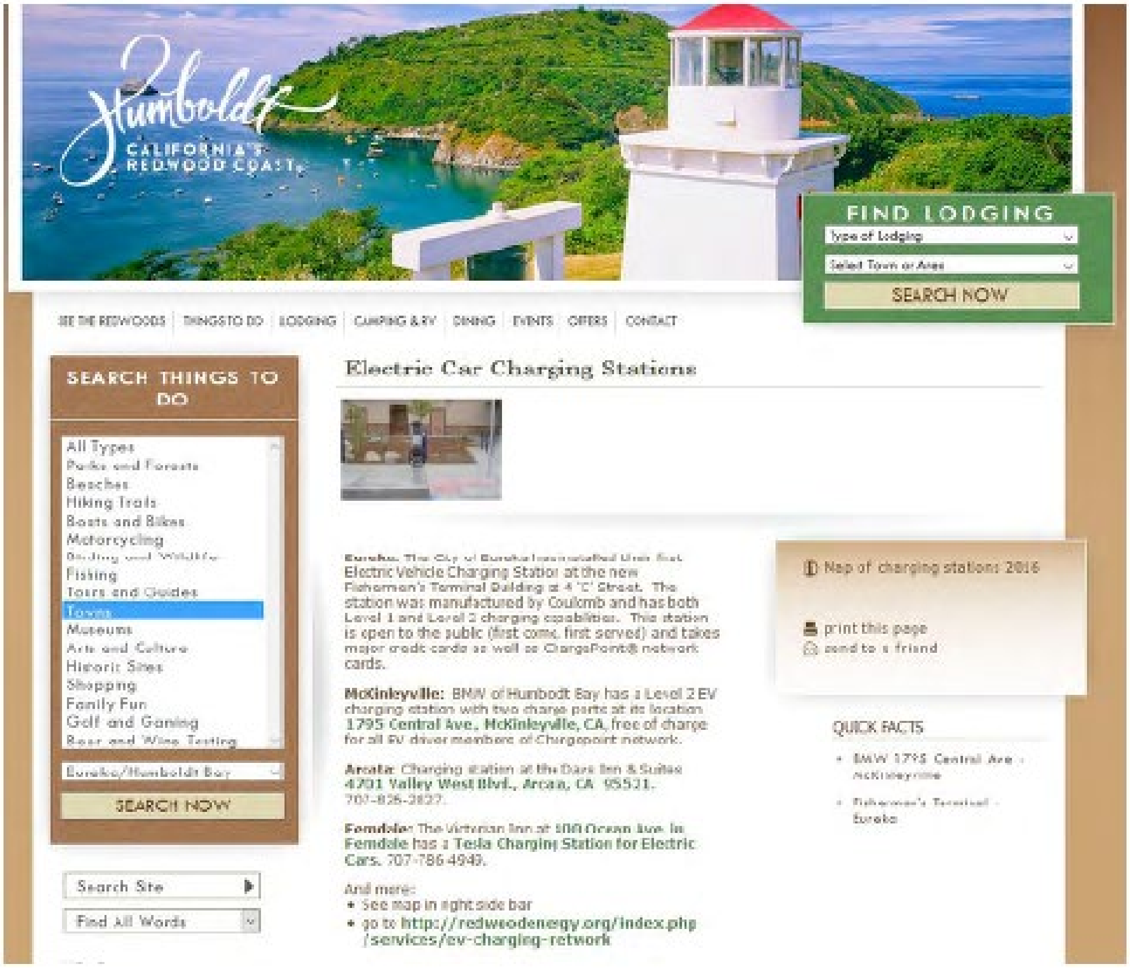
Like Comment

Eureka-Humboldt Visitors Bureau website

July 22, 2016: RCEA EV charging station network map placed on www.redwoods.info

http://redwoods.info/showrecord.asp?id=5691&source=Search%20Results

Figure 11: Media Reports (cont'd)



Lost Coast Outpost

https://lostcoastoutpost.com/lowdown/events/all-electric-vehicle-show/

News Channel 3

September 18, 2014: *Humboldt County celebrates National Drive Electric Week*

http://kiem-tv.com/video/humboldt-county-celebrates-national-drive-electric-week

February 17, 2015: *Eureka to get three electric vehicle charging stations in next two years*

http://kiem-tv.com/video/eureka-get-three-electric-vehicle-charging-stations-next-two-years

March 16, 2015: *Nine new electric car charging stations coming to the North Coast*

http://kiem-tv.com/video/nine-new-electric-car-charging-stations-coming-north-coast

Figure 11: Media Reports (cont'd)

Nine new electric car charging stations coming to the North Coast

NORTH COAST - Over 3,000 electric cars are estimated to be on North Coast roads within the next few years and that means, more charging stations are in the works.

Electric cars are becoming more popular and the North Coast is keeping up with the trend. Currently, Eureka, Arcata, Blue Lake and Redway all have plug-in charging stations for electric cars.

"I think it's important, so that new electric vehicle customers have comfort. People that are thinking about getting an electric car have comfort knowing they can charge up all over the county if their plans change in the middle of the day. There's no chance on them not being able to get home or something like that," said Alison Talbott, Chevrolet Volt electric car owner.

The Redwood Coast Energy Authority has received a $500,000 grant from the California Energy Commission to install more charging stations in the area.

"The state has very aggressive targets for getting electric vehicles on the road. They're looking at by 2025 or so to have about 3% of vehicles in California to be electric vehicles," said Matthew Marshall, RCEA Executive Director

October 19, 2015: *Electric vehicle charging station coming to Rio Dell*

http://kiem-tv.com/video/electric-vehicle-charging-station-coming-rio-dell

July 13, 2016: *EV charging corridor coming to Highway 101*
http://kiem-tv.com/video/ev-charging-corridor-coming-highway-101

NGT News

April 29, 2016: *EV Charging Network Grows with Nine New California Stations*
http://ngtnews.com/ev-charging-network-grows-on-north-california-coast-with-nine-new-stations/

Figure 11: Media Reports (cont'd)

North Coast Journal

April 17, 2014: *How Green is Humboldt?*

http://www.northcoastjournal.com/humboldt/how-green-is-humboldt/Content?oid=2537685

January 21, 2016: *Hot Streak*

http://www.northcoastjournal.com/humboldt/hot-streak/Content?oid=3524383

North Coast News (Channel 23)

November 17, 2015: *Two electric car chargers installed in Trinidad*

http://www.krcrtv.com/north-coast-news/news/two-electric-car-chargers-installed-in-trinidad/36511884

April 29, 2016: *Nine new electric vehicle charging stations in Humboldt County*
http://www.krcrtv.com/north-coast-news/news/nine-new-electric-vehicle-charging-stations-in-humboldt-county/39271966

May 12, 2016: *Electric public bus coming to Humboldt County*

http://www.krcrtv.com/north-coast-news/eureka-news/humboldt/electric-public-bus-coming-to-humboldt-county/33226032

October 20, 2016: *Electric car charging station to be installed in Rio Dell*

http://www.krcrtv.com/north-coast-news/news/electric-car-charging-station-to-be-installed-in-rio-dell/35954322

Figure 11: Media Reports (cont'd)

RCEA Facebook Posts

May 23, 2014

June 4, 2014

September 19, 2014

June 9, 2015

Figure 11: Media Reports (cont'd)

September 19, 2015

Redwood Coast Energy Authority at Arcata Sports Complex.
September 19, 2015

Tacos are here! Come on down and test drive an electric vehicle and get a free taco! National Drive Electric Week

October 21, 2015

Redwood Coast Energy Authority shared a link.
October 21, 2015

Electric car charging station to be installed in Rio Dell

A new electric car charging station is being introduced in the City of Rio Dell.

KRCRTV.COM | BY KRCR

Like Comment Share

McKeever Energy & Electric, Inc., Isaac Timm, Calder Johnson and 10 others like this.

1 share

December 8, 2015

Redwood Coast Energy Authority
December 8, 2015

After experiencing some technical difficulties, the GHD electric vehicle charger, located in their parking lot on the corner of 3rd and H Streets in Eureka, is back up and running! This ChargePoint station is always open to the public and part of the North Coast Plug-in EV Charging Network. Charge on!

April 29, 2016

Redwood Coast Energy Authority
April 29

"This is a major step forward for electric vehicles in Humboldt County because we really need the infrastructure up here. It's a great way to tackle green house gas emissions."

http://www.times-standard.com/.../getting-charged-up-about-el...

www.times-standard.com

Home â€" Getting charged up about electric vehicle stations Peter Lehman, Founding Director of the Schatz Energy Research Center at HSU, prepares to top off his electric car battery at the new charging station at St. Joseph Hospital in...

TIMES-STANDARD.COM

Figure 11: Media Reports (cont'd)

May 5, 2016	
	

RCEA Website

http://www.redwoodenergy.org/events

Times Standard

April 28, 2016: *Getting charged up about electric vehicle stations*
http://www.times-standard.com/article/NJ/20160428/NEWS/160429855

U.S. Climate Resilience Toolkit

July 6, 2016: *The Blue Lake Rancheria Tribe Undertakes Innovative Action to Reduce the Causes of Climate Change*

https://toolkit.climate.gov/taking-action/blue-lake-rancheria-tribe-undertakes-innovative-action-reduce-causes-climate-change

U.S. Department of Energy

February 27, 2015: *Leading the Charge: Jana Ganion Advances Blue Lake Rancheria's Climate Action Agenda*

http://energy.gov/indianenergy/articles/leading-charge-jana-ganion-advances-blue-lake-rancheria-s-climate-action

Figure 11: Media Reports (cont'd)

September 1, 2015: *Renewable Energy Vision and Development at Blue Lake Rancheria*

http://energy.gov/sites/prod/files/2015/09/f26/Jana%20Ganion%20-%20Blue%20Lake%20Rancheria.pdf

Source: Redwood Coast Energy Authority

Appendix I:
PEV Newsletters

Figure 12 shows several newsletters featuring plug-in electric vehicle information.

Figure 12: PEV Newsletters

NORTH COAST PLUG-IN ELECTRIC VEHICLE PROJECT JANUARY 2016 | NEWS & UPDATES

In This Issue

Welcome Message

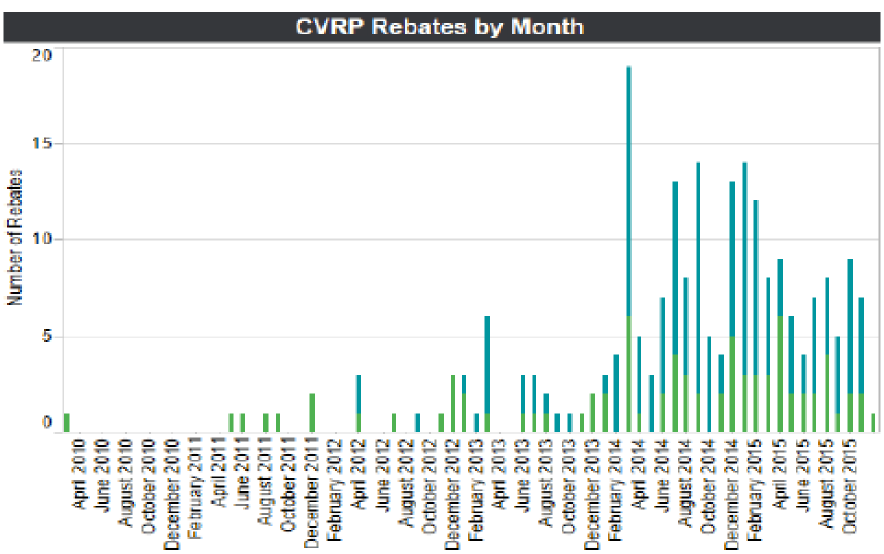
Welcome to the fifth issue of the North Coast Plug-in Electric Vehicle (PEV) Project newsletter series! This is a continuation of the newsletter series of the North Coast PEV Project that began in 2012.[1] For further information about the project, visit www.RedwoodEnergy.org, or contact us at info@redwoodenergy.org.

News and Events

Events[2]
There are currently no upcoming events scheduled, but they will be posted in future newsletters. Be sure to watch out for Ride and Drives and other opportunities to test drive Plug-in Electric Vehicles (PEVs) coming this spring. Can't wait? Check out RCEA's events page for the most up-to-date information.[2]

PG&E PEV Expansion[3]
In October 2015 it was announced Pacific Gas and Electric Company (PG&E) plans to add about 750 Plug-in Hybrid Electric Vehicles (PHEVs) to their fleet, allocating upwards of $100 million to the effort over the course of five years.[3]

Humboldt County Rebates[4]
The chart to the left shows monthly PEV rebate data from the California Clean Vehicle Rebate Project (CVRP), from March 2010 to January 2016.[4] In Humboldt County, a total of 229 Battery Electric Vehicle (BEV) and Plug-in Hybrid Electric Vehicle (PHEV) rebates have been processed for a total of $424,250 in rebate funding to date.[4]



Number of Humboldt County, CA, CVRP Rebates per month. Center for Sustainable Energy (2016). California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated February 01, 2016. Retrieved February 03, 2016 from https://cleanvehiclerebate.org/rebate-statistics

| 1 |

Figure 12: PEV Newsletters (cont'd)

Charging Plug-in Electric Vehicle (PEV). Source: Redwood Coast Energy Authority.

Want to buy a PEV but not sold on the rebates and incentives? Look into used PEVs! Read up at www.greencarreports.com, www.carfax.com, www.insideevs.com, or www.autotrader.com to get started.

Electric Vehicle Charging Station (EVCS). Source: Redwood Coast Energy Authority.

PEV Nuts and Bolts

A Plug-in Electric Vehicle (PEV) is a vehicle with an electric motor powered by a battery that can be recharged by plugging into an electricity source.[5] But what is the difference between a Plug-in Hybrid Electric Vehicle (PHEV), a Zero Emissions Vehicle (ZEV), and a Battery Electric Vehicle (BEV)? Read on to learn the basics of a PEV.

TYPES OF VEHICLES

EV- Term for any vehicle partially or fully powered by an electric motor.[5]

PEV- Plug-in Electric Vehicle. Power is provided by electricity stored in batteries.[5]

BEV- Battery Electric Vehicle. Power comes solely from an electric motor and batteries.[6]

PHEV- Plug-in Hybrid Electric Vehicle. The vehicle plugs into an electric grid to charge the battery and fuel the electric motor. PHEVs also use petroleum or alternative fuel to power the ICE.[5]

ZEV- Zero Emissions Vehicle. No tailpipe emissions are generated by the vehicle during operation.[8]

ICE- Internal Combustion Engine. Power is typically generated through the burning of gasoline, diesel, or compressed natural gas.[5]

How much does a PEV cost?
The cost of a PEV can range from $23,000-80,000.[6]

How far can a PEV travel?
Travel distance ranges from 30-200 miles,[7] depending on the type of PEV, outside temperature, driving style, and additional factors.

How long do PEVs last?
Modern conventional gasoline vehicles last about 180,000 miles, or roughly 15 years.[7] Due to the limited amount of current PEVs, there is not enough concrete lifespan data.

CHARGING

EVSE; EVCS- Electric Vehicle Supply Equipment; Electric Vehicle Charging Stations.[10]

Level 1 Charging- A charging process using a cord that plugs into a standard 120 volt outlet, usually taking between 8-20 hours to fully charge depending on type of PEV.[11]

Level 2 Charging- A charging process using a 240 volt electric circuit, usually taking 4-8 hours to fully charge depending on type of PEV.[11] Level 2 is the most common type of public charging in California.[11]

DC Fast Charger- A charging station using a 480 volt electric circuit, usually taking 20 minutes to reach 80% charge.[11]

Range- The distance a PEV can travel on a single full charge.[7]

How long do PEVs take to charge?
PEV charging time varies depending on type of charging station and battery size (time ranges from 30 minutes to 20 hours for a full charge[5]), typically charging in 3-8 hours.[9] Most charging will take place at home.

ENERGY

Alternative Fuels- Fuels that come from resources other than petroleum.[12]

CVRP- Clean Vehicle Rebate Project. California program offering rebates of up to $5000 for the purchase or lease of a new ZEV.[13]

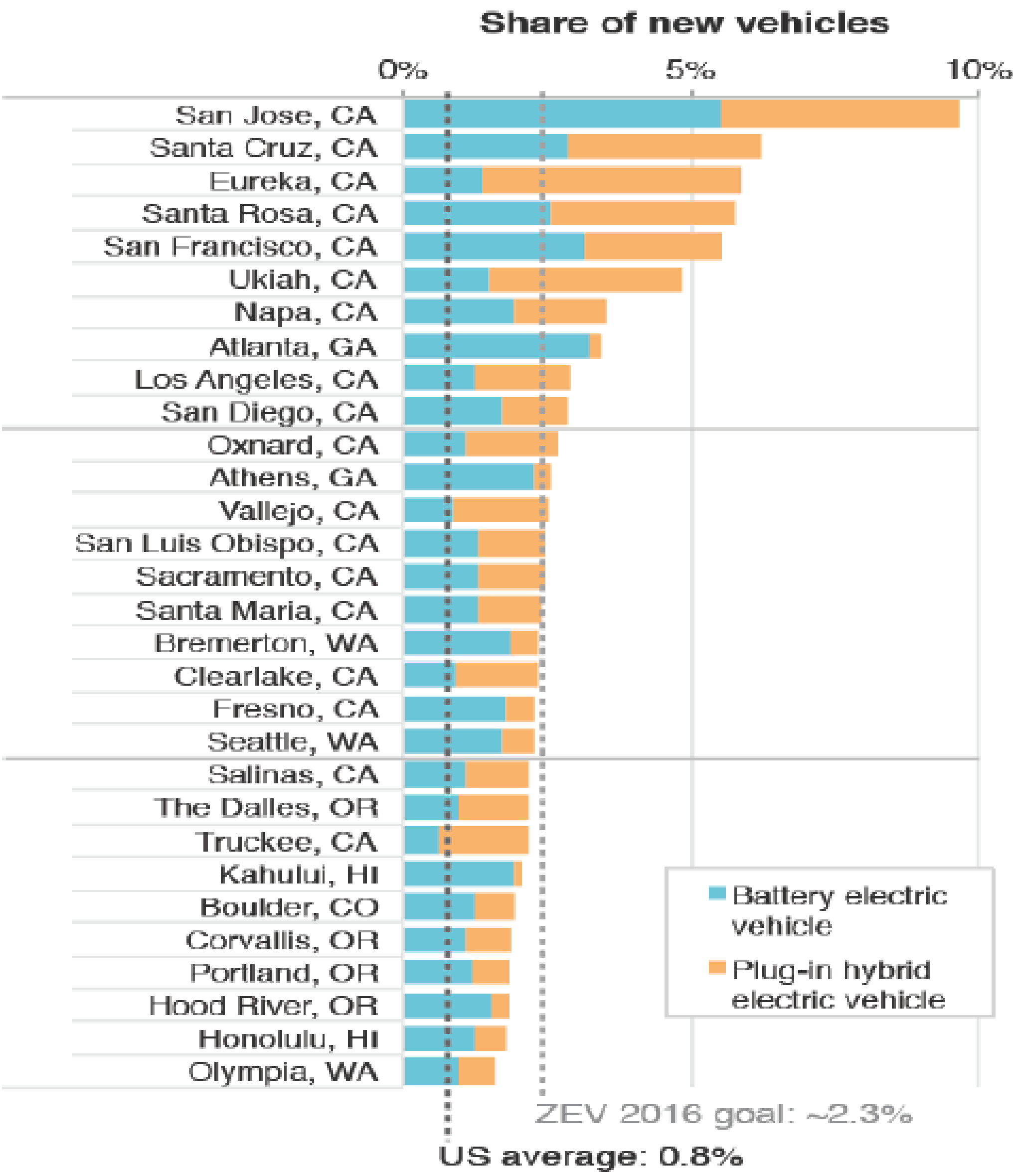
Peak hours- Times of highest electricity use throughout the day.[14]

| 2 |

Figure 12: PEV Newsletters (cont'd)

California Ahead in PEVs

The International Council on Clean Transportation (ICCT) recently charted the top 30 metropolitan areas in the US, based on the share of new light-duty Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs).[15] The demographic region surrounding Eureka, one of many California cities on the list, ranks well above the U.S.'s average percentage of new PHEVs and BEVs.[15] The North Coast Plug-in Electric Vehicle (PEV) Project team is working on strategies to help businesses and municipalities to invest in charging infrastructure to keep up with a quickly growing number of Electric Vehicles (EVs) in the North Coast.



Have you heard of regenerative braking? PEV engines transfer saved energy back to the battery whenever brakes are applied, which recharges it.[16] Sounds like smart conservation!

Share of New Vehicles. Image used with permission from: http://www.theicct.org/blogs/staff/ev-future%E2%80%94already-here-just-not-evenly-distributed-yet

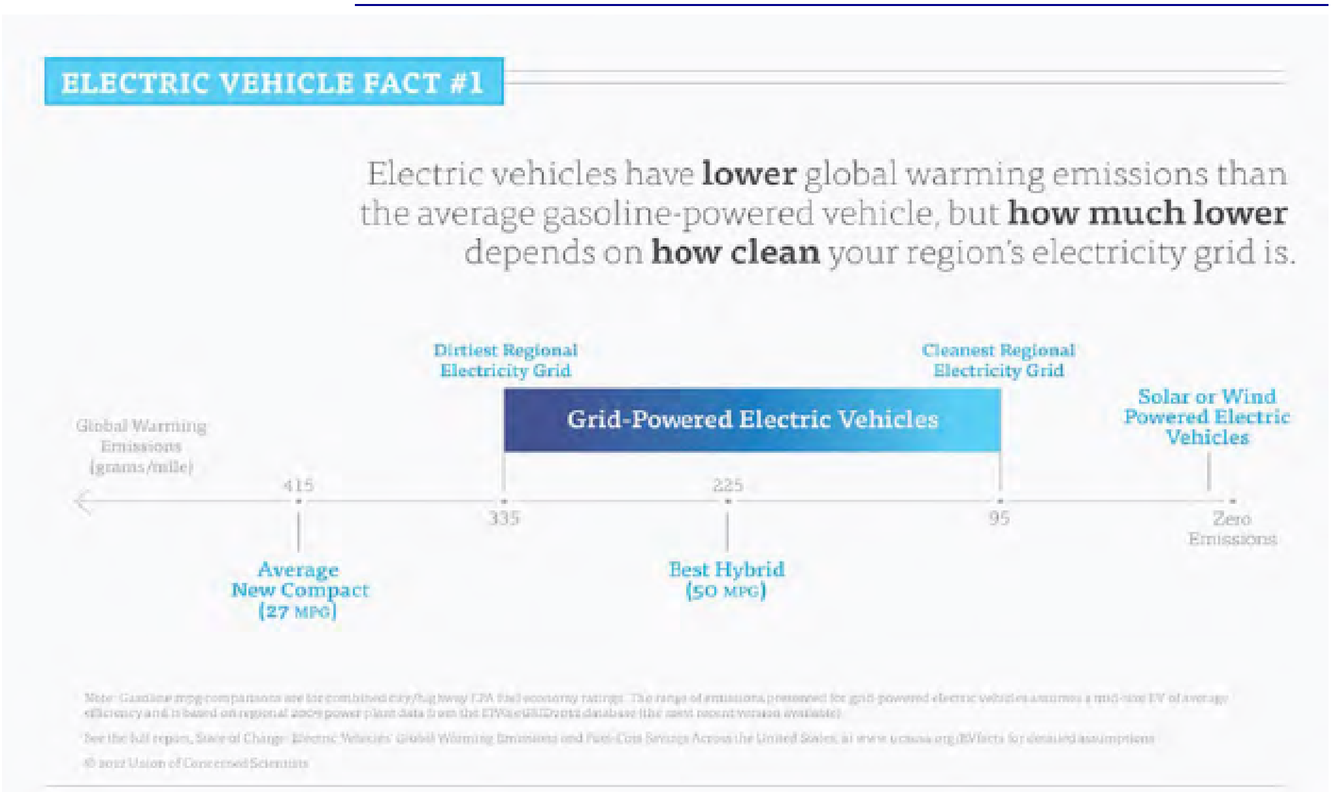
Figure 12: PEV Newsletters (cont'd)

Breathe Easier in a PEV

Did you know? During the 2011 Tsunami in Japan, people were able to use their PEVs as back-up generators to power their houses when electricity went out.[17]

There are a few key differences between Plug-in Electric Vehicles (PEVs) and conventional gas-powered internal combustion engine (ICE) vehicles, but one of the main differences is in greenhouse gas (GHG) emissions. The Union of Concerned Scientists (UCS), a non-profit organization focused on advocating innovative and sustainable solutions to prevalent issues, recently released an analysis comparing GHG emissions of Battery Electric Vehicles (BEVs), a type of PEV, and ICE vehicles. The report consisted of GHG emissions over the lifespan of the vehicles from manufacture to disposal. The UCS found the total emissions from the average BEV generates about 50 percent fewer GHG emissions than a comparable ICE car.[7]

PEVs contain lithium-ion batteries, plugging in to the local electrical grid to recharge. Humboldt County's grid power comes from the Pacific Gas and Electric Company (PG&E) electric system.[14] PG&E's generating plants make electricity by hydropower, gas-fired steam, and nuclear energy.[14] The electricity is then carried over transmission lines from power plants to substations, which lower the electricity voltage, to the distribution system, to the PEV.[14] Now PEV users can breathe easier knowing PG&E provides some of the cleanest electricity in the nation.[14]



Electric Vehicle Electric Grid Fact. Source used with permission from: http://www.ucsusa.org/sites/default/files/images/2014/08/electric-cars-global-warming-emissions-fact-1.jpg

Figure 12: PEV Newsletters (cont'd)

Electric Vehicle (EV) Myths Debunked

Are EVs too quiet? Are they *really* more environmentally friendly? Won't they be too inconvenient to refuel? Some popular myths about electric vehicles are debunked.

Plug-in Electric Vehicle (PEV). Source: Redwood Coast Energy Authority.

Myth: EVs are too new to the market.

Fact: Contrary to popular belief, PEVs are not a new concept. In 1900, 38% of automobiles were powered by electricity compared to only 22% powered by gasoline.[18] From 1901-1920, electric vehicles were produced by manufacturers such as Anderson, Anthony Electric, and Edison.[18] Later on they were not able to compete with the cheaper prices of oil and mass production of internal combustion engine (ICE) vehicles. The modern-day resurgence of EVs began in the 1990s, but the technology remains the same.[18]

Myth: EV batteries are not recyclable.

Fact: The lithium-ion batteries used in EVs are recyclable, but because the materials are relatively inexpensive, it may not be cost effective to recycle them. However, damaged batteries can often be repaired by car manufacturers, or sold for secondary uses once they are no longer able to service an EV.[22] Their "second" life may be as energy storage coupled with solar modules, or energy storage that helps utilities manage grid load.[23]

Myth: There are not enough EV charging stations.

Fact: The average American drives around 35 miles per day,[19] eliminating the common worry that EVs will run out of power before returning home to plug in. If you anticipate your round-trip commute to be more than 60 miles per day, consider looking into a plug-in hybrid (PHEV), which is equipped with a gasoline tank and internal combustion engine that kicks in when needed. Although home charging at night is typically the most affordable refueling option, public stations are growing in numbers, allowing workplace or destination charging for longer trips.[19]

Myth: EVs will overwork the electrical grid.

Fact: Based on estimates from the Pacific Northwest National Labs, "the current national grid has the capacity to accommodate up to 180 million plug-in cars, without a single new power plant."[18] In addition, it's anticipated that most EV owners will choose to plug-in at night during off-peak hours when the energy grid is least likely to be overloaded.[18]

Myth: Battery replacement costs are too high.

Fact: Although lithium-ion batteries used in EVs are more expensive to replace than lead-acid batteries used in conventional vehicles, there a fair number of cost-saving options. Many EV manufacturer warranties include battery replacement for 8 years after vehicle purchase.[20] It is also likely that only some of the battery cells, not the entire battery pack, will need to be replaced due to underperformance over time.[20]

Myth: EVs are a danger to pedestrians.

Fact: EVs are indeed quieter than conventional ICE vehicles, and it may be hard to audibly detect them moving nearby.[18] However, there are no specific research reports linking EVs to an increased number of pedestrian injuries. Moreover, EV manufacturers are addressing the potential issue by experimenting with adding artificial sounds to EVs that are designed to alert close pedestrians of movement.[18]

Fun fact—Electric Vehicles have instant acceleration, and therefore no gear changing involved![21]

Plug-in Electric Vehicle (PEV) interior. Source: Redwood Coast Energy Authority.

Figure 12: PEV Newsletters (cont'd)

REDWOOD COAST EnergyAuthority

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707.269.1700

info@redwoodenergy.org

www.RedwoodEnergy.org

Funded by the California Energy Commission's Alternative and Renewable Fuels and Vehicle Technology Program, the North Coast Plug-in Vehicle Project is being led by the Redwood Coast Energy Authority along with implementation partner Humboldt State University's Schatz Energy Research Center. The purpose of this bulletin will be to provide relevant local, state, and national news related to the deployment of vehicles powered by electricity.

Blue Lake Rancheria charging station site. Source: Redwood Coast Energy Authority.

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[1] http://redwoodenergy.org/index.php/transportation/ev-readiness-planning
[2] http://redwoodenergy.org/index.php/events/community-events
[3] http://www.greenfleetmagazine.com/channel/electric/news/story/2015/10/pg-e-to-invest-100m-in-evs-hybrids.aspx
[4] https://cleanvehiclerebate.org/rebate-statistics
[5] http://afdc.energy.gov
[6] http://driveclean.ca.gov
[7] http://www.ucsusa.org/
[8] https://www.goultralow.com/
[9] http://www.sustainableamerica.org/
[10] http://www.metroplugin.com/
[11] https://www.smud.org/
[12] https://www.fueleconomy.gov/
[13] http://cleanvehiclerebate.org
[14] http://www.pge.com/
[15] http://www.theicct.org/
[16] http://auto.howstuffworks.com/
[17] http://www.thetruthaboutcars.com/
[18] http://www.plugincars.com/
[19] http://www.sierraclub.org/
[20] http://www.hybridcars.com/
[21] http://pluginbc.ca/
[22] http://www.greencarreports.com/
[23] https://energycenter.org/

Figure 12: PEV Newsletters (cont'd)

NORTH COAST PLUG-IN ELECTRIC VEHICLE PROJECT APRIL 2016 | NEWS & UPDATES

In This Issue

Upcoming Events

June 4th- Electric Vehicle (EV) Expo at McKinleyville's 48th annual Pony Express Days

July 4th- EV Expo at Eureka Main Street's annual 4th of July Festival

Check out RCEA's events[1] page for the most up-to-date information.

News

CA Rebate Update[2]

The Clean Vehicle Rebate Project (CVRP) is offering increased rebates for low- and moderate-income consumers, effective March 29, 2016. The CVRP issues rebates for the purchase or lease of a range of battery electric, plug-in hybrid electric, and fuel cell vehicles. For more information, visit cleanvehiclerebate.org[3].

EV Forecast[4]

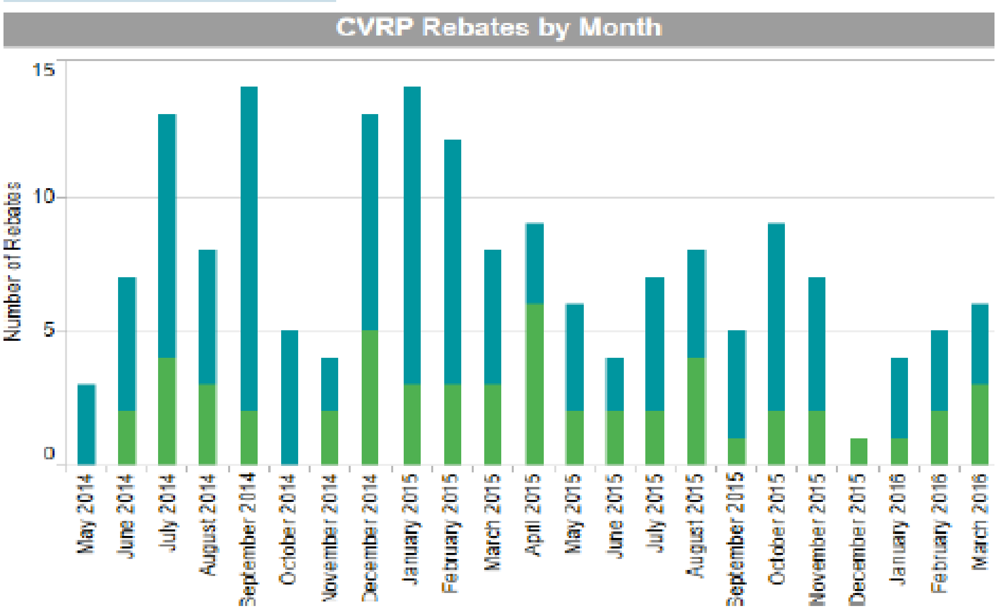
Bloomberg New Energy Finance (BNEF) published a study forecasting that sales of electric vehicles (EVs) will reach 41 million by 2040, representing 35% of new light duty vehicle sales. Their research cites anticipated cost reductions in Lithium-ion batteries as a large contributor in the predicted upsurge. Additionally, BNEF predicts that EVs will become a better economic option than internal combustion engine (ICE) vehicles by 2020.

New EVs[5]

New EVs debuting in 2016 include the Tesla Model 3, Chevy Bolt, and BMW 330e.

CVRP Statistics Update[3]

The chart to the left shows monthly PEV rebate data from the California Clean Vehicle Rebate Project (CVRP), from April 2014 to April 2016. In Humboldt County, a total of 172 Battery Electric Vehicle (BEV) and Plug-in Hybrid Electric Vehicle (PHEV) rebates have been processed for a total of $313,000. Each newsletter will display data from the previous 24-month period.



Number of Humboldt County CVRP Rebates April 2014-April 2016. Center for Sustainable Energy (2016). California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated May 02, 2016. Retrieved May 02, 2016 from https://cleanvehiclerebate.org/rebate-statistics

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Figure 12: PEV Newsletters (cont'd)

New Humboldt Electric Vehicle Charging Stations

Humboldt County ranks nationally as one of the leading regions[6] for electric vehicles (EVs), and public charging stations ensure that EV drivers have more options and peace of mind to travel farther and visit more destinations during their daily driving. Read more about Humboldt's newest charging stations below.

North Coast Unified Air Quality Management District charging station site.

The vast majority of EV owners charge their cars at home, and 95% of typical daily driving[7] easily fits within the range of EVs. However, there are times when EV drivers want to run some extra errands, didn't top off their cars the previous evening, or simply don't want to worry about running out of battery capacity. Public chargers are ideal to satisfy these needs and make EVs suitable for more drivers.

All new charging locations provide at least two Level 2 charging ports equipped with an industry-standard J1772 plug. A Level 2 port provides a typical EV with about 10 to 20 miles of range for every hour of charge[8]. The stations accept payment through the Greenlots network membership, or with a typical credit card. The stations include a retractable power cable to simplify handling, keep the cable and driver clean, and reduce vandalism.

The stations are new and still have a few growing pains. For example you may notice some intermittent operation at some locations, especially for remote sites. Most of these interruptions will relate to handling payments since the stations rely on cell signals to transmit data between the station and banking services. RCEA's goal is to support charging beyond town centers, and believe that this broader access is worth a little downtime as we fine-tune each location.

To identify the best locations for the charging stations, RCEA worked with the Schatz Energy Research Center (SERC) to develop a modeling tool that simulates typical EV usage in the region and identifies locations that most benefit local EV drivers. Using the highest priority locations, RCEA secured agreements with site hosts and installed the stations.

These stations expand the existing small but growing network of EV public charging stations in our region. To learn more about station location and EV charging in general, visit websites such as Openchargemap.org. RCEA owns and operates their stations with a goal to grow a network of economically self-supporting charging stations available to the public. Our hope is that these stations will provide a valuable community asset and encourage adoption of EVs for more families, businesses, and service providers in Humboldt County.

RCEA gratefully thanks the following organizations for their collaboration on this successful project:

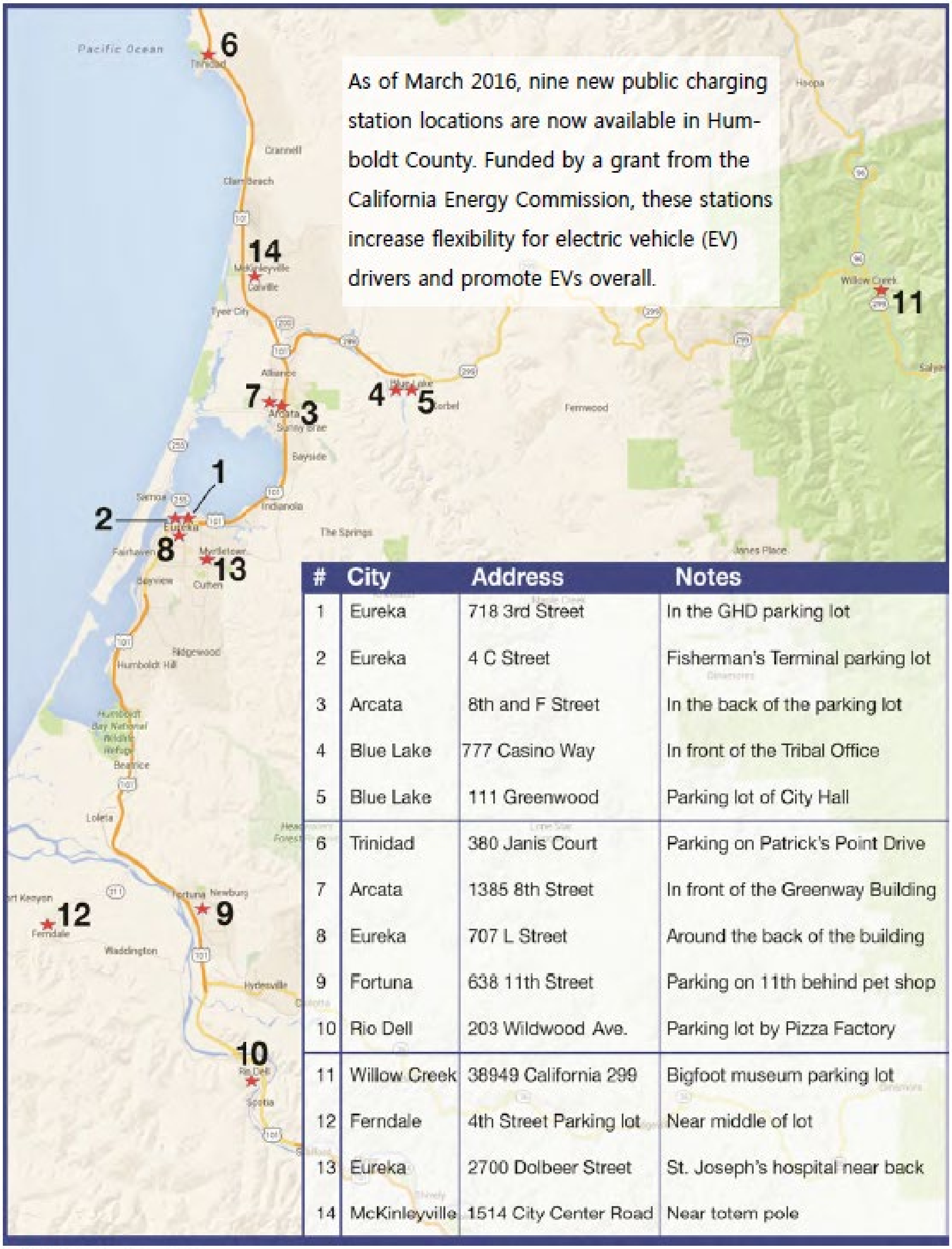
Participating site hosts: Arcata Technology Center Partners, City of Ferndale, City of Fortuna, City of Rio Dell, City of Trinidad, L and A Enterprises, North Coast Unified Air Quality Management District, Roger and Nancy Brown, St. Joseph Hospital, and Willow Creek Community Services District.

Project partners: Colburn Electric, DCI Builders, GHD, McKeever Energy & Electric, OurEvolution Energy & Engineering, Pierson Company, Schatz Energy Research Center, Pacific Gas and Electric Company.

City of Fortuna charging station.

Figure 12: PEV Newsletters (cont'd)

Charging Station Map



As of March 2016, nine new public charging station locations are now available in Humboldt County. Funded by a grant from the California Energy Commission, these stations increase flexibility for electric vehicle (EV) drivers and promote EVs overall.

#	City	Address	Notes
1	Eureka	718 3rd Street	In the GHD parking lot
2	Eureka	4 C Street	Fisherman's Terminal parking lot
3	Arcata	8th and F Street	In the back of the parking lot
4	Blue Lake	777 Casino Way	In front of the Tribal Office
5	Blue Lake	111 Greenwood	Parking lot of City Hall
6	Trinidad	380 Janis Court	Parking on Patrick's Point Drive
7	Arcata	1385 8th Street	In front of the Greenway Building
8	Eureka	707 L Street	Around the back of the building
9	Fortuna	638 11th Street	Parking on 11th behind pet shop
10	Rio Dell	203 Wildwood Ave.	Parking lot by Pizza Factory
11	Willow Creek	38949 California 299	Bigfoot museum parking lot
12	Ferndale	4th Street Parking lot	Near middle of lot
13	Eureka	2700 Dolbeer Street	St. Joseph's hospital near back
14	McKinleyville	1514 City Center Road	Near totem pole

RCEA EV Charging Network Map.

Figure 12: PEV Newsletters (cont'd)

Locating Electric Vehicle Charging Stations

With so much information about charging electric vehicles (EVs), it's helpful to know how to use RCEA's EV charging stations (EVCSs), what mobile EVCS options are available, and which online mapping sites to check out. Read further for useful instructions and information.

How to use RCEA Stations

Greenlots: For stations still in Free mode; press the ON button on the charger to release the cable. Plug the handle into your vehicle to charge for free. When finished, use the thumb button to release the cable from your vehicle and it will automatically retract. Then, move your vehicle from the parking space so others can charge.

Greenlots: For stations in paid mode; use the payment module between the chargers to select a charger (usually charger 1, 2, 3 or 4), then slide your credit card or tap your Greenlots card to complete the payment initialization. Next it will release the corresponding charger plug. You can grab it and walk it over to your vehicle charging port and plug it in to start charging. When charging completes, use the black thumb button on the charging handle to release the plug from your vehicle and it will automatically retract back to the machine. Please avoid dragging the plug on the ground as this will wear it out faster. If the cable does not retract automatically, you can also press the OFF button on the charger for it to retract manually.

Chargepoint: Locate a Chargepoint station using the Chargepoint app or a similar EV mapping app or website. Sign up at chargepoint.com[9] and click SIGN UP on the top right of the homepage, call Chargepoint homepage, or call Chargepoint Driver's Hotline 24/7 at 1-888-758-4389. It's important to note that these stations do not read credit cards.
To use a credit card you can call the Driver's Hotline above. Or come by RCEA (633 3rd Street in Downtown Eureka) to obtain a free Chargepoint card and start your account. If you already have a Chargepoint Member RFID card, wave or tap it on the machine near the wireless signal logo. Once a session is started, release the plug from the holster by using the silver thumb button and uncoil the cable in order to reach your vehicle's charging port. Plug in the charger to your vehicle and wait for the charge to complete. Once the charge is complete, remove the plug by using the thumb button again and recoil the cable back onto the charging cable holder and reseat the plug back into the charger's holster. Please remember to move your vehicle after charging has completed in order to make room for the next vehicle.

Plug-in Electric Vehicle (PEV) charging port.

Mobile Applications

Example Android Apps

Chargepoint- Used to locate chargepoint stations globally, manage your Chargepoint account.
Greenlots- Used to locate Greenlots stations globally and also start a charging session using a unique QR code on the Station. Use Charge.greenlots.com[10] to sign up for a Greenlots account and RFID quick payment card.
Plugshare- Used for locating stations globally.

Example iOS Apps

CarStations- Used to locate and update charging stations.
ChargeBud- Used to find charging locations, filter stations based on Charging level, and view charging station details.
Chargepoint- Used to locate chargepoint stations globally, manage your Chargepoint account.
EV ChargeHub- Used to locate charging stations throughout North America.
Next Charge EV- Used to locate charging stations.
Plugshare- Used for locating stations globally.

Online Mapping Sites

Afdc.energy.gov[8]
Carcharging.com[11]
Carstations.com[12]
Chargemap.com[13]
Openchargemap.org[14]
Plugshare.com[15]

Figure 12: PEV Newsletters (cont'd)

Charging Levels Chart

Electric vehicle (EV) supply equipment (sometimes referred to as charging equipment), currently falls into three categories that indicate their charging power: Level 1, Level 2, and Level 3. The higher the level, the more power delivered and the shorter the charging time. This diagram shows an overview of their applications.

THE CHARGING PYRAMID

Level	Charge Time	Cost to Charge
L3	*Travel* 20 min	$$$$
L2/L3	*Public* 1/2 - 3 hours	$$$
L1/L2	*Workplaces* 4-8 hours	$$
L1/L2	*Residential* 8-10 hours	$

Level 1	Level 2	Level 3
		
• 120 Volts, 12-16 Amps • 2-5 miles of range per hour of charge • Plug-in to any standard outlet	• 240 Volts, up to 80 Amps • 10-20 miles of range per hour of charge • Typical installed cost $1,000 - $7,000	• 208-600 VDC, up to 200 Amps • 60-80 miles of range per hour of charge • Typical installed cost $20,000 - $100,000

This document was prepared as a result of work sponsored by the California Energy Commission. It does not necessarily represent the views of the Energy Commission, its employees, or the State of California. The Commission, the State of California, its employees, contractors, and subcontractors make no warranty, express or implied, and assume no legal liability for the information in this document; nor does any party represent that the use of this information will not infringe upon privately owned rights. Charging Pyramid courtesy of: Zero-Emission Vehicles in California: COMMUNITY READINESS GUIDEBOOK, accessible at http://opr.ca.gov/docs/ZEV_Guidebook.pdf.

EV Charging Systems info graphic.

Figure 12: PEV Newsletters (cont'd)

Incentives to Buy an EV

No electric vehicle (EV) owner misses the gas pump. The savings in fuel coupled with the well-appointed EVs available today make the transition an appealing choice. However for many consumers, the upfront cost of EVs, along with necessary charging equipment, keeps EVs out of reach. Fortunately, there are a number of incentives available to make the switch to electric much less shocking.

The federal government wants to see you in an EV. They offer a tax credit of $2,500 for the purchase of a new electric vehicle, with an additional $417 for every kilowatt hour of battery capacity above the 5 kilowatt hour minimum.[16] This adds up quickly for most new EVs, with the credit capped at $7,500.[16] Vehicles qualifying for this maximum credit include battery electric vehicles (BEVs) like the Nissan Leaf and Tesla Model S, as well as most Plug-in Hybrid Electric Vehicles (PHEVs) like the Chevy Volt.

Tesla Model S.

Unlike the Federal tax credit, which is applied to taxes owed at the end of the year, the Clean Vehicle Rebate Project's (CVRP) $2,500 rebate equals quick* savings for California residents.[3] The process is simple: purchase a new BEV ($2,500 rebate) or a PHEV ($1,500 rebate).[3] Fill out an online form and receive a check in the mail. Then, go spend it on some eco-friendly swag for the new ride. Head to cleanvehiclerebate.org[3] and compare qualifying vehicles.

Even after driving off the lot, the savings continue. Farmers Insurance offers a 10% discount to drivers of Alternative Fuel Vehicles (AFVs).[17] Guess what? That new battery powered car is pretty alternative. Additionally, a special "Clean Air Vehicle" sticker grants access and eliminates or discounts tolls in High Occupancy Toll (HOT) lanes.[17]

Now, what to do with the old clunker in the driveway? The California Bureau of Automotive Repair's Consumer Assistance Program (CAP) is sending gas guzzlers the way of the dinosaurs.[18] The program gives income qualified consumers $1,500 to retire polluting vehicles early.[18] Check out smogcheck.ca.gov[18] to learn more about eligibility requirements.

After all the emissions-free joy riding, that new EV is going to need some juice. Most EV owners agree a level 2 charger is essential, with a full charge in 4 to 8 hours. Prices range from $400 to $700, plus installation costs anywhere from $200 to several thousand dollars. Thankfully, Property Assessed Clean Energy (PACE) financing lets homeowners gradually pay off energy saving improvements, which includes EV charging equipment.[19] Find out what options are available in your area at energycenter.org[19].

When it's finally time to plug in, EV owners can often take advantage of lower rates for electricity. For Pacific Gas and Electric Company (PG&E) customers, cheaper night time charging is available through special "Time-of-Use" rates.[20] Compare different rate plans on pge.com[20] and sleep better knowing your EV is using the cheapest possible electricity.

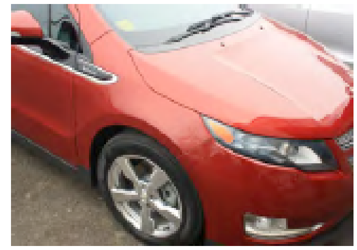
After adding up all the credits, rebates, discounts and financing options, EVs become an increasingly pragmatic choice. New incentives crop up all the time, so be sure to keep an eye out for the latest deals. The planet, and now your wallet, wants to see you in an EV.

** subject to availability*

Figure 12: PEV Newsletters (cont'd)

RFID

As cards are becoming more commonplace as a way to easily access information, you may have heard about "RFID", or Radio Frequency Identification. Unlike barcodes that need to be in the line of sight of a bar-code reader, or magnetic strips that must be swiped through a reader, RFID uses a copper coil antenna and a chip to store small amounts of data that can be accessed by a reader within close proximity using radio waves.



Chevy Volt EV.

Essentially, the RFID device functions in the same way the magnetic strip on the back of a debit or credit card does.[21] It provides information for the object by being scanned to retrieve identifying information.[21]

Here is how RFID is being utilized in the world of EV charging:

RFID Cards

Setup a Greenlots account at charge.greenlots.com[10] and they will send you a card in the mail that can be tapped on the top of our Greenlots payment modules. A Chargepoint card from chargepoint.com[9] can be used in the same way at our Chargepoint locations by tapping the card on the front of the machine.

RFID Credit Cards

RFID credit cards use a 128 bit encryption method to confirm payments and at this time RCEA Network stations are not capable of decoding the encryption. Greenlots stations are equipped with magnetic readers, but Chargepoint stations require a credit card number to be called in and charged over the phone.

RFID Smartphones

Some newer smartphones contain wireless RFID chips (also called Near Field Communication or NFC chips). RFID allows a smartphone or small plastic keyring card to communicate with nearby devices without a cable. Using an RFID enabled smartphones you can make payments from your phone using Apple/Android Pay, exchange files with nearby devices, and swap contact information, all with just a light touch of your phone on the device. To reduce the number of things on your keyring, there are some smartphone apps that can duplicate and save your RFID card's information to your phone. Then you can scan your Chargepoint or Greenlots card using your RFID app and store it in your phone to use next time you visit an EV charging station instead of bringing your member card.

Blue Lake City Hall charging station site.

Figure 12: PEV Newsletters (cont'd)

REDWOOD COAST
EnergyAuthority

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Funded by the California Energy Commission's Alternative and Renewable Fuels and Vehicle Technology Program, the North Coast Plug-in Vehicle Project is being led by the Redwood Coast Energy Authority along with implementation partner Humboldt State University's Schatz Energy Research Center. The purpose of this bulletin will be to provide relevant local, state, and national news related to the deployment of vehicles powered by electricity.

Dealer Spotlight

This month we are featuring BMW of Humboldt Bay located in McKinleyville. BMW of Humboldt Bay serves all communities on the North Coast and includes a free maintenance program on all new cars they sell for 50,000 miles. We talked with Sales Manager Matthew Brodhag about EVs.

RCEA: When did your dealership start offering PEVs?
BMW: BMW started selling EV's nationwide in 2014 starting with the i3 model.

RCEA: What is available in your showroom today?
BMW: I currently have 3 new BMW i3's with Range Extender and 1 Certified Pre Owned without.

RCEA: Do you offer repair services, and if so, what is different about working on PEVs?
BMW: Yes we offer repair services. EV's require specific training for the technicians to attend along with certification to work on them. The maintenance is quite a bit less which also helps with cost of ownership.

RCEA: What are the most frequent questions customers ask about PEVs?
BMW: By far the most common question is "What is the range". People also commonly ask about battery life, charging time, charging stations, and safety.

RCEA: What is the most surprising information customers learn about PEVs?
BMW: The most surprising thing for BMW customers is the drive. People assume the car will be slow and boring and are always very surprised to find the complete opposite. With the instant torque and light weight the cars are a blast to drive.

RCEA: How important are PEVs to the current market? How will it change in future years?
BMW: I feel that the EV's are important as a stepping point in the current market. They are not the vehicle for most people yet but they are getting the word out that these cars can be fun, clean, and practical. It always takes a long time for changes to be accepted in the auto industry and we are showing people that this is a good change.

Thanks, Matthew! Check out more information at bmwofhumboldtbay.com[22], or stop by their showroom on Central Avenue. Stay tuned, we will continue to highlight North Coast PEV dealers throughout the newsletter series.

1 Redwoodenergy.org
2 Arb.ca.gov
3 Cleanvehiclerebate.org
4 About.bnef.com
5 Cheatsheet.com
6 Insideevs.com
7 Greencarreports.com
8 Afdc.energy.gov
9 Chargepoint.com
10 Charge.greenlots.com
11 Carcharging.com
12 Carstations.com
13 Chargemap.com
14 Openchargemap.org
15 Plugshare.com
16 Irs.gov
17 Farmers.com
18 Smogcheck.ca.gov
19 Energycenter.org
20 Pge.com
21 Technovelgy.com
22 Bmwofhumboldtbay.com

All pictures by Redwood Coast Energy Authority unless otherwise noted.

Figure 12: PEV Newsletters (cont'd)

NORTH COAST PLUG-IN ELECTRIC VEHICLE PROJECT MAY 2016 | NEWS & UPDATES

In This Issue

Upcoming Events

June 4th- EV Expo at McKinleyville's 48th annual Pony Express Days

July 4th- EV Expo at Eureka Main Street's annual 4th of July Festival

Check out RCEA's events[1] page for the most up-to-date information.

News

SDG&E's EV Campaign[2]

San Diego Gas & Electric (SDG&E) recently pledged to invest $7.5 million over the next couple of years towards developing an education campaign to promote electric vehicle ownership. This outreach and awareness project expects to lead the charge among big cities to electrify the transportation sector.

New EV Rate Options[3]

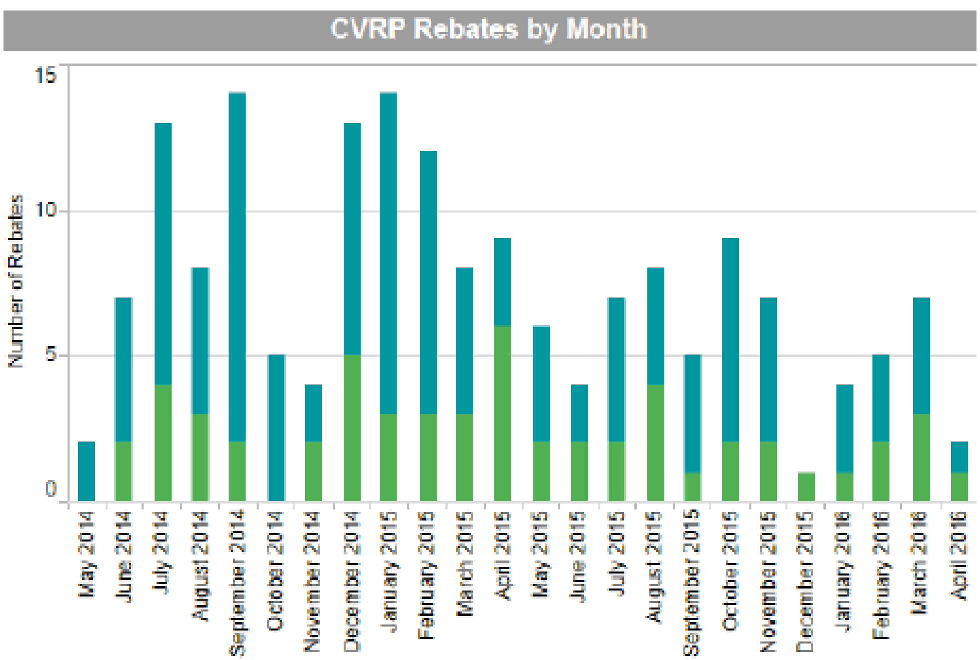
Curious about home charging costs? PG&E offers two residential EV rate options: EV charging costs can be incorporated into your total household electric bill, or you can have your home charging station on a separate meter. Fortunately EV rate plans are not tiered; the price per kWh is based only on the time of day you use electricity-Peak, Partial-Peak and Off-Peak.

Heavy Duty Transit Battery Advancement[2]

Electric bus maker Proterra announced a new design for a battery that provides 28 percent more energy to their Proterra Catalyst XR transit vehicle. All current Catalyst XR customers will receive complimentary battery upgrades.

CVRP Statistics Update[4]

The chart to the left shows monthly rebate data from the Clean Vehicle Rebate Project (CVRP). In Humboldt County, a total of 174 Battery Electric Vehicle and Plug-in Hybrid Electric Vehicle rebates were processed between May 2014 and May 2016.



Number of Humboldt County CVRP Rebates April 2014-April 2016. Center for Sustainable Energy (2016). California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated May 23, 2016. Retrieved May 24, 2016 from https://cleanvehiclerebate.org/rebate-statistics

Figure 12: PEV Newsletters (cont'd)

MAY 2016 POWERED BY ELECTRICITY

Humboldt Contributes to California Low/Zero-Emissions Vehicles Goal

In 2014 Governor Brown approved Senate Bill 1275, with a goal for at least one million zero-emission and near-zero-emission vehicles on California roadways by January 1, 2023. In terms of rebates issued by the California Vehicle Rebate Project (CVRP), Humboldt County is a rural leader in adopting EVs.

Most EV rebates in Humboldt County were issued to buyers living near Humboldt Bay, which is unsurprising since EVs are ideal for short trips around our most populated areas. EVs are also gaining traction in outlying areas, thanks to plug-in hybrid electric vehicles (PHEVs) that combine the benefits of electric with the extended range of an internal combustion engine.

Zip code 95519 (McKinleyville) leads the county with 60 rebates issued to date, followed by 95521 (Arcata) with 53 rebates (see figure on following page). If the statistics considered population within each zip code, we believe that Trinidad would be the likely winner for most EVs per capita.

As of May 2016, the CVRP has issued 247 rebates in Humboldt County. PHEV buyers received 158 rebates, 87 rebates were for battery electric vehicles (BEVs), and two rebates were issued for electric motorcycles. The CVRP Rebate Map lets you sort by variables such as zip code or county, and by clicking on a specific area you get more details such as the types of vehicle rebates, total rebates issued, and total rebate dollars. This doesn't represent all EVs on Humboldt roads since the used market is growing, but it is a simple way to compare how we're doing with the rest of the state.

Trinidad Library electric vehicle charging station.

City of Ferndale electric vehicle charging station (EVCS).

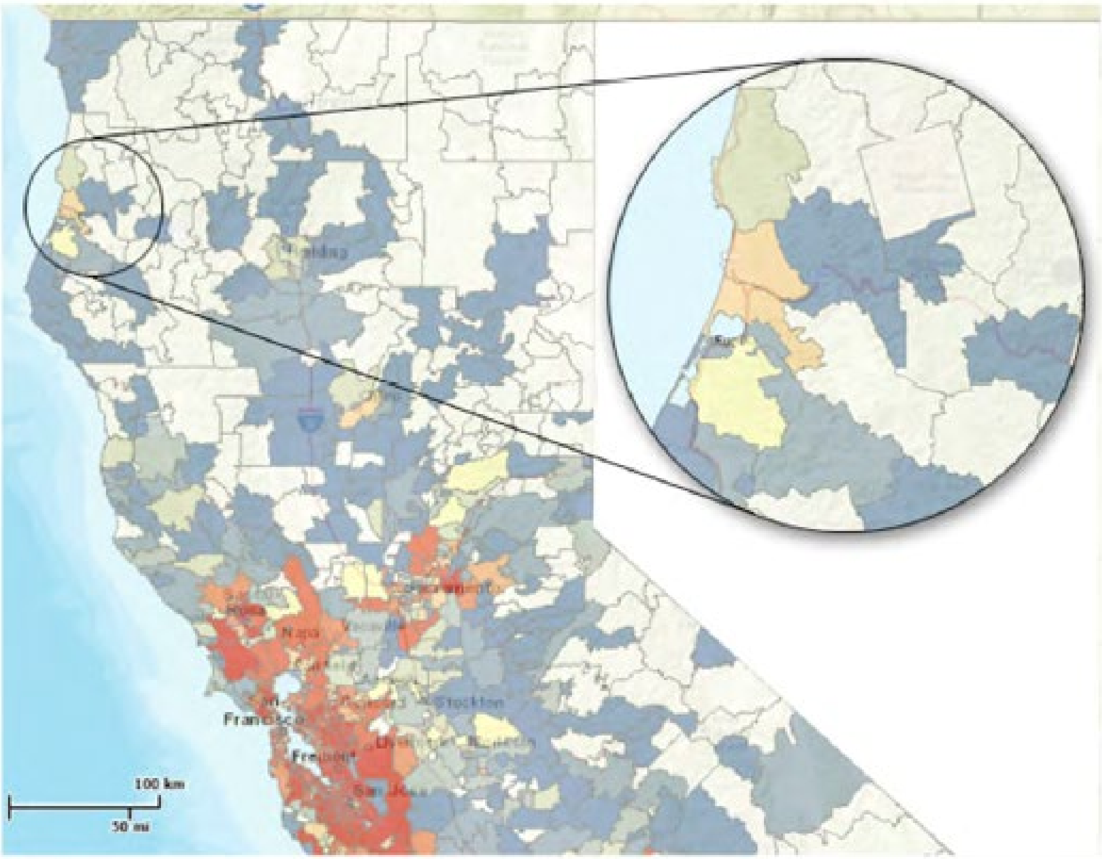
Figure 12: PEV Newsletters (cont'd)

MAY 2016 POWERED BY ELECTRICITY

CLEAN VEHICLE REBATE PROJECT

Rebate Distribution Map

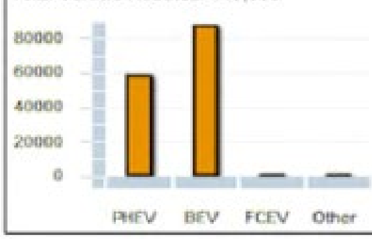
Report Generated On: May 26, 2016



Map Legend by Zip Code (Vehicle Rebates):

0	49 - 65
1 - 5	66 - 86
6 - 13	87 - 127
14 - 23	128 - 200
24 - 34	201 - 10000
35 - 48	

Zip Code: All
Total Rebate Dollars: $317,066,031.00
Total Vehicle Rebates: 149,085



Center for Sustainable Energy (2015). California Air Resources Boart Clean Vehicle Rebate Project, Rebate Map. Report Generated on May 26, 2016 at http://cleanvehiclerebate.org/cvrp-rebate-map.

Clean Vehicle Rebate Project rebate distribution map. Source derived and used with permission from: https://cleanvehiclerebate.org/eng/cvrp-rebate-map.

| 3 |

Figure 12: PEV Newsletters (cont'd)

Finding the Right EV

So you've decided to trade in your old sedan for a newer model- maybe you've got your sights set on something a little easier on your wallet and the planet? Fortunately, vehicle manufacturers have employed a variety of strategies to ease the burden at the pump - everything from lighter, more aerodynamic vehicles, to eliminating gas powered motors all together.

One of the most successful methods to reduce or eliminate gasoline use in an auto has been to add an electric motor and battery. Depending on the type of technology, this battery electric system is responsible for locomotion always, most of the time, or only occasionally. Your driving habits and range requirements are important to consider when evaluating these technologies, as they all have unique advantages and drawbacks.

BEVs

Battery electric vehicles, or BEVs, rely exclusively on a large battery and electric motor. The big advantages here are never having to pump gas again (or be tempted by that giant slurpee) and significantly reduced maintenance costs. Simply cruise by the gas station in your whisper quiet, zero emission vehicle. A recent analysis by the Union of Concerned Scientists concluded that the lifetime carbon footprint of a BEV is roughly half that of a conventional gas powered vehicle.[5]

A few important drawbacks have kept BEVs from enjoying mass market adoption. Most affordable BEVs have ranges under 90 miles requiring frequent extended charging periods, for which there is a lack of charging infrastructure. However, the recently announced Tesla Model 3 and Chevy Bolt both have ranges over 200 miles, DC fast charging technology is shortening charge times, and infrastructure is rapidly expanding in California.

Electric vehicles at a EV Ride and Drive event at Redwood Acres.

PHEVs

Plug in hybrid electric vehicles, or PHEVs, eliminate some of the challenges posed by BEVs. These vehicles are capable of a limited amount of all-electric range (the Chevy Volt goes 53 miles) before the gas motor takes over. Considering the average American typically travels under 30 miles every day[6], this limited electric range can be quite ideal for both daily commuting and long distance trips.

While this hybrid technology serves to dramatically reduce gasoline consumed, it lacks the zero emission and reduced maintenance benefits of a BEV.

Hybrids

While quite a few manufacturers produce hybrid models, none are quite as popular as the ubiquitous Toyota Prius. Toyota introduced the hybrid concept back in 1997—combining an electric motor and a small battery with an efficient gas engine. Unlike the PHEVs, traditional gas/electric hybrids can't take advantage of electricity from the grid; they don't have a plug. Rather, the small battery is charged by the gas engine and, to a lesser extent, regenerative braking.

Even with the significant gains in efficiency made by small gas engines over the last decade, hybrids still represent the highest MPG option outside of plug-in models. These vehicles perform exceptionally well in stop and go city traffic. If you often find yourself in this type of environment and would rather steer clear of emerging plug-in technology, this could be a great fit.

Fortunately, finding a fuel-efficient vehicle is easier than ever before. New technologies are constantly being developed and tested—it's an exciting time in the world of electric vehicles.

Figure 12: PEV Newsletters (cont'd)

The Bigger Benefits of an EV

Every year millions of people buy new and used cars. If you are among the auto-shopping masses, consider weighing your non-petroleum options. What better place to start than electric vehicles (EVs)? EVs have a long list of positive attributes beneficial to a consumer, but what about the bigger picture? Read on to learn about some of the global benefits of EV technology.

Climate disruption is not a far off phenomenon that will affect the planet generations into the future. It's an all hands on deck issue. It's no secret we need to adapt and prepare for the growing demand for clean energy. In 2010, about 25% of greenhouse gas emissions (GHGs) in Humboldt County came from passenger vehicles.[7] That's a significant portion of harmful pollutants emitting into the air we breathe. The World Health Organization (WHO) estimates that 3.7 million deaths a year are caused by ambient air pollution.[8]

Cue the EV solution. EVs allow for a vast array of renewable energy opportunities, which means there won't be just one replacement power source for gasoline.[9] Many individuals are already consciously driving emissions-free EVs by opting for solar electricity systems. In addition, you will be able to charge your vehicle regardless of the changes made to the nation's power grid.[9] When electricity from clean energy is used to power electric vehicles, they are driving emissions free and not contributing to climate disruption or adding to air pollution.

A study conducted by researchers at Michigan State University and in China found that EVs emit significantly less heat than conventional ICE vehicles. Compared to gas-powered cars, EVs emit 20% less heat.[10] This is important because the difference could alleviate the urban heat island effect, which is the phenomenon that helps convert larger cities into pressure cookers in hotter months.[10]

Moreover, Americans drive more than other countries. In 2010 the total distance traveled by passenger vehicles in the US was greater than China, India, Russia, Germany, the UK, Italy, Spain and France combined.[11] That means more people driving EVs fueled by clean energy has a huge climate and public health impact.

Buying an EV will ultimately save you time, the convenience of less noise pollution, and money. By preparing now we are: protecting ourselves and our community, preventing future disruptions, taking responsibility for the health of our loved ones, and having the foresight and fairness to be part of the solution. There are many advantages to owning an EV, and the list of benefits of EVs to our planet will only grow with time.

EVs at Eureka Natural Food's 2016 Earth Day Celebration.

Figure 12: PEV Newsletters (cont'd)

More EV Options for 2016 and Beyond

EVs at Alternative Fuels Symposium.

Choices continue to grow in the electric vehicle market, and 2016 will see even more models arrive. Below is a list of production EVs available or announced as of May 2016.[12]

There is also a growing used electric vehicle market, giving drivers the option of a used EV often at an exceptionally good price. Although it can be challenging to find used EVs locally given their popularity, Humboldt residents are importing EVs from neighboring areas such as Santa Rosa and southern Oregon.

Trinidad Library electric vehicle charging station.

Several automakers experienced late launches of best-selling plug-in vehicles in previous years. For example, there was a limited 2016 Chevy Volt launch in late fall 2015, a very late arrival of the 2016 Nissan Leaf, and withdrawal of the Toyota Prius PHV until an all-new version is available in late 2016. This restricts inventory of some EVs, but is less of a concern since the used market now fulfills some of the demand.[13] Manufacturers also continue to bring new models to the EV marketplace each year, broadening the makes and models available to shoppers.

Looking ahead, 2016 appears poised for strong growth and is expected to continue the current string of record-breaking months for EV sales. Of particular interest are longer-range EVs such as the Chevy Bolt. With a projected 200-mile range, the Bolt will be the first EV in its price range to reach this desirable milestone.[13] Tesla is also taking reservations (almost 400,000 as of April) for the long-anticipated Model 3, with a similar range to the Chevy Bolt. Since range anxiety is a concern for potential EV buyers, a longer range is an important step to put consumers at ease. These new models will also raise expectations for all EVs and encourage healthy competition from other auto manufacturers.

All Electric

2016 BMW i3 (BEV)
2016 Chevrolet Spark EV
2016 Kia Soul EV
2015 Fiat 500e
2015 Ford Focus Electric
2016 Mercedes-Benz B250e
2016 Mitsubishi i-MiEV
2016 Nissan Leaf
2015 Smart Fortwo Electric Drive
2016 Tesla Model S
2016 Tesla Model X
2016 Volkswagen e-Golf

Plug-in Hybrid

2016 Audi A3 Sportback e-tron
2016 BMW 330e
2016 BMW i3 (PHEV)
2016 BMW i8
2016 BMW X5 xDrive 40e
2016 Chevrolet Volt
2015 Ford C-MAX Energi
2016 Ford Fusion Energi
2016 Hyundai Sonata Plug-In Hybrid
2016 Mercedes-Benz S550H
2016 Porsche Panamera S E-Hybrid
2016 Porsche Cayenne S E-Hybrid
2016 Volvo XC90 T8 "Twin Engine"

To Be Announced

2017 Audi Q7 e-tron
2017 Chevrolet Bolt EV
2017 Chrysler Pacifica Hybrid
Hyundai Ioniq
2016 Mercedes-Benz C350e
2016 Mercedes-Benz GLE550e

Discontinued

Honday Accord (PHEV)
Toyota Prius (PHEV)
2016 Cadillac ELR

Figure 12: PEV Newsletters (cont'd)

Celebrating EVs

Electric vehicles from McCrae Nissan and Northwood Chevrolet Dealerships were on display at the Home, Garden, and Recreation Show at Redwood Acres in April 2016. Attendees were able to view vehicles and talk to dealer representatives.

Eureka Natural Food's 9th Annual Earth Day Celebration. Teslas quietly gathered at Eureka Natural food's 9th Annual Earth Day Celebration. The new Tesla Model X was a popular attraction.

The ribbon cutting ceremony for the new electric vehicle charging stations (EVCSs) at St. Joseph's Hospital provided onlookers with a glimpse of infrastructure soon to be seen throughout Humboldt County.

Figure 12: PEV Newsletters (cont'd)

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Dealer Spotlight

This month we are featuring McKinleyville Chevrolet Buick. They offer a wide variety of new and pre-owned inventory. We talked with Monica and Linus about their plug-in electric vehicles (PEVs).

RCEA: When did your dealership start offering PEVs?
MCB: 2008

RCEA: What is available in your showroom today?
MCB: 2017 Chevrolet Volt

RCEA: What are the most frequent questions customers ask about PEVs?
MCB: How long does the battery last? How many miles to charge?

RCEA: What is the most surprising information customers learn about PEVs?
MCB: Electric savings on home [electricity] bill and tax credits.

RCEA: Any favorite story about selling a PEV?
MCB: Customer had only used one tank of gas in 3 years owning his Volt, and drove it everyday extremely in his race to stop fossil fuels.

RCEA: How important are PEVs to the current market? How will it change in future years?
MCB: I believe all vehicles will become hybrid in some way.

Check out more information at http://www.mckinleyvillechevrolet.com/. Stay tuned, we will continue to highlight North Coast PEV dealers throughout the newsletter series.

1 http://redwoodenergy.org/
2 http://electriccarsreport.com/
3 http://www.pge.com/
4 https://cleanvehiclerebate.org/
5 http://www.ucsusa.org/
6 https://www.aaafoundation.org/
7 Data based off of 2010 Humboldt County Greenhouse Gas Inventories
8 http://www.who.int/
9 http://www.cheatsheet.com/automobiles/
10 http://msutoday.msu.edu/news/
11 http://shrinkthatfootprint.com/
12 http://www.greencarreports.com/
13 http://insideevs.com/

All pictures by Redwood Coast Energy Authority unless otherwise noted.

Figure 12: PEV Newsletters (cont'd)

POWERED BY ELECTRICITY

NORTH COAST PLUG-IN ELECTRIC VEHICLE PROJECT JUNE 2016 | NEWS & UPDATES

In This Issue

Upcoming Events

Would you like to see more programs in our region that promote electric vehicles (EVs)? Be sure to attend the Community Choice Energy Public Meeting coming up on July 28, 5pm at the Eureka Woman's Club to provide your input on how best to invest in Humboldt's energy future. Check out the Redwood Coast Energy Authority (RCEA) website events[1] page for the most updated information.

Local PEV News

Coming soon: Tesla superchargers in Eureka[2]

If you drove by the Bayshore Mall recently you may have noticed construction in the parking lot near the main entrance. These are Tesla Supercharger stations being installed, part of Tesla's plan to provide "convenient charging at hotels, restaurants, and shopping centers". The photo below shows four of the eight partially installed supercharger stations. Tesla drivers will soon have fast charging from Eureka to the SF bay area along Highway 101. For those of us driving non-Tesla electric vehicles (EVs), it'll be a few years until non-proprietary fast chargers are installed in our region. No need to wait though, there are already Level 2 charging stations within the Redwood Coast Energy Authority (RCEA) network!

California EV incentives on hold, waiting list in place[3]

In June the Clean Vehicle Rebate Project (CVRP) posted on their website, "Funding is currently exhausted. All applications submitted after June 10, 2016 will be placed on a rebate waitlist." According to the LA Times, Governor Brown and lawmakers eliminated $500 million for various low-emission initiatives as part of a political impasse during negotiations on the recently passed state budget. In the meantime, CVRP is maintaining a waiting list pending resolution of future funding. We'll continue to track the number of EV rebates issued for Humboldt County, but once approved applications for May and June 2016 are recorded, we'll see a hard drop-off on the charts.

Pony Express Days event highlights

On June 4, Redwood Coast Energy Authority partnered with McKinleyville Chevrolet Buick to promote EVs while enjoying the annual Pony Express Days festivities. The dealership had a BMW i3, BMW i8, Nissan Leaf, and 2 Volts on display on their lot. We had a great time at the event!

Tesla charging station construction in Eureka.

Figure 12: PEV Newsletters (cont'd)

Dealer Spotlight

This month we are featuring Northwood Auto Plaza[4] in our dealer spotlight. They offer a wide variety of vehicle inventory and services. We talked with Don Hackett about their plug-in electric vehicles (PEVs).

RCEA: When did your dealership start offering PEVs?
NAP: 2009 with the launch of the Volt

RCEA: What is available in your showroom today?
NAP: Chevy Volt, Chevy Spark, Hyundai Sonata, Chevy Malibu, [and] coming soon the Chevy Bolt

RCEA: Do you offer repair services, and if so what is different about working on PEVs?
NAP: We do offer full service of electric vehicles. We have several trained technicians who specialize in PEVs. We are also the only place in the county with on-site highly sophisticated EV battery diagnostic and servicing equipment.

RCEA: What are frequent questions that customers ask about PEVs?
NAP: How far can I go between charges, and what is my cost per charge? What happens when I run out of charge?

RCEA: What is the most surprising information that customers learn about PEVs?
NAP: The cost is going down as the market for them grows, and the minimal cost of charging due to the discounts you can receive on your power bill makes an EV an even better choice than the standard hybrid.

RCEA: Any favorite story about selling a PEV?
NAP: Nothing too special comes to mind. We did sell a Volt a few years ago and when the customer had returned to visit the parts department nearly 3 months later, he had only used 3/10's of one gallon of the original fuel from his complimentary tank when he purchased the car.

2016 Chevrolet Spark EV. Northwood Auto Plaza.

RCEA: How important are PEVs to the current market? How will it change in future years?
NAP: PEVs are extremely important in a time with an ever changing economy and cost of living. You can eliminate a fuel bill altogether sometimes saving you hundreds of dollars per month. The fact that it costs less to charge your electric vehicle than it does to run your washing machine. Not to mention what you are doing for the environment and the residual effect that it may have on your neighborhood, and or community. Charging stations are popping up all over the place, there are government incentives for people to drive electric vehicles, there are community and government organizations replacing their fleets with EVs. The cost of ownership hits record low numbers for an EV driver as opposed to standard cars. The only way for it to change is to see the selection grow. Soon manufactures will likely try to offer SUVs and small pickups in EV options. The market is still relatively limited for EV options. In the coming years we anticipate them becoming this generation's hybrid.

Thanks, Don! Check out more information at http://northwoodauto.com/NorthwoodAuto/. Stay tuned, we will continue to highlight North Coast PEV dealers throughout the newsletter series.

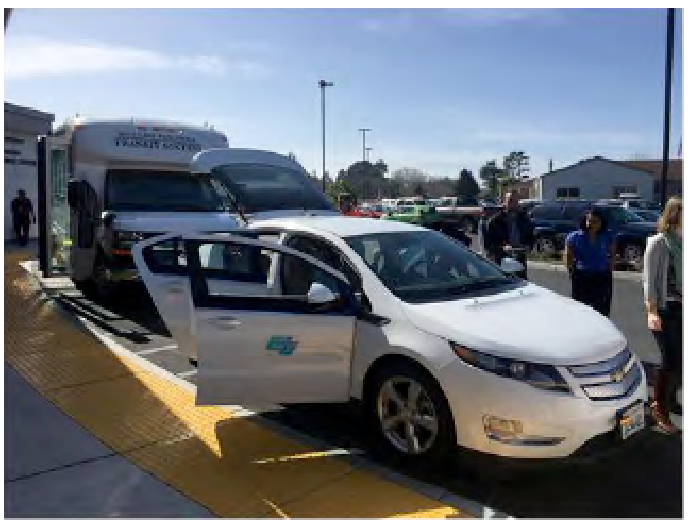
Figure 12: PEV Newsletters (cont'd)

Caltrans Support for EV Signage

It takes an entire community to create a sustainable transportation system. Consumers, planners, manufacturers and other stakeholders all have critical roles to play. One of those major stakeholders is the California Department of Transportation, better known as Caltrans. They have made a commitment to the triple bottom line of sustainability: weighing social, environmental, and economic factors when making decisions.

This commitment to sustainability has made Caltrans a valued partner. The Redwood Coast Energy Authority (RCEA) recently hosted an event that brought together organizations interested in decreasing the impact of our transportation system. The event focused on creating a Clean Cities Coalition- a U.S. Department of Energy program that helps communities reduce their dependence on petroleum for transportation.[5]

To show their support, Caltrans brought a couple of their alternative fuel fleet vehicles: an all-electric Nissan Leaf, and a plug-in hybrid Chevy Volt. Having these vehicles parked right out front of the event generated interest from attendees. Caltrans representatives described their overwhelmingly positive experiences, highlighting the fleet applications of electric vehicles (EVs). Increasing the adoption of alternative fuel vehicles in fleets is a critical step in greening our transportation system.



Caltrans fleet vehicle at Alternative Fuels Clean Cities Symposium.

In addition to fleet adoption, increasing the use of EVs for commuting and day-to-day activities will take a huge chunk out of our carbon emissions. To ensure this widespread EV adoption, we must build out charging infrastructure so that drivers don't worry about running out of juice. This is something RCEA has been working towards and has benefited greatly from Caltrans support.

A key component of charging infrastructure is signage. Installing an EV charging station is critical, but so is helping EV drivers find it. Deb Meredith heads up the signage division for Caltrans District 1 and has been essential in the move towards more sustainable transportation. Thanks to her help, EV drivers in Humboldt County will now be able to locate charging stations more easily, using blue and white EV wayfinding signs.

Not only has Caltrans supported the build-out of charging infrastructure, they also have helped agencies acquire alternative fuel vehicles. With help from funding administered by Caltrans, the Humboldt Transit Authority has purchased an electric bus and a charging station. The new bus will run the route between Humboldt State University and College of the Redwoods.

By taking a leadership role in sustainable transportation, Caltrans will continue to benefit our community. Through cooperation with allies like Caltrans, we will continue to build a transportation system that produces less harmful emissions and better supports the needs of everyone living on the North Coast.

Figure 12: PEV Newsletters (cont'd)

EV Updates: Local and Beyond

Electric vehicles (EVs) continue their steady forward march, and Humboldt County is doing well when compared with other counties in California. In June the County hit a milestone with 253 rebates issued for new EV purchases.[6] This places Humboldt firmly in the middle of the pack despite our remote location. Kudos go to local EV drivers for doing their part to reduce emissions and consume less petroleum in our region.

Humboldt County

To provide more charging options for our growing population of EV drivers, the Redwood Coast Energy Authority (RCEA) continues to pursue funds to build out the network of local charging stations. The California Energy Commission (CEC) is currently evaluating grant applications to install fast-charger, or Level 3, stations from near the Oregon border to Garberville, among other corridors. RCEA partnered with Chargepoint to submit a joint application for our region, and we eagerly anticipate feedback this fall regarding grant awards. Regardless of the winner, in a few years local EV drivers can expect to enjoy fast-chargers stretching from the Oregon border through Humboldt, Mendocino, and Sonoma counties. Most stations will be reasonably spaced, but there will still be a few longer gaps where there is little in the way of electric power and other services.

This is a good time to consider a fast-charging option while shopping for an EV in the near future.

State

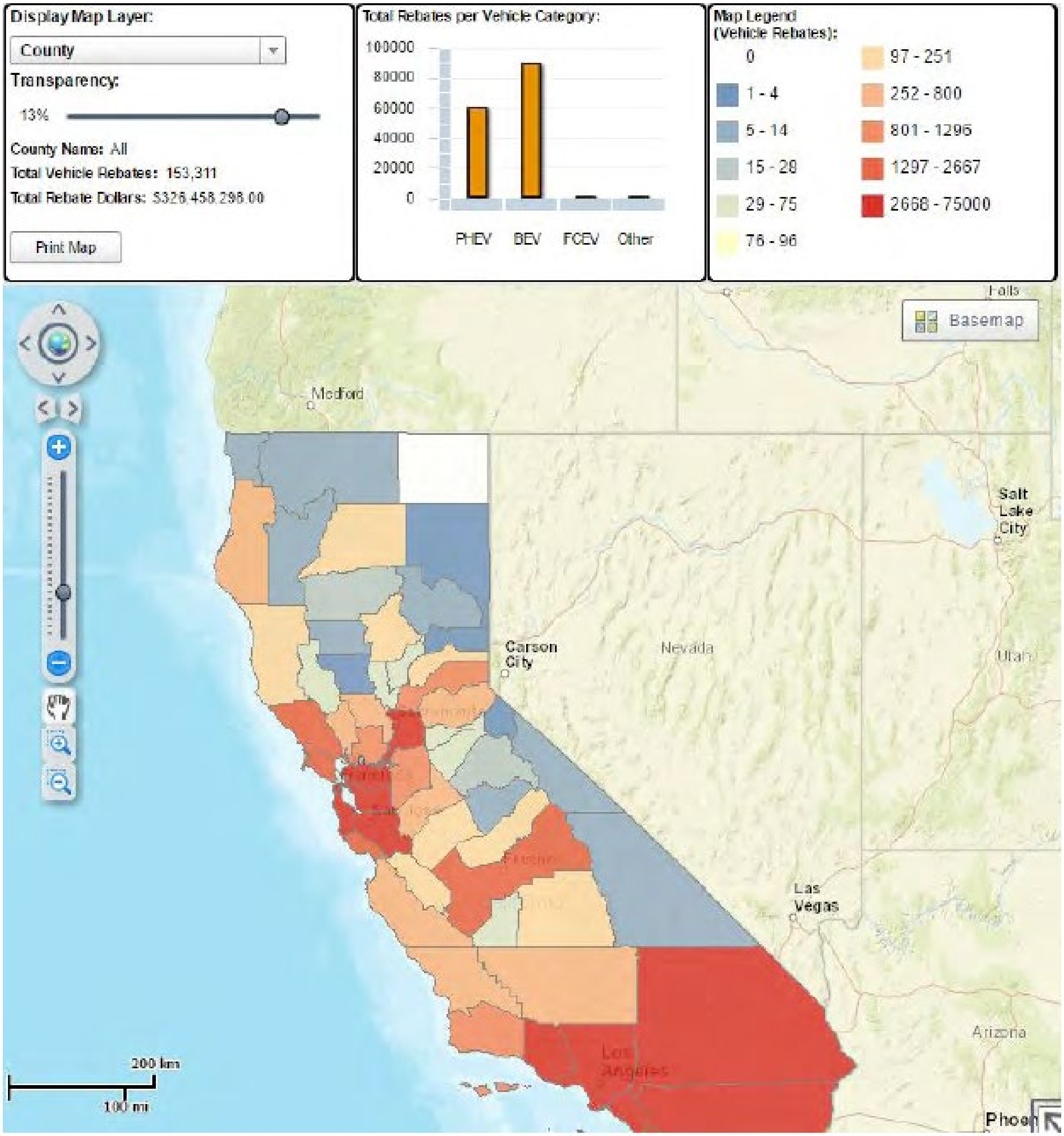
Looking at trends beyond Humboldt County, the California Plug-In Electric Vehicle Collaborative estimates that in the five years or so since EVs entered the vehicle market in force, about one-third to one-half of U.S. EV sales occurred in California. As of January 2016, California contributed about 55% of total EVs sold in the U.S., often attributed to ongoing state policies that encourage low-emission vehicles.[7]

Although the state is doing well to embrace alternative transportation such as EVs, California has an ambitious plan to cut vehicle petroleum use in half by 2030.[7] The California Air Resources Board outlines a few approaches to meet this target, such as reducing total vehicle miles travelled, increasing fuel efficiency, and at least doubling the use of alternative fuels.[8] EVs can play an important role, but will need to see strong and substantial growth in sales to help meet the state's 2050 climate change goals.

National

According to InsideEVs, a new all-time national EV sales record was set this June. Compared to 2015, sales increased 45% in June 2016, equaling about 15,000 EVs.[9] The previous record was March 2016, with sales of roughly 13,845 vehicles. The top selling manufacturers include Tesla, GM, Ford, BMW, Nissan, and VW. When comparing types of vehicles, pure battery electric vehicles accounted for 57.1% of sales, and plug-in hybrids were 42.9%.[9] So far 2016 is off to a strong start for EV sales, and is projected to finish just as strongly as more options, longer ranges, and lower prices stimulate demand.

Figure 12: PEV Newsletters (cont'd)



Number of CVRP rebates by county for plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), fuel cell electric vehicles (FCEVs), and other. Center for Sustainable Energy (2016). California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated July 05, 2016. Retrieved July 13, 2016 from https://cleanvehiclerebate.org/rebate-statistics

Figure 12: PEV Newsletters (cont'd)

California Energy Commission Instrumental to EV Adoption

With their consistent, competitive grant opportunities to develop and implement plans for low-emission vehicles in California, we can thank the California Energy Commission (CEC) for much of the progress to promote electric vehicles (EVs) in Humboldt County.

Chevy Spark EV. 4th of July EV Expo 2016.

Like many emerging technologies, we face a dilemma where consumers hesitate to buy EVs until they see enough infrastructure to support their new vehicle. Likewise, businesses hesitate to build infrastructure until they see a viable market of vehicles to service. The CEC bridges this gap with critical early funding that minimizes risks for consumers and private businesses while stimulating community investments in low-emission transportation.

These state funds are particularly important to rural areas such as Humboldt County. New technologies need "early adopters" who take the risk to supply, purchase, and maintain a new service or product. Humboldt has one of the highest EV adoption rates in the nation on a per capita basis;[6] clearly there are people willing and able to buy EVs and charge them at home. But with a population of around 134,000, our market is too small to readily stimulate private investment in EV charging infrastructure. To kick-start our local market, the Redwood Coast Energy Authority (RCEA) routinely competes for CEC funds to develop and implement plans to install public charging infrastructure. Since 2011, RCEA has coordinated roughly $1.3 million in grant and matching funds to accelerate alternative transportation in our region. Our hope is that these investments will give our market the boost that it needs so that more of our community members can enjoy the benefits of low-emission vehicles such as EVs.

Tesla Model X. 4th of July EV Expo 2016.

RCEA is a proud and appreciative partner with the CEC to bring EVs to Humboldt County, and looks forward to the broad adoption of low-emission transportation in our region and beyond.

Figure 12: PEV Newsletters (cont'd)

RCEA Charging Network Update

The Redwood Coast Energy Authority's (RCEA) electric vehicle (EV) network is up and running full force with new equipment, more upgrades, and modifications on the way. Read further for charging station status updates.

We currently are administering 14 locations with level 2 chargers (240 Volt) and a total of 6 ADA compliant EV chargers at level 1 (120 Volt) and level 2 (240 Volt) free of charge. We continue to encourage EV drivers to visit Chargepoint.com and charge.Greenlots.com to sign up for an account. Once you create an account, they will send you a card that will maximize convenience at the stations.

Our recent network improvement efforts include network maintenance, data analyzing, and customer interaction to best support our local EV drivers and their vehicles. The Ferndale charging station, located in the 4th Street parking lot, will soon be receiving a custom-made cell antenna booster to get our remote connection online and available for status and pricing updates. It will remain free of charge until we implement the new antenna. Our Arcata City Hall station has seen the most use so far and has finally worn out enough to go offline. We are currently working with the City of Arcata and a local electrician to restore this location. We apologize for the brief outage but remain confident that it will be back online soon.

Arcata Technology Center Partners, LLC charging station.

The nine new sites on the RCEA network have seen light usage in the past months with few car charges from grateful EV drivers. These few EV drivers are satisfied with our more remote locations. We have been mapping our sites on the RCEA website as well as on Plugshare.com, a highly-used website across the globe for finding an EV charging station. RCEA continues to be dedicated to providing the public with convenient charging locations with the best technology we can provide. Through California Energy Commission (CEC) grant funding, other resources, and matched funds we can gather as well as promote EV adoption in our region.

RCEA gratefully thanks the following organizations for their collaboration on this successful project:

Participating site hosts: Arcata Technology Center Partners, City of Ferndale, City of For-tuna, City of Rio Dell, City of Trinidad, L and A Enterprises, North Coast Unified Air Quality Management District, Roger and Nancy Brown, St. Joseph Hospital, and Willow Creek Community Services District.

Project partners: Colburn Electric, DCI Builders, GHD, McKeever Energy & Electric, OurEvolution Energy & Engineering, Pierson Company, Schatz Energy Research Center, Pacific Gas and Electric Company.

Figure 12: PEV Newsletters (cont'd)

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Funded by the California Energy Commission's Alternative and Renewable Fuels and Vehicle Technology Program, the North Coast Plug-in Vehicle Project is being led by the Redwood Coast Energy Authority along with implementation partner Humboldt State University's Schatz Energy Research Center. The purpose of this bulletin will be to provide relevant local, state, and national news related to the deployment of vehicles powered by electricity.

News

Used electric cars sell quickly[10]

A recent study from iSeeCars.com recorded the amount of time used electric vehicles (EVs) take to sell and found that on average they sell much faster than a used gasoline car.

DOE Announces $22 million in funding for sustainable transportation development[11]

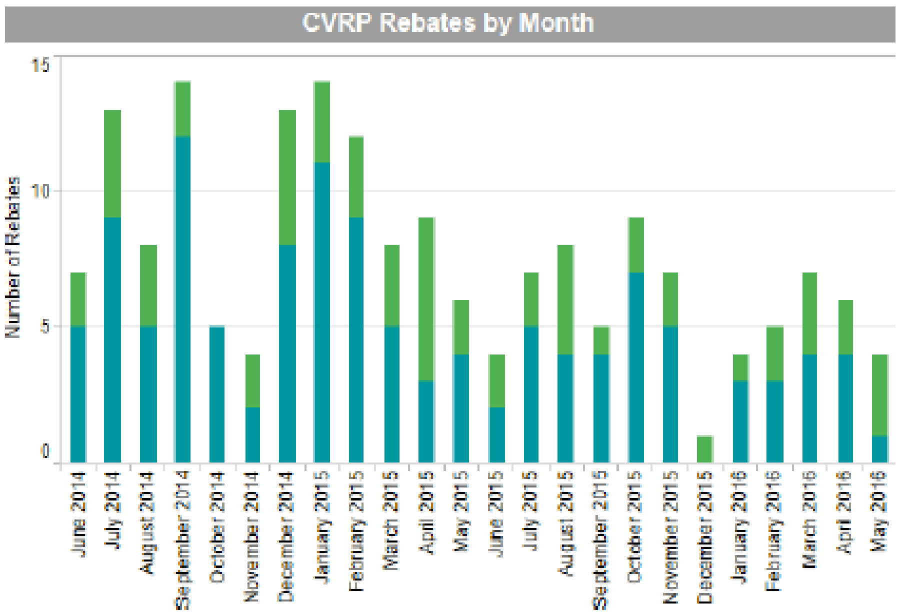
On June 6, the U.S. Department of Energy announced $22 million in funding directed towards the support of research and development of EV technologies, as well as community-based projects focused on accelerating the adoption of light, medium, and heavy duty vehicles that operate on other alternative fuels.

Welcome to the Electric Vehicle Explorer[12]

A team at the UC Davis Plug-in Hybrid & Electric Vehicle Research Center has developed an interactive online tool that allows users to explore if an EV is right for them. It takes into account home location, travel habits, and vehicle charge cost comparisons.

CVRP stats update[6]

The chart to the left shows monthly rebate data from the Clean Vehicle Rebate Project (CVRP). In Humboldt County, a total of 180 battery electric vehicle (BEV) and plug-in hybrid electric vehicle (PHEV) rebates were processed between June 2014 and June 2016.[6]



Number of Humboldt County CVRP Rebates June 2014-June 2016. Center for Sustainable Energy (2016). California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated July 05, 2016. Retrieved July 06, 2016 from https://cleanvehiclerebate.org/rebate-statistics

1 http://redwoodenergy.org/
2 https://www.tesla.com/
3 http://www.latimes.com/
4 http://northwoodauto.com/
5 https://cleancities.energy.gov/
6 https://cleanvehiclerebate.org/rebate-statistics
7 http://www.greencarreports.com/
8 http://www.arb.ca.gov/
9 http://insideevs.com/
10 http://www.cheatsheet.com/automobiles/
11 http://energy.gov/
12 http://gis.its.ucdavis.edu/

All pictures by Redwood Coast Energy Authority unless otherwise noted.

NORTH COAST PLUG-IN ELECTRIC VEHICLE PROJECT   JULY 2016 | NEWS & UPDATES

In This Issue

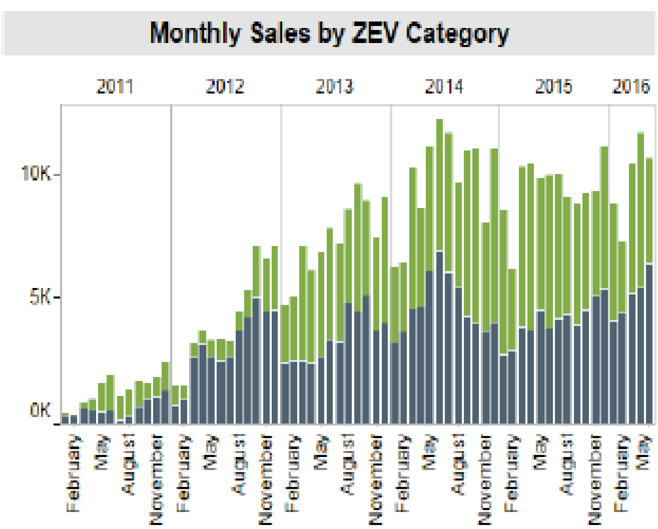
Upcoming Events

The Redwood Coast Energy Authority (RCEA) will be at the Humboldt County Fair this year, on August 24th and 25th. We will be promoting the statewide Energy Upgrade campaign, encouraging people to conserve energy, and have info on how electric vehicles (EVs) can help California achieve its petroleum-reduction goals. Check out RCEA's events[1] page for the most up-to-date information.

News

ZEV sales by state[2]

The chart below shows monthly U.S. zero emission vehicle (ZEV) sales from January 2011 to May 2016. The interactive map on the Sales Dashboard website also displays electric vehicle (EV) sales by state.



Number of nationwide EV sales Jan. 2011-May 2016. Center for Sustainable Energy, Auto Alliance, R.L. Polk & Co, 2015 (2016). Retrieved August 22, 2016 from http://www.zevfacts.com/sales-dashboard.html.

White House to accelerate electric vehicle adoption in the U.S.[3]

In addition to announcing over $4 billion in loan guarantees toward the support of commercial deployment of innovative EV charging facilities, the U.S. Department of Energy and the U.S. Department of Transportation have published a guide to highlight examples of federal support and technical assistance for plug-in electric vehicles (PEVs) and charging stations. The guide provides a list of current tax credits and incentives applicable to PEVs and EV charging.

Organizations agree to accelerate electric vehicle market[4]

The American Public Power Association and the U.S. Department of Energy will be partnering to advance EV adoption and charging infrastructure deployment for private and commercial vehicles. They will also develop a Community Action Plan focusing on smaller communities with under 200,000 electric customers.

Electric bikes may play a part in CA's Zero Emissions Plan[5]

According to *Next City*, about $8 million in funding will be available in the second year of the California Air Resources Board (ARB) Car Share and Mobility Options project. This means cities and nonprofit organizations will have the option to apply for funds for electric bike sharing projects, and California will be able to explore bike sharing programs to reduce transportation emissions.

Figure 12: PEV Newsletters (cont'd)

Electric Vehicle Charging Station Etiquette

As the number of electric vehicles (EVs) on the road continues to climb, EV owners are coming to experience congestion at their favorite public EV charging stations. Unlike fueling stations for internal combustion engine (ICE) vehicles for which drivers abide by etiquette that they have learned from generations of drivers before them, EV fueling stations are new and pose a few issues that call for some clear etiquette to be defined. Many online blogs and EV sites have weighed in on the topic of EV charging etiquette, but we found the below graphic, a compilation of advice from EV customers on the Clipper Creek website, to synthesize the consensus of the EV community well.[6]

EV Etiquette graphic. Source used with permission from: https://www.clippercreek.com/electric-vehicle-etiquette/

Figure 12: PEV Newsletters (cont'd)

Solar & EV Go Together Like PB & J

In regions of the country where renewables make up a good portion of the power mix, like California, driving a car powered by electricity clearly makes more sense. However, in regions with more carbon-intensive power, the advantages become less striking. One way to ensure that miles travelled in your electric vehicle (EV) are clean is to install rooftop solar.

There has been quite a bit of buzz about solar-powered EVs. The electric car manufacturer Tesla recently agreed to acquire one of the largest residential solar installers, SolarCity, for $2.6 billion.[7] Elon Musk, Tesla's CEO, explained in his recent master plan that the new partnership will "create a smoothly integrated and beautiful solar-roof-with-battery product that just works, empowering the individual as their own utility."[7] Analysts predict Tesla will begin selling solar charging packages bundled with car purchases.[8]

Envision Solar charging station. Source used with permission from: www.envisionsolar.com/ev-arc/

Sungevity, another large solar installation company, has partnered with the station locator app Plugshare to provide free residential charging stations.[9] Members of Plugshare in California are eligible to receive a free GE Wattstation when they purchase a residential solar system from Sungevity.[9] Residential charging stations are often expensive to install on their own, with most of the cost coming from electrical work and permitting. Installing solar and EV charging at the same time can save on these costs.

Outside the home, solar-powered charging for public stations has also begun to pick up speed. Envision Solar makes a stand-alone, portable charging station that integrates a solar panel and storage battery. Called the EV ARC™, these units take up a single parking space and provide 100% solar power for car charging.[10] While they come with a hefty initial price tag, these units avoid the sometimes costly trenching and installation requirements that come with traditional public charging stations.[10]

Aside from a dramatically reduced carbon footprint, charging your EV with solar also makes financial sense. According to SolarCity, "powering an EV with electricity generated from a home solar system can be 77 percent less expensive than powering a car with gas."[11] As solar panel and battery technology improves, we will only see more attractive and cost effective charging options emerge. With all the advancements and expansions, we look forward to a world where we all drive on sunshine.

Figure 12: PEV Newsletters (cont'd)

The Humboldt EV Experience

When looking to purchase a car, consumers are faced with too many choices. Add electric vehicles (EVs) into the mix and the possibilities continue to confound. Plug-in hybrid electric vehicle (PHEV) versus battery electric vehicle (BEV)? Range versus price? The list goes on. Of course much of the decision depends on user experience, and who better to advise than folks with firsthand EV driving experience? The Redwood Coast Energy Authority (RCEA) sent out surveys to local EV users in the community, ranging from new to seasoned owners, who graciously relayed their experience of driving an EV in Humboldt County.

Survey Responses

How long have you been a plug-in electric vehicle (PEV) owner?

Anonymous: 70 days
Chip Sharpe: Since March 2014
Gilly and Jeff Black: We have had a PEV for just 5 months - a Kia Soul.

What aspects about your PEV do you enjoy?

A: Fun to drive. Smooth. Quiet. Great acceleration.
CS: Most appreciate: Responsiveness (immediate torque and regenerative braking provide superior control in challenging conditions); clean, simple (compared to ICE), and elegant technology; engineered for safety; able to fuel our car with solar-generated electricity
GB: We love not having to buy gas and how quiet it is.

How would you respond to people who are worried about PEVs running out of battery before reaching a charging station?

A: After a month of driving the range anxiety disappears. Here's an example of week in the life of the car. It shows you that range and range anxiety are simply not issues. Note that we are *much* further from town than most people. I show the round-trip miles for each trip. Our [car] has a range of about 82 miles.

Ford Focus at 4th of July EV Car Show 2016.

Sunday: Run at the park, 8 miles of driving (round trip).
Song group, 17 miles
Monday: Dentist. 35 miles.
Tuesday: Choir. 35 miles.
Wednesday: Go into town for fun. 70 miles.
Thursday: Volunteer at hospital. 36 miles.
Friday: Coffee with friends. 40 miles.
Saturday: Go into town for fun. 110 miles (with charging).

CS: I have enjoyed the challenge of planning trips with the requisite charging stops
GB: Range anxiety is no worse than worrying about filling up your gas tank on a long trip - it just requires some forethought - a little more frequently! Plugging in at home overnight is easy. We signed up for PG & E's overnight rate and our electric bills have not increased significantly. So, this shows that range just isn't an issue. If we need to go further, we just take our other car. No big deal.

Do you take your PEV out of town? If so, what methods do you use to locate charging stations?

A: No.
CS: We have taken three "long" trips of five or six hundred miles each way (1,000-1,200 round-trip) and several trips of about 700 miles round-trip. We use the PlugShare app and Tesla GPS to locate a variety of chargers. And, for trips greater than 400-other-so miles, we prefer to stay a night at a motel. Lots of motels are adding charging stations.
Charging stations are now increasing in number at such a rate that "range anxi-

Figure 12: PEV Newsletters (cont'd)

ety" is becoming less serious. Remember that needing to recharge is only one of many possible delays; the wise traveler leaves large margins of time and relaxes into enjoyment of the journey.

GB: We have not taken our car far out of town, but websites such as Charge point and Plug Share are inspiring us to take longer trips - albeit more slowly. Some of these sites include users photos/descriptions of the charging station which makes them easy to find. The websites and charging stations are very easy to use.

Did you apply for a state rebate? If so, how much time did it take for you to receive it?

A: No. We bought ours used.

CS: The $2,500 California rebate arrived after a few weeks.

GB: We did apply for a state rebate. It came pretty quickly - probably within [a] month.

What specifications or features were you looking for when shopping for a PEV?

A: Range of at least 70 miles. No gasoline range extender.

CS: We would have opted for a 300-mile range, had that been available, but we can make do with 265 from a charge that we get with the 85 kWh battery. The quality and safety of the Tesla made us enthusiastic buyers, though our initial interest was primarily environmental protection.

GB: When we shopped for this car we were actually looking for a PHEV, but found this one that has a charge that

City of Rio Dell charging station.

lasts for close to 100 miles, which is great! We also wanted a car with space in the back for multiple dogs, which, due to it's boxy shape, the Soul has.

What advice would you give to new Plug-in electric vehicle (PEV) owners?

A: Have fun.

GB: We love our relatively pollution free car- and it's our only car. We leased it for 3 years thinking that within that time frame new electric cars will come on the market that will have more miles per charge- or there will be many more available fast chargers around. We are looking forward to the time that we can drive to San Francisco in a day in our PEV - and all other cars on the road will be similarly powered! So, if you're thinking of getting a new car, don't hesitate to get a PEV!

Resources

Are you already a satisfied EV driver but looking for ways to connect with the EV community? Listed below are a few resources for EV enthusiasts, both owners and non-owners alike:

Local Groups

Humboldt Electric Vehicle Association (HEVA)
Heva.org[12]

North Coast Groups

Pacific Coast Collaborative
Pacificcoastcollaborative.org[13]

State and National Groups

Electric Auto Association (EAA)
Electricauto.org[14]

Online Forums

DIY Electric Car
Diyelectriccar.com[15]

Electric Car Forum
Electricforum.com[16]

Electric Vehicle Discussion List (EVDL)
Evdl.org[17]

Speak EV
Speakev.com[18]

| 5 |

Figure 12: PEV Newsletters (cont'd)

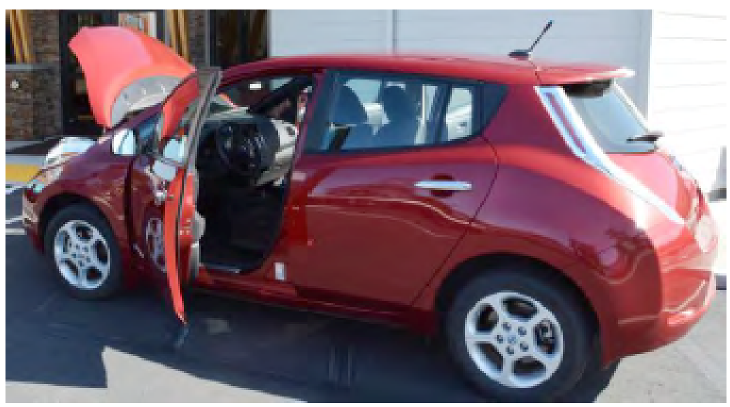
Home is for Recharging

Having an electric vehicle (EV) means needing to be able to reliably recharge it overnight in order for it to be used to reach your destination the next day. This typically means having a charger at home or in the garage for your vehicle to sip on as you sleep. Charging at home offers several advantages over public charging, including more control over costs, and more control over where your electricity is coming from.

Plugging in at home means you can often take advantage of reduced electricity rates during off-peak hours. Instead of paying a flat price for charging at a public station, you can plug-in at a time when you expect to pay the lowest electricity rates. Utility companies' flexible pricing encourages charging during cheaper energy rate hours which relieves stress on the power grid.[19]

For Pacific Gas and Electric Company (PG&E) customers, there are two EV rate plans available: EV-A, in which your EV charging costs are incorporated into your total home electric bill, and EV-B, in which your in-home charging station is on a separate meter.[19] The EV-A option is best for customers with overall low energy usage and is no cost. The EV-B option is ideal for higher usage, particularly during peak hours.[19] Every EV automatically comes with a Level 1 cord that connects straight from the car to a 120V outlet. However, if you are considering installing a Level 2 charging station at home, follow the easy steps outlined by PG&E at www.pge.com.[19]

Plugging in at home also means you can use power your generate yourself. Generating power at home could mean rooftop solar, micro wind turbines, micro-hydro - or other small renewable energy systems providing electricity "behind your meter." Storing the power you generate is becoming more affordable as storage technologies progress. Whereas old-school storage systems consisted of many car batteries wired together to make a large battery bank, new systems are sleeker and designed to integrate smoothly with your home power needs. Battery banks can be tied in with the public power grid, and like an EV, recharged when rates are lowest, and expended when rates are high. This helps keep EV charging costs down even when you aren't able to plug-in at times when electricity rates are low. Battery banks can also be used to create "off-grid" EV charging systems, allowing home charging no matter where you live.



Nissan Leaf at Alternative Fuels Clean Cities Symposium 2016.

Figure 12: PEV Newsletters (cont'd)

4th of July Event Highlights

On July 4, Redwood Coast Energy Authority (RCEA) partnered with Eureka Main Street to promote electric vehicles (EVs) while enjoying the annual 4th of July Festival activities. We invited individual EV owners to showcase their cars for event attendees to see. At the end of the day, there had been a Nissan Leaf, Ford Focus, Chevy Spark, and three Teslas generously displayed in Old Town Eureka. Many people stopped to chat and enjoyed themselves.

EVs at Eureka Main Street 4th of July EV Car Show 2016.

Nissan Leaf at Eureka Main Street 4th of July EV Car Show 2016.

Figure 12: PEV Newsletters (cont'd)

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BMW i8 at Pony Express Days EV Expo 2016.

1 http://redwoodenergy.org/
2 http://www.zevfacts.com/
3 https://www.whitehouse.gov/
4 http://www.sustainablecitynetwork.com/
5 http://bikocity.com/
6 https://www.clippercreek.com/
7 https://www.tesla.com/
8 http://www.bloomberg.com/
9 http://evobsession.com/
10 http://www.envisionsolar.com/
11 http://www.solarcity.com/
12 Heva.org
13 Pacificcoastcollaborative.org
14 Electricauto.org
15 Diyelectriccar.com
16 Electricforum.com
17 Evdl.org
18 Speakev.com
19 Pge.com

All pictures by Redwood Coast Energy Authority unless otherwise noted.

Figure 12: PEV Newsletters (cont'd)

NORTH COAST PLUG-IN ELECTRIC VEHICLE PROJECT AUGUST 2016 | NEWS & UPDATES

In This Issue

Upcoming Events

The Redwood Coast Energy Authority (RCEA) will be celebrating Energy Awareness Month throughout October, and will be at the Festejando Nuestra Salud Health Fair on Sunday, October 16 at Redwood Acres Fairgrounds in Eureka with information on the link between energy and a healthy environment. Check out RCEA's events[1] page for the latest on local plug-in electric vehicle (PEV) and alternative transportation events.

News

New BMW showroom in McKinleyville[2]

BMW of Humboldt Bay may debut its new showroom at 1781 Central Ave. in September or October 2016. The new, bigger space, will feature an electric vehicle (EV) display.

Prepping power grids for the EV revolution[3]

Discussions have been underway to address the effect of EV adoption on the grid and electricity costs. Rocky Mountain Institute's Chris Nelder outlined risks associated with ill preparation, but greater electricity demand on the grid also presents an opportunity for utilities and power generators, as well as for distributed renewables to reduce grid demand.

KEPCO to use utility poles as EVCS[4]

South Korea's power supplier, the Korea Electric Power Corp. (KEPCO), is conducting a trial test in the city of Busan to install EV chargers on telephone poles. The results have not yet been determined, but the approach is anticipated to cut installation costs associated with purchasing land and stand-alone stations.

Upgrade Athens County offers interest free loans for energy efficient vehicles[5]

In December 2015, the Ohio University Credit Union in Athens County launched an EV loan program with opportunities for individuals to receive a loan of up to $30,000, interest-free, to buy an EV or PHEV. The program was initiated to incentivize more residents of Athens County to go green, and will end in December 2016.

Figure 12: PEV Newsletters (cont'd)

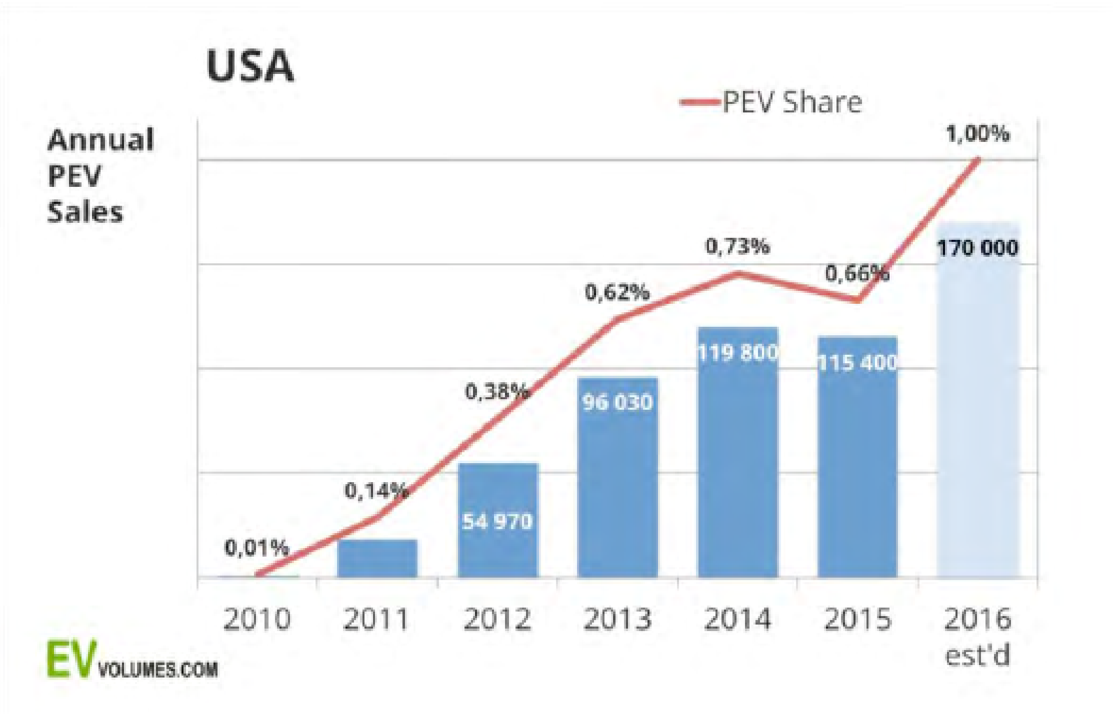
Looking at the Future of EVs in California and Beyond

Forecasting the future is hardly a strict science, but there are some emerging themes that shed light on the next decade of electric vehicles (EVs) in our region. A good starting point is California state policy since it exerts considerable influence on one of the largest vehicle marketplaces in the nation.

California Governor Brown has established a state policy to achieve 1.5 million zero emission vehicles (ZEVs) on the road by 2025, and to have all cars sold in the state to be emissions-free by 2050.[6] California law defines if a vehicle qualifies as a ZEV by evaluating tailpipe emissions. Today there are two technologies that result in zero tailpipe emissions: an electric drive train powered by rechargeable batteries, and an electric-drive vehicle with fuel cells supplied by compressed hydrogen gas. Note that the ZEV definition doesn't consider emissions generated while producing the electricity or hydrogen, so producing these fuels using renewable energy sources can reduce total emissions even further.

Using a simple per-capita calculation, Humboldt's share of those 1.5 million ZEVs is about 10,000 vehicles by 2020.[6] As of March 2016, Humboldt County listed 294 EVs registered with the California Department of Motor Vehicles, or about 0.2% of total registered vehicles.[7]

ZEV mandates remain complex, with an evolving credit system to motivate production quotas, ongoing legislative debate, and negotiations with auto manufacturers and other



Annual U.S. PEV Sales. Source used with permission from: http://www.ev-volumes.com/country/usa/

Figure 12: PEV Newsletters (cont'd)

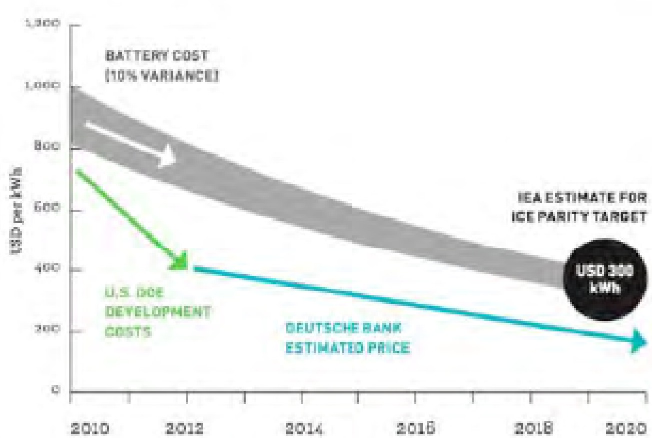
parties. Even with these challenges, ZEVs are poised for growth. According to Automotive News, "California and the 9 other states that follow its zero-emission vehicles rules accounted for more than a quarter of U.S. new-car registrations in 2015.[8]" This makes it increasingly important for car manufacturers to address this growing market segment.

Automakers and EV drivers observe some perks in the California EV market through financial incentives, access to extensive high-occupancy-vehicle (HOV) lanes, charging infrastructure, and reduced parking rates. These benefits help to build an ecosystem for EV drivers and accelerate progress toward cleaner transportation.

The EV market is still in the early stages, and in 2016 sales are projected to be about 1% of total new car sales in the U.S.[9] Temporarily set back by weak 2015 performance attributed to limited product availability, EV sales have returned to historic trends. The chart shows sales for plug-in electric vehicles (PEVs), which includes some hybrids.

Figure 16. Estimated Costs of EV Batteries through 2020

Source: IEA, U.S. DOE, Deutsche Bank.



Estimated Costs of Lithium EV Batteries through 2020. Source: https://evannex.com/blogs/news/18110144-battery-costs-falling-part-1-electric-vehicles

California has a strong ZEV incentive program, the California Clean Vehicle Rebate Project, but in June 2016 it exhausted incentive funds owing to a legislative impasse, which hopefully will resolve later this year.[10] Traditional auto manufacturers are still developing their business cases toward volume EV production, making steady but slow progress. Early adopters have embraced EVs, but that's a fraction of the population, and consumers can now tap the emerging used EV market where a 3-year-old Nissan Leaf is now consistently under $10,000.

Battery cost-reduction turns out to be a realistic expectation. Much of future EV vehicle sales growth is credited to lower battery prices, and in 2013 the International Energy Agency (IEA) projected lithium-ion battery price would be equal to internal combustion engine (ICE) vehicles when the cost reached $300 per kWh of storage capacity by 2020.[11] In 2015, MIT referenced a study which found that lithium-ion EV battery costs are declining more quickly than expected.[11]

Other major markets are also pushing battery technology forward, including portable digital devices such as laptops and smart phones, and electricity storage for renewable energy systems such as wind and solar. This diverse market results in robust research and development, with many battery technology improvements underway.

Figure 12: PEV Newsletters (cont'd)

Mapping a Route for Your EV Through Humboldt County

Mapping a route for your road trip in your electric vehicle (EV) through Humboldt County has never been easier. With 14 total Level 2 EV charging station (EVCS) locations on the Redwood Coast Energy Authority (RCEA) network and numerous other public and private chargers around the county, you're sure to have enough juice to get you through--that is if you plan your trip accordingly. When devising a route to, from, or through our gorgeous county, there are several important variables to consider before you hit the road.

There are many new and used EVs on the market that all have different battery capacities, charging times, run times, plug types, and driving modes that can affect the length of road you can span on a single charge. Keeping these variables in mind, plot your trips using one or two EV charger-locator websites or apps, and you are sure to have a fully charged battery to get you to your destination. So, read the manual for your vehicle, find out how far you can travel on a single charge, do some research, and most importantly, test it out for yourself. There can often be a difference in what the manual claims compared to your actual driving experience and conditions. The electronics in your automobile, especially batteries, are susceptible to environmental conditions such as temperature, humidity, altitude, physical damage, and manufacturing quality. Some additional considerations for your vehicle's driving distance can include tire pressure, suspension, wheel bearings, weather, steep inclines as well as declines, regenerative breaking, built-in solar panels, and the age of your vehicle and its separate components. When organizing your trip, consider Humboldt County's abundant hills and mountains, various temperature changes and climate zones, and varying altitudes.

City of Ferndale EVCS site.

Above all, you need to know when and where you're going to charge your EV. Planning to get to a charger before you run out of juice is of utmost significance. Many EV chargers on our network and other EV chargers in the county are purposefully placed near town centers, malls, restaurants, and points of interest as convenient break locations while your vehicle charges. Our network spans as far south as Rio Dell, as far north as Trinidad, and as far east as Willow Creek to keep EV travelers comfortably charged. These stations were strategically installed with the help of the Schatz Energy Research Center (SERC), affiliated with Humboldt State University, and their custom EV modeling software which predicted where drivers would need to charge up the most while considering communities and entertainment for the EV charging time layover. Whether you're going out, to, or through Humboldt County there's an EV charger waiting for you.

Figure 12: PEV Newsletters (cont'd)

EV Community Spotlight

This month we spoke with an anonymous local plug-in electric vehicle (PEV) owner. They had plenty of insight about PEVs. Read on to hear what they shared!

RCEA: How long have you been a PEV owner?

A: 5 years (before that 10 years of battery assist Prius'). Then a plug-in Prius for 2 years and now a Chevy Volt for 3+ years. Love the Chevy Volt!

RCEA: What aspects about your PEV do you enjoy?

A: All aspects, but particularly we like knowing we're decreasing our carbon footprint, especially with solar panels to fuel the Volt. Also, the Chevy Volt has plenty of torque, so it is a quick car when you need it to be.

Chevy Volt PHEV.

RCEA: How would you respond to people who are worried about PEVs running out of battery before reaching a charging station?

A: The Chevy Volt has a gas generator that kicks in when it exceeds its range (40 miles), but we seldom exceed the range so we are electric about 90% of the time.

RCEA: Do you take your PEV out of town? If so, what methods do you use to locate charging stations? **A:** We don't often go beyond the range, but when we do we have a generator in the Chevy Volt that replenishes the electricity in the batteries. When we get to our destination there are apps that can help a person find a fueling station, also if you stay with a friend you can plug it in at their house if they are willing.

RCEA: Did you apply for a state rebate? If so, how much time did it take for you to receive it?

A: We got a tax rebate on the plug-in Prius, but we couldn't get one on the Chevy Volt because we had already received one on the plug-in Prius. We did get a federal rebate of 7500 dollars for the Chevy Volt. Different rules between State and Fed. We also got a federal tax rebate on the solar panels. I think we got 2500 dollars from the State on the Prius.

RCEA: What specifications or features were you looking for when shopping for a PEV?

A: We wanted a car that has decent electric range, but with gas backup when needed. We liked the hatchback design. We also wanted a car that looked great.

RCEA: What advice would you give to new PEV owners?

A: Learn how to alter your driving habits to get the best range, and get solar panels so you can fill your batteries using the sun. PEV plus solar panels (and a vegetarian or better yet, vegan diet) will reduce your carbon footprint to near 0. The solar panels are pumping out clean solar electricity from sunrise to sunset into the grid, so you build up carbon credits, so to speak, to offset carbon use, and that includes charging the electric vehicle batteries.

Figure 12: PEV Newsletters (cont'd)

What EV Makers Have in Store

This is an exciting period for electric vehicles (EVs). Established manufacturers, as well as newcomers, are innovating at an unprecedented speed. There are a number of high-quality EV options available today, with ranges of anywhere from 60 miles to just over 100 miles. Considering the average American travels under 40 miles per day,[12] currently available EVs can satisfy most drivers' needs. However, an EV with a 200 mile range or greater offers drivers more flexibility, enabling longer trips and less time recharging. While Tesla has accomplished this greater range in both the Model S and Model X, their six-figure price tags put them out of reach for many people. Fortunately, the following upcoming EVs promise to deliver greater flexibility for a much more affordable price.

Nissan Leaf

The Nissan Leaf is the world's best selling electric car, with global sales reaching over 200,000 units in January 2016.[13] The second-generation Nissan Leaf will feature a 60 kilowatt battery and a range of over 200 miles, though no release date has been confirmed. That's almost twice the 107 mile range of the current model. This greater range offering comes in response to the upcoming Chevy Bolt and Tesla Model 3, which both offer ranges above 200 miles.[14]

Chevy Bolt

Touted as the first long-range affordable EV, there is undeniable excitement around its proposed "late 2016" release. The Chevy Bolt features 200 miles of range for $37,500, before incentives.[15] The crossover hatchback design emphasizes utility, with generous passenger and cargo space. A large proportion of Chevy's first run of the Bolt has been promised to Lyft drivers, the popular ride-hailing service.[14]

Model 3

Tesla received 373,000 reservations for the Model 3, with each reservation costing $1,000. There is little debate that the Model 3 is the most anticipated electric car in history. It will feature a 215 mile range, $35,000 starting price (before incentives), and a sleek design. Tesla anticipates delivering these cars in late 2017, ramping up construction of their huge manufacturing plant, called the "Gigafactory", to handle the demand.[16]

Nissan Leaf charging port at 4th of July EV Car Show 2016.

Chevy Volt

The Chevy Volt is a Plug-In Hybrid, meaning it is powered by an externally charged battery for some distance before switching over to a traditional gasoline engine. With the 2017 model providing 53 miles of all-electric range, Chevy estimates drivers will go "1,000 miles between fill-ups with regular recharging".[15] This technology provides an intriguing compromise between all-gas or all-electric vehicles, giving drivers an opportunity to drive electric without range anxiety.

With these new EVs hitting the market, including anticipated longer-range offerings from Ford, Volkswagen, Hyundai, and others, EV technology will only continue to improve while prices fall. Although the incumbent internal combustion engine will be hard to unseat, the undeniable benefits of EVs will keep pulling an ever greater number of drivers away.

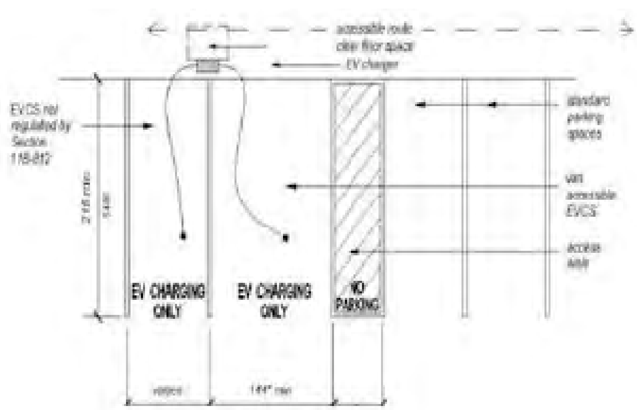
Figure 12: PEV Newsletters (cont'd)

Accessible Charging

How to best provide universal access to electric vehicle (EV) charging infrastructure has been an ongoing debate here in California. Ensuring that EV drivers with disabilities can park in front of, navigate to, and operate charging equipment has been a mission of the Division of the State Architect (DSA).

Recently adopted changes to the California Building Code will ensure that the location, layout, and dimensions of EV parking spaces allow universal access to associated charging infrastructure. The DSA solicited feedback and heard from a number of interested parties before moving forward with making changes to the code. The proposed, and ultimately adopted, changes reflected the consideration of multiple viewpoints.

The building code now requires the first EV charging station (EVCS) installed at a site be made accessible to drivers with disabilities. This means the parking space in front of the first charging station, at a minimum, will need to be built as the new code specifies. The space will look like a typical van-accessible space, with a wide aisle to accommodate wheelchair use, but will be available for use by all EV drivers. The diagram below represents the new required configuration for the first charging station at a site. The accessible spot is labeled "EV Charging Only", but isn't designated with an International Symbol of Access, meaning anyone with an EV can park there.



Accessible route diagram example. Source: http://www.documents.dgs.ca.gov/dsa/access/2016-Pt2_Final-Express-Terms_12-22-15.pdf

In addition to layout requirements, the first charging station at a site needs to be on an "accessible route" to the facility. This means that someone using a wheelchair can both navigate from their vehicle to the charging station and from the charging station to the main facility.

A vehicle currently in development, called the Kenguru, is a unique small EV designed especially for drivers who use a wheelchair. The driver simply enters and exits the vehicle via the ramp in the back.[17]

Providing access to EV charging infrastructure is critical to the ongoing reduction in our petroleum use. Universal access is an important step in promoting EVs as a viable choice for all California drivers.

Figure 12: PEV Newsletters (cont'd)

REDWOOD COAST EnergyAuthority

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707.269.1700

info@redwoodenergy.org

Funded by the California Energy Commission's Alternative and Renewable Fuels and Vehicle Technology Program, the North Coast Plug-in Vehicle Project is being led by the Redwood Coast Energy Authority along with implementation partner Humboldt State University's Schatz Energy Research Center. The purpose of this bulletin will be to provide relevant local, state, and national news related to the deployment of vehicles powered by electricity.

EVs at 4th of July EV Car Show 2016.

1 http://redwoodenergy.org/
2 http://madriverunion.com/
3 http://www.power-technology.com/
4 http://www.koreaherald.com/
5 http://www.thepostathens.com/
6 Redwood Coast Energy Authority and Schatz Energy Research Center Alternative Fuels Final Draft Report 2016
7 http://www.times-standard.com/
8 http://www.autonews.com/
9 http://www.ev-volumes.com/
10 https://cleanvehiclerebate.org/
11 https://evannex.com/
12 http://driveclean.ca.gov/
13 http://www.nissan-global.com/
14 http://www.greencarreports.com/
15 http://www.chevrolet.com/
16 https://www.tesla.com/
17 http://www.kenguru.com

All pictures by Redwood Coast Energy Authority unless otherwise noted.

Source: Redwood Coast Energy Authority

Appendix J:
City of Arcata Fleet Analysis Report

Figure 13 shows City of Arcata Fleet Evaluation memorandum.

Figure 13: City of Arcata Fleet Evaluation Memorandum

City of Arcata Fleet Evaluation

MEMORANDUM

To: Lori Reed, City of Arcata
From: Pierce Schwalb, Redwood Coast Energy Authority
Re: Updated evaluation of plug-in electric vehicle adoptions for the City fleet (revised numbers)
Date: May 4th, 2016

<u>Executive Summary</u>
We assessed opportunities for the deployment of plug-in electric vehicles (PEVs) into the City of Arcata's fleet. We found that a handful of alternatives will pay for themselves within the anticipated lifetime of the replacement vehicle.

Key findings include:

- PEVs can replace vehicles in the Administration Department fleet while meeting the needs of this department and providing favorable paybacks. The Nissan Leaf and Mitsubishi i-MiEV have the quickest paybacks. **The analysis reflects an $8,000 discount for Nissan Leaf fleet purchases. Two Leafs must be purchased to receive this discount.**[1]
- All-electric parking enforcement vehicles are expected to have a reasonable payback time and should be considered.
- The water meter reader vehicle in the Water/Wastewater Department is not a good fit for PEV replacement due to the need to carry a ladder. Even if one of the two Ford Rangers servicing the water department were replaced with a Kia Soul EV, it will not pay for itself within its expected lifetime.
- The cost of electric vehicle charging equipment can be substantial and can significantly lengthen payback times. Installing more than one unit in a given location can help reduce the impact of installation costs. Finding ways to minimize the cost of charging equipment and/or securing grant funding for charging equipment is desirable. The cost of installing charging equipment is very dependent on site specific conditions and needs.
- Purchasing multiple PEVs along with multiple charging stations that are all installed in one location can be cost effective.

<u>Introduction</u>
The Redwood Coast Energy Authority, in partnership with the Schatz Energy Research Center and GHD Consulting Engineers, conducted a North Coast Plug-in Electric Vehicle Readiness Study. The study was funded by the California Energy Commission and prepared our region for the successful deployment of a large number of PEVs into our regional vehicle fleet. 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.

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[1] See www.nissancommercialvehicles.com/media/pdf/MY16%20Nissan%20Fleet%20Sales%20Program%20-%20Fleet%20Accounts.pdf for more information.

Figure 13: City of Arcata Fleet Evaluation Memorandum (cont'd)

This latest analysis serves as an update from our analysis conducted in 2013. Due to the rapid evolution of electric vehicle technology, a more current analysis was conducted to provide the City with the most up-to-date information. To support this activity and others related to PEV readiness plan implementation, the RCEA received another round of funding from the CEC through agreement ARV-13-046.

This memo describes the approach we took and summarizes the results we obtained in our analysis of PEV opportunities for the City of Arcata vehicle fleet.

Approach

We worked with Lori Reed in Environmental Services. She provided a list of vehicles in the City's fleet. We reviewed the list and identified a set of vehicles that offered key opportunities.

The criteria we used to identify key opportunities included the following:

- **PEVs are appropriate for the application**. The state of the technology of PEVs is most commercially mature for light duty passenger vehicles. Therefore, this analysis only considered this vehicle class. However, there are options for light duty and medium duty trucks. See Appendix for details. This means fleet applications requiring a truck, off-road capability, or other special attributes are not eligible for replacement.
- **The existing fleet vehicle is anticipated to be replaced in the next couple of years.**
- **The existing fleet vehicle has relatively high annual miles driven**. Annual miles driven has a big effect on the economic payback. In general, more miles driven results in a quicker payback because of fuel savings.
- **The required vehicle range (miles driven per trip) is compatible with PEV characteristics**. Currently available and reasonably priced BEVs typically have a 50 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

W used 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), time-of-use electric rate schedules, 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 tailpipe CO_2 emissions.

To help the City of Arcata evaluate the economic costs and/or 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 will pay for themselves within the anticipated lifetime (10 years) of the replacement vehicle. Note that the PEV FleET spreadsheet tool is being provided to City staff to allow them to conduct future analyses as they see fit.

Figure 13: City of Arcata Fleet Evaluation Memorandum (cont'd)

Results

The City of Arcata elected to consider the replacement of ten vehicles in their fleet. These vehicles serve three different departments/purposes: Administration (5), Police (3) and Water (2). A list of the current fleet vehicles and their characteristics are included in Attachment A.

Table 1 shows all 10 vehicles, and whether they can be replaced with a PHEV, BEV, or neither. Each vehicle is placed in either the "BEV" or "PHEV" category based on the maximum required trip mileage. If maximum trip mileage exceeds current BEV range (approx. 80 miles) the vehicle is placed in the "PHEV" category. All current vehicles that cannot be replaced by EV's due to protracted payback periods are additionally marked in the "Neither" category. **Four out of the 10 vehicles chosen for this analysis will have payback periods within the vehicle's expected lifetime.**

Tables 2 through 4 present the economic results for a one-for-one replacement of a vehicle in each of these departments.

All purchase prices listed for BEV's include the $2,500 rebate through CVRP. Incremental cost and payback calculations include an estimated cost for the purchase and installation of EVSE.

Vehicle	BEV	PHEV	Neither
102 Administration/ Ford Ranger	X		
119 Administration/ Toyota Prius		X	X
120 Administration/ Toyota Prius		X	X
121 Administration/ Honda Civic	X		
123 Administration/ Toyota Prius		X	X
311 Police/ GO 4 Interceptor III	X		
312 Police/ GO 4 Interceptor III	X		
394 Police/ Ford Explorer	X		X
533 Water/Wastewater/Ford Ranger	X		X
556 Water/Wastewater/Ford Ranger	X		X

Table 1

Administration

The Administration Department is currently serviced with a Ford Ranger and four hybrid-electric vehicles, including three Toyota Priuses and a Honda Civic. We assumed that the conventional replacement vehicle for these existing Administration Department vehicles would be the Toyota Prius V 1.8L. This is comparable to the current vehicles in the department fleet.

We examined a number of PEV options for the Administration Department fleet, including both plug-in (PHEV) and full-electric (BEV) vehicles. Due to the high per-trip mileage requirements of the existing Toyota Priuses (300 average miles per trip and 600 maximum miles per trip) PHEV replacements would be required. Due to the relatively high cost of current PHEVs, they will not pay for themselves within their expected lifetime.

The results shown in Table 2 include the PEVs with the shortest payback periods for replacement of the Honda Civic. Table 3 shows the payback periods for the Ford Ranger. The differences in payback periods are mainly due to the differences in purchase cost for each of the plug-in electric vehicles.

Administration

Replacement options for the Hybrid Honda Civic

PEV Replacement	HEV Toyota Prius	BEV Nissan Leaf	BEV Mitsubishi i-MiEV	BEV Chevy Spark EV
Avoided downstream CO_2 (tons/yr)	0	1.3	1.3	1.3
Average MPG/MPGe	52	112	112	119
Incremental initial cost	0	$1,210	$3,195	$5,320
Simple payback (yrs)	0	1.7	4.4	7.3
Purchase Price	$24,200	$18,510*	$20,495	$22,620

Table 2: Assumes 75% city traffic, and 10 mile average trip distance.

*Assumes two Leafs are purchased, triggering $8,000 discount.

Administration

Replacement options for the Ford Ranger

PEV Replacement	HEV Toyota Prius	BEV Nissan Leaf	BEV Mitsubishi i-MiEV	BEV Chevy Spark EV
Avoided downstream CO_2 (tons/yr)	0	1.3	1.3	1.3
Average MPG/MPGe	52	112	112	119
Incremental initial cost	0	$1,210	$3,195	$5,320
Simple payback (yrs)	0	3.1	8.2	13.4
Purchase Price	$24,200	$18,510*	$20,495	$22,620

Table 3: Assumes 80% city traffic and 30 mile average trip distance.
*Assumes two Leafs are purchased, triggering $8,000 discount.

Police

The Police department (Table 4) currently has two gasoline powered GO-4 vehicles. Additionally the evidence vehicle, a Ford Explorer, was selected for analysis. There are two possible replacement electric vehicles that will meet the unique needs fulfilled by the current GO-4 vehicles. The GO-4 EV and the Smart Fortwo EV. The GO-4 EV is identical to the current GO-4 vehicles with the exception of an electric power train.

Because parking enforcement is moving away from GO-4 vehicles, we compared electric vehicles with the purchase of an ICE Smart Fortwo. When compared with the ICE Smart Fortwo, the Go-4 EV is substantially more expensive and will not pay for itself within its expected lifetime.

Figure 13: City of Arcata Fleet Evaluation Memorandum (cont'd)

Due to the lower purchase price of the Smart ForTwo EV, replacement of both ICE GO-4 vehicles by Smart ForTwo EVs will have a payback of 6.8 years.

To replace the evidence vehicle, we considered the Kia Soul EV. This represents the only currently available EV SUV. However, when compared with the ICE Kia Soul, the Kia Soul EV will not pay for itself within its expected lifetime.

Police

Replacement options for the ICE GO-4		
PEV Replacement	Smart ForTwo ICE	Smart ForTwo EV (68 mi range)
Avoided downstream CO_2 (tons/yr)	0	2.3
MPG/MPGe	45	107
Incremental initial cost	0	$24,850
Simple payback (yrs)	0	6.8
Purchase Price	$14,650	$22,500

Table 4: Assumes 100% city traffic, and 12 mile average trip distance

Water/Wastewater

We selected two Ford Rangers for analysis from the water/wastewater department. According to City staff it could be replaced with either a Ford F150 or a Ford Transit Connect. Currently, there are no electric vehicles that can haul a ladder, which is a critical function of these vehicles. We attempted to compare the replacement of one Ford Ranger with a Kia Soul EV, but when compared to the ICE version, will not pay for itself within its lifetime.

Combined Fleet Analysis

The one-for-one vehicle replacement economics presented above are expanded to a full fleet analysis in Table 5. By incorporating the discount of $8,000 by purchasing two Nissan Leafs, and by sharing the cost of the EVSE installation across all four PEVs, the replacements will pay for themselves in less than four years. The payback is less than a year if the cost of the EVSE is not included.

This analysis assumes that one charging port is necessary for each vehicle if EVSE are purchased, though it may be possible to coordinate fleet charging with fewer EVSE. Note that there are California Energy Commission grants available to help cover the cost of EVSE, and these grants can substantially improve fleet payback times. It may also be possible to install EVSE at a lower cost. EVSE installation costs are very particular to the specific installation.

Figure 13: City of Arcata Fleet Evaluation Memorandum (cont'd)

	Fleet	
ICE Replacement	Honda Civic, Ford Ranger, GO-4 (2)	
PEV Replacement	BEV Nissan Leaf (2), BEV Smart Fortwo (2)	
Avoided downstream CO_2 (tons/yr)	4.9	
Number of EVSE: Clipper Creek CS40 Wall mount	0	4
Incremental initial cost	$4,320	$17,970
Simple payback (yrs)	0.9	3.8

Table 5: All four vehicles replaced

Sensitivity Analysis

The baseline assumptions used in this analysis are shown in Table 7. To assess the impact of variations in these parameters we conducted a sensitivity analysis. We found that the economic results are most sensitive to the maintenance cost for the PEVs. The literature indicates that PEVs are likely to have substantially lower maintenance costs than their ICE counterparts. We assumed that maintenance costs for a BEV would be one half that for the ICE vehicle it was replacing, and maintenance costs for a PHEV would be 90% of the ICE maintenance costs. If there is no maintenance cost savings associated with the PEVs, paybacks can be significantly longer (e.g., 2 to 3 times as long). However, even modest savings in maintenance costs (i.e., 10% reduction with PHEVs) can significantly reduce payback times.

Economic results are also quite sensitive to the up-front cost of the vehicles and EVSE equipment. With regard to the installed cost of EVSE, it is important to note that installation costs can vary greatly depending on site characteristics (e.g., need for trenching, need for electric service upgrades, etc.). Also, although EVSE are expensive, the bulk of the installation costs tend to be incurred with the installation of the first unit. If additional EVSE are installed at the same location and no upgrades are required to the electrical service, additional installation costs can be more modest.

The CVRP rebate can also have a significant impact on the economic results. This analysis assumed that the City of Arcata will be able to redeem the CRVP rebate for each PEV purchased. If not, payback periods will typically increase by a few years.

After the vehicle and EVSE costs, the economic results are most sensitive to the miles driven per year; more miles driven means more avoided gasoline costs. In fact, the relatively steep price of gasoline compared to electricity only has a strong effect on the economic results when the annual mileage driven is high. Although these results will change depending on the price of both fuels (gasoline and electricity), volatility in gasoline prices typically has a larger impact.

In all scenarios we assumed that charging occurs during off-peak hours (9:30 PM to 8:30 AM). The results are not sensitive to this assumption.

Figure 13: City of Arcata Fleet Evaluation Memorandum (cont'd)

Baseline Assumptions

Parameter	Value	How sensitive are the results to this parameter ?
CVRP rebate (Y/N)	Yes	High
Purchase cost	MSRP (where available), else from distributor	High
State negotiated purchase cost	From CA Department of General Services (where applicable)	High
EVSE equipment costs	From mfg./distributor	High
EVSE installation costs	Per local EVSE contractor/distributor	High
Annual BEV maintenance cost	Half the cost of ICE maintenance	High
Annual PHEV maintenance cost	90% the cost of ICE maintenance	High
Gasoline cost	$2.80/gal	Medium
Annual mileage	Average based on vehicles evaluated by department	Medium
Fuel economy	Per EPA ratings (where available), else mfg. rating	Medium
Percent miles driven in city	100%	Low
Average miles per trip	30 miles	Low
Electric rate schedule	REU E2 - Small Commercial	Low
Electricity cost	Per PG&E rate schedule	Low
Charging period	100% off-peak	Low

Table 7: Baseline assumptions

Figure 13: City of Arcata Fleet Evaluation Memorandum (cont'd)

APPENDIX

Medium and heavy duty electric vehicles are beginning to be produced. These manufacturers may be worth considering.

- VIA Motors: http://www.viamotors.com/
- Motiv Power Systems: https://motivps.com/
- Zenith Motors: http://www.zenith-motors.com/

Source: Redwood Coast Energy Authority

Appendix K: Humboldt County Fleet Analysis Report

Figure 14 shows the Humboldt County Fleet Evaluation memorandum.

Figure 14: Humboldt County Fleet Evaluation Memorandum

County of Humboldt Fleet Evaluation

MEMORANDUM

To: Jo Wattle, County of Humboldt
From: Elliot Goodrich, Redwood Coast Energy Authority
Re: Evaluation of plug-in electric vehicle adoptions for the County fleet
Date:

Executive Summary

The Redwood Coast Energy Authority assessed opportunities for the deployment of plug-in electric vehicles (PEVs) into the municipal fleet of the County of Humboldt. We evaluated economic payback opportunities, as well as avoidable greenhouse gas (GHG) emissions, which can be achieved by replacing aging vehicles with PEVs rather than conventional internal combustion engine powered vehicles. The following are the key conclusions:

- Given the list of vehicles provided by the County, there are ample opportunities to save money and reduce emission by replacing existing sedans with PEVs rather than conventional vehicles.
- There are not cost-effective replacements for other classes of vehicles.
- There are seven different PEV models, all with different specifications when it comes to size, range, and price, among other variables, that will pay for themselves in less than ten years.
- When compared to a Dodge Charger, some PEVs can provide savings of more than $12,000 and reduce GHG emissions by more than four tons per year over a ten-year lifetime
- When compared to a Ford Fusion Hybrid, only two PEVs have payback times of less than ten years.
- The cost of electric vehicle charging equipment can be substantial and can significantly lengthen payback times. Installing more than one unit in a given location can help reduce installation costs.

Introduction

The Redwood Coast Energy Authority (RCEA), in partnership with the Schatz Energy Research Center and GHD Consulting Engineers, conducted a North Coast Plug-in Electric Vehicle Readiness Study. The study was funded by the California Energy Commission and prepared our region for the successful deployment of a large number of PEVs into our regional vehicle fleet. PEVs include both battery all-electric vehicles (BEVs) like the Nissan Leaf, as well as plug-in hybrid electric vehicles (PHEVs) like the Toyota Prius Prime.

Figure 14: Humboldt County Fleet Evaluation Memorandum (cont'd)

This memo describes the approach we took and summarizes the results we obtained in our analysis of PEV opportunities for the County of Humboldt vehicle fleet. Included are discussions of environmental and economic paybacks of replacing specific existing fleet vehicles with PEVs, as well as about the range of options for available PEVs and electric vehicle supply equipment (EVSE).

Please note that our analysis was limited by several informational constraints. For example, exact County bid information has not been finalized, so conventional vehicle replacements used to compare operating costs of PEVs are reflective of 2016-2017 models, rather than accurate 2017-2018 models. Furthermore, there are a host of environmental, type-of-use, economic, and other variables that can influence operating costs for both conventional vehicles and PEVs. Because of these constraints we intend for this evaluation to provide only a general and categorical cost comparison between conventional vehicles and PEVs of several types.

Approach

We worked with Jo Wattle, Senior Automotive Service Technician for the County. She provided a list of vehicles in the City's fleet that were scheduled for replacement during the 2017-2018 fiscal year. We reviewed the list and identified a set of vehicles that offered key opportunities. The criteria we used to identify key opportunities included the following:

- **PEVs are appropriate for the application**. The state of the technology of PEVs is most commercially mature for light duty passenger vehicles. Therefore, this analysis only considered this vehicle class. However, there are options for light duty and medium duty trucks. See Appendix for details. This means fleet applications requiring a truck, off-road capability, or other special attributes are not eligible for replacement.
- **The existing fleet vehicle is anticipated to be replaced in the next year.**
- **The existing fleet vehicle has relatively high annual miles driven**. Annual miles driven have a big effect on the economic payback. In general, more miles driven results in a quicker payback because of fuel savings.
- **The required vehicle range (miles driven per trip) is compatible with PEV characteristics**. Currently available and reasonably priced BEVs typically have a 50 to 100 mile range on a full charge, with several notable exceptions. 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.

Figure 14: Humboldt County Fleet Evaluation Memorandum (cont'd)

Analysis

We used the PEV Fleet Evaluation Tool (PEV FleET), to assess the economic viability of replacing a subset of the County's internal combustion engine (ICE) fleet vehicles with PEVs. In the analysis we included the cost of electric vehicle charging stations (also known as electric vehicle supply equipment, or EVSE), time-of-use electric rate schedules, 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 tailpipe CO_2 emissions.

To help the County of Humboldt evaluate the economic costs and/or 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 will pay for themselves within the anticipated lifetime (10 years) of the replacement vehicle. Note that the PEV FleET spreadsheet tool is being provided to County staff to allow them to conduct future analyses as they see fit.

Additionally, PEV FleET calculates the environmental benefits of purchasing PEVs instead of conventional vehicles. These benefits are calculated in the form of "avoided downstream tons of carbon dioxide per year." This assumes a CO2 content of 8.0 kg per gallon of gasoline. Note that downstream emissions do not account for emissions resultant from gasoline production or electricity generation.

Results

The County of Humboldt elected to consider the replacement of eighteen vehicles that had cost effective PEVs in their class. These vehicles were fifteen Ford Taurus's and three Toyota Prius's.

Fleet operators can achieve savings by switching to PEVs through two different areas: lower fuel costs and lower maintenance costs. Electricity can be a more cost effective fuel than gasoline. The County's summer price per kilowatt-hour (kWh) for off-peak electricity use is about fourteen cents. A 2017 Nissan Leaf, the most common BEV, uses about 28 kWh per 100 miles, for an average cost of $3.92 per 100 miles. For comparison, a 2017 Dodge Charger, rated at 30 miles per gallon highway, would incur a cost of $8.03 per 100 miles, assuming a fuel cost of $2.41 per gallon. This cost would be even greater for city driving or if fuel costs for the operator were higher.

Maintenance costs are also a significant area of savings for operators of PEVs. According to a 2013 study by the Electric Power Research Center, entitled "Total Cost of Ownership Model for Current Plug-in Electric Vehicles," BEVs have routine maintenance costs as low as 22% of conventional vehicles' maintenance costs. This is because BEVs do not burn fuel, so their engines do not need oil changes or exhaust maintenance. BEVs also do not use transmissions, so there are no transmission-related maintenance costs. Finally, BEVs, PHEVs, and conventional hybrids all use regenerative breaking to charge their batteries, which reduces break usage and further lowers maintenance costs. For PHEVs, the maintenance costs are about 51% of conventional vehicles maintenance costs. BEV maintenance costs are 47% of the maintenance costs of a conventional (non-plug-in) hybrids.

Given current range, fuel economy, and pricing, there are certain PEVs that perform best for a range of vehicles. We found that the 2017 Nissan Leaf S, 2016 Volkswagen e-Golf, and 2017 Chevrolet Bolt were the best performing and most cost-effective BEVs, while the 2017 Prius Prime and 2017 Ford C-Max Energi were cost-effective PHEVs. *Table 1* is a list of vehicles scheduled for replacement or purchase alongside their likely conventional replacement and all PEV models in their class that have economic paybacks of less than ten years.

Table 1: Cost effective PEV replacements

Vehicle	ICE replacement	Cost-effective BEVs	Cost-effective PHEVs
Ford Taurus	Dodge Charger	Nissan Leaf, Volkswagen e-Golf, Ford Focus Electric, Mitsubishi i-Miev, Kia Soul EV	Ford C-Max Energi, Toyota Prius Prime
Toyota Prius	Ford Fusion Hybrid	Nissan Leaf, Mitsubishi i-Miev	N/A
Ford Escape Hybrid	Ford Escape Hybrid	N/A	N/A
Minivan	Dodge Grand Caravan	N/A	N/A
Mini Cargo Van	Ford Transit Connect	N/A	N/A

jThe biggest factor in determining whether or not a PEV replacement will pay for itself within the ten-year lifetime of the vehicle is the up-front cost of the vehicle. New PEVs tend to be more expensive than their conventional counterparts, with a couple of exceptions. While fuel and maintenance cost savings from PEVs can be substantial, the upfront cost of buying a new PEV in some cases is too much to overcome.

Price is the main reason why PEVs are not cost-effective replacements for the larger vehicles considered in this assessment. The only PEV minivan on the market, the Chrysler Pacifica plug-in hybrid, starts at $43,000 before incentives. The sole PEV cargo van, the Zenith Motors Cargo Van, costs $45,000. The up-front costs for this class of PEVs are prohibitively high, and until they drop into the low $30,000 range, will remain so.

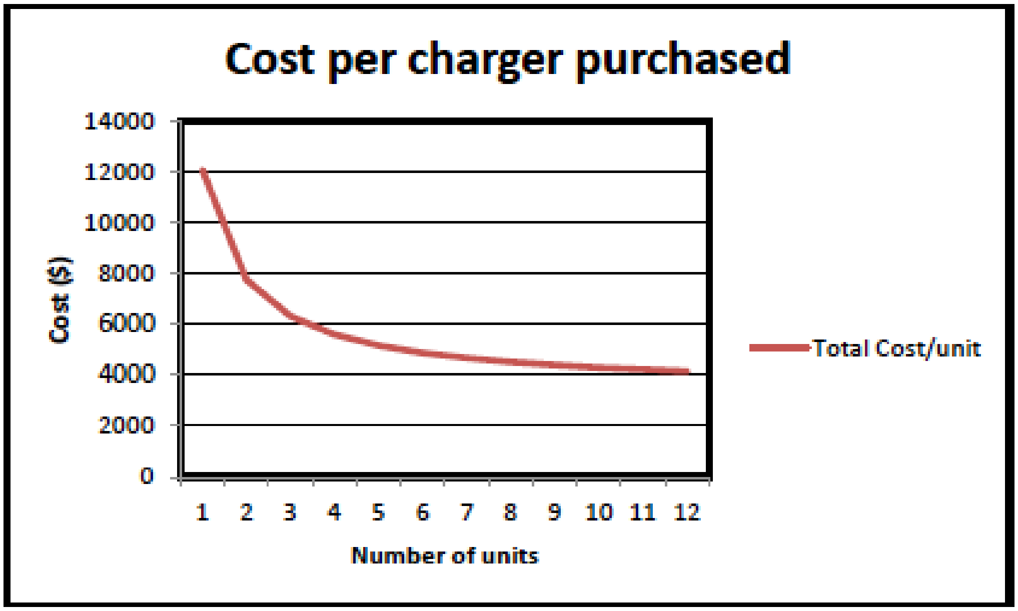
The other main cost of PEVs for fleet operators is proprietary electric vehicle supply equipment (EVSE). Not only does the equipment itself cost money, but there are also substantial costs to engineer, permit, and install the equipment. However, these costs can be lowered by installing multiple EVSE at a given location. This is because the

Figure 14: Humboldt County Fleet Evaluation Memorandum (cont'd)

costs associated with engineering, permitting, and installation do not increase substantially with each additional unit. For the purpose of this assessment, we chose a 7.7kW -Clipper Creek CS-40 Wall Mount unit as the most appropriate EVSE unit. This unit costs $1,750. Installation costs, including engineering, permitting, drawings, signage, labor and materials, were estimated at $5,150 for the first unit, and $500 for each additional unit.

Chart 1 shows how installation costs per unit decrease with every additional unit purchased:

Chart 1: Unit cost per charger



As indicated by *Chart 1*, total costs to install one EVSE unit are cut in half by the fourth unit purchased at a given location, and continue to decrease with every additional unit. To simplify this analysis, we assumed that the fleet operator would install one EVSE unit for every PEV and that all EVSE units would be installed at the same location to minimize design and installation costs.

Table 2 shows the paybacks of each cost effective PEV replacement. To simplify the analysis, the following six assumptions were made:

1. The conventional replacement for the vehicle in question is the same as the 2015-2016 replacement models for the County – Ford Taurus models were replaced with Dodge Chargers, and Toyota Prius models were replaced with Ford Fusion Hybrids;
2. Every vehicle in the class – fifteen Ford Taurus's or three Toyota Prius's – was replaced with the specified PEV;
3. One 7.7kW -Clipper Creek CS-40 Wall Mount EVSE unit, non-networked, non-tracking, was purchased for every vehicle replaced;
4. All EVSE units were installed at the same location;

Figure 14: Humboldt County Fleet Evaluation Memorandum (cont'd)

5. The PEV had sufficient range to meet the average driving needs of the given vehicle to be replaced or added (note: this was not true in every case);
6. Economic results – net present value after 10 years, and payback period – are discounted to reflect inflation.

This table is meant to be illustrative of the relative savings achievable by replacing conventional vehicles with a given PEV. It does not consider the capability of a PEV to duplicate the specific function of the conventional vehicle that it would replace.

Table 2: Cost effective PEVs

ICE vehicle	ICE Price	PEV	PEV Price	Payback period (years)	Net present value per vehicle (dollars)	GHG savings per vehicle (tons per year)
2017 Dodge Charger	$23,500	2017 Nissan Leaf S	$20,180***	immediate	$12,867	4.4
2017 Dodge Charger	$23,500	2017 Mitsubishi i-Miev	$22,995*	immediate	$12,493	4.4
2017 Dodge Charger	$23,500	2017 Volkswagen e-Golf	$28,995*	4.2	$6,620	4.4
2017 Dodge Charger	$23,500	2017 Ford Focus Electric	$29,170*	4.6	$5,800	4.4
2017 Dodge Charger	$23,500	2017 Kia Soul EV	$31,950*	6.9	$3,226	4.4
2017 Dodge Charger	$23,500	2017 Prius Prime	$25,600**	4.4	$5,073	3.4
2017 Dodge Charger	$23,500	2017 Ford C-Max Energi	$25,620**	5	$4,013	2.7
2017 Ford Fusion Hybrid	$20,500	2017 Nissan Leaf S	$22,680***	0.9	$4,200	2.1
2017 Ford Fusion Hybrid	$20,500	2017 Mitsubishi i-Miev	$22,995*	1.5	$3,833	2.1

Figure 14: Humboldt County Fleet Evaluation Memorandum (cont'd)

* Includes $2500 Clean Vehicle Rebate Project (CVRP) rebate.

** Includes $1500 CVRP rebate.

*** Includes $2500 CVRP rebate and Nissan's fleet discount of $8000 when two or more Leafs are purchased.

As *Table 2* illustrates, pure battery electric vehicles generally had quicker payback times than plug-in hybrid vehicles. BEVs are eligible for a higher value CVRP rebate than PHEVs, which brings their purchase cost down. 2017 Nissan Leafs were the most cost-effective PEV replacement in large part because of the $8000 fleet discount offered by Nissan to fleet operators who buy two or more of the vehicle at a time. BEVs also have quicker payback periods because they maximize the relatively cheaper cost of electricity, while PHEVs may use gasoline for parts of their trip.

When substituted for a 2017 Dodge Charger, more PEVs paid for themselves within ten years than when substituted for a 2017 Ford Fusion Hybrid. This can be attributed to both the lower fuel economy of the Charger and the higher purchase price of that model. In general, PEVs have prohibitively long payback periods when compared to hybrids and cheaper vehicles. There were five BEV models and two PHEV models that provided paybacks of less than ten years when replacing Dodge Chargers. Only two BEVs, and zero PHEVs, had payback times of less than ten years when replacing Ford Fusion Hybrids.

Environmental payback amounts (measured in tons of carbon emissions avoided) were dependent on whether the replacement PEV was a BEV or PHEV and on the fuel economy of the conventional vehicle replacement. Because this model does not factor in upstream emissions, all BEVs achieved the same GHG savings compared to each other. GHG savings from PHEVs were dependent on the all-electric range of the model, as well as the fuel economy when using the vehicle's internal combustion engine. Cost-effective BEVs achieved more than twice the GHG emission reductions when replacing a 2017 Dodge Charger than when replacing a 2017 Ford Fusion Hybrid, due to the higher fuel economy of the latter model.

Figure 14: Humboldt County Fleet Evaluation Memorandum (cont'd)

Table 3, below, details the "best case" scenario in which the County can achieve maximum savings by switching to PEVs. Under this scenario, the County would replace all fifteen Ford Taurus's and all three Toyota Prius's with Nissan Leafs. The County would purchase a separate EVSE unit, specified above, for each vehicle.

Table 3: Combined fleet savings--highest payback scenario

<table>
<tr><th>ICE vehicle</th><th>PEV</th><th>Number purchased</th><th>Payback period (years)</th><th>Total net present value (after 10 years)</th><th>Total GHG Savings (tons of Carbon)</th></tr>
<tr><td>2017 Dodge Charger</td><td>2017 Nissan Leaf*</td><td>15</td><td rowspan="2">Immediate</td><td rowspan="2">$212,000</td><td rowspan="2">715</td></tr>
<tr><td>2017 Ford Fusion Hybrid</td><td>2017 Nissan Leaf*</td><td>3</td></tr>
</table>

* Includes $2500 CVRP rebate and $8000 Nissan fleet discount when two or more Leafs are purchased.

As shown in *Table 3* above, this scenario results in substantial economic and environmental savings. Because of the lower purchase cost of a 2017 Nissan Leaf (including Nissan's fleet discount) compared to a 2017 Dodge Charger, and the high volume of Leafs purchased, the County would save money immediately upon purchase, even including design, installation, and purchase of EVSE units. Over the ten-year lifetime of the vehicles, the county would save $212,000 and reduce GHG emissions by 715 tons.

Sensitivity Analysis

The baseline, model-level, assumptions used in this analysis are shown in *Table 3*. These assumptions dictate model inputs available to users of the PEV_FleET tool. *Table 4* outlines the input categories, as well as the assumed values and sources for each category. The table also provides a qualitative rating of how "sensitive" the analysis is to each input. This reflects the amount that a relative change in each input can change the tool outputs of economic and environmental paybacks.

Figure 14: Humboldt County Fleet Evaluation Memorandum (cont'd)

Table 4: Baseline assumptions

Parameter	Value	How sensitive are the results to this parameter ?
CVRP rebate (Y/N)	Yes	High
Purchase cost	MSRP (where available), else from distributor	High
State negotiated purchase cost	No	High
EVSE equipment costs	Per manufacturer and/or distributor	High
EVSE installation costs	Per local EVSE contractor/distributor	High
Annual BEV maintenance cost	50% the cost of ICE maintenance	High
Annual PHEV maintenance cost	90% the cost of ICE maintenance	High
Gasoline cost	$2.41/gal	Medium
Annual mileage	Average based on vehicles evaluated by department	Medium
Fuel economy	Per EPA ratings (where available), else manufacturer rating	Medium
Percent miles driven in city	60%	Low
Average miles per trip	100 miles	Low
Electric rate schedule	A5 – Small General Time-of-Use Service	Low
Electricity cost	Per PG&E rate schedule	Low
Charging period	100% off-peak	Low

Figure 14: Humboldt County Fleet Evaluation Memorandum (cont'd)

Appendix

For medium and heavy-duty applications of PEV technology, please refer to the following manufacturers:

VIA Motors (www.viamotors.com)

Zenith Motors (www.zenith-motors.com)

Motiv Power Systems (www.motivps.com)

Smith Electric Vehicles (www.smithelectric.com)

References

"Total Cost of Ownership Model for Current Plug-in Electric Vehicles." Electric Power Research Institute. June 2013. http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002001728