Schatz Energy Research Center

Memorandum

Date: May 16, 2024

To: Beth Burks, Humboldt County Association of Governments

From: Jim Zoellick and Alka Verma, Schatz Energy Research Center

Cc: Greg Pratt and Jerome Qiriazi, Humboldt Transit Authority

Subject: Technical Memo – MD/HD Hydrogen Fueling Station Micrositing Analysis

This memo and the accompanying slide presentation fulfills the deliverable requirements to provide a MD/HD Hydrogen Fueling Station Micrositing Analysis for Humboldt County.

I. Introduction

A. Overview of the Problem Statement

The shift to hydrogen fuel cell electric vehicles (FCEVs) and other zero-emission vehicles (ZEVs) is required by the State of California's aggressive climate targets. For medium- and heavy-duty transportation, the need for a reliable hydrogen fueling infrastructure becomes clear when considering the limits of battery electric vehicles (BEVs) with respect to longer ranges and faster refilling times needed by medium and heavy-duty (MD/HD) fleets. In order to close this gap and promote the widespread adoption of FCEVs while also furthering California's sustainability goals, a network of hydrogen fueling stations must be established throughout the state that provides connectivity between various geographic regions. For the North Coast region of California there will need to be connectivity between the Humboldt Bay Area, adjacent rural communities, and the metropolitan centers of Sacramento and the San Francisco Bay Area. This analysis was focused on identifying possible locations in Humboldt County for hydrogen fueling stations that can meet the needs of interregional MD/HD FCEVs traffic.

B. Purpose of the Memo

The purpose of the memo is to document the analysis that was conducted to identify possible locations for hydrogen stations in Humboldt County. Specifically, this memo documents:

- the methodology, criteria and assumptions used for identifying potential hydrogen station locations,
- the results of the analysis, including maps showing where the potential sites are located, and
- the lessons learned from this analysis and findings regarding how the methodology might be applied to identify a complete network of stations throughout the North Coast region.

C. Disclaimer

It is important to note that the purpose of this study was to conduct a very high level, preliminary investigation of potential sites in Humboldt County for a medium duty and heavy duty (MD/HD) hydrogen fueling station. No planners or other staff were consulted at any of the respective jurisdictions that would be required to issue a building permit for the installation of a hydrogen fueling station. In addition, no land owners were contacted. Therefore, the results of this study should be considered as extremely preliminary, and further investigation may show that the sites identified here are not suitable for any variety of reasons. In addition, it may be the case that there are additional sites that we have not identified that would be suitable and even more favorable than the sites identified here.

II. Methodology

In our methodology for identifying suitable sites for hydrogen fueling stations in the broader Humboldt Bay Area we focused on key areas adjacent to the major transportation corridors, namely Highway 101 and Highway 299. Within this framework, we concentrated our study on the population centers in the Humboldt Bay Area, including areas within and near to the cities of Eureka, Arcata, Fortuna, Rio Dell,

and Blue Lake. The following section describes the steps we carried out and the criteria we used to identify potential hydrogen station locations.

1. **Identify areas within approximately 0.5 miles from the major highway corridors, with areas immediately adjacent preferred.**

The map below (Figure 1) displays the key areas of interest in the Humboldt Bay region. Note that the yellow highlighted area in the figure is not to scale (i.e., it is wider than 0.5 miles on each side of the highway).

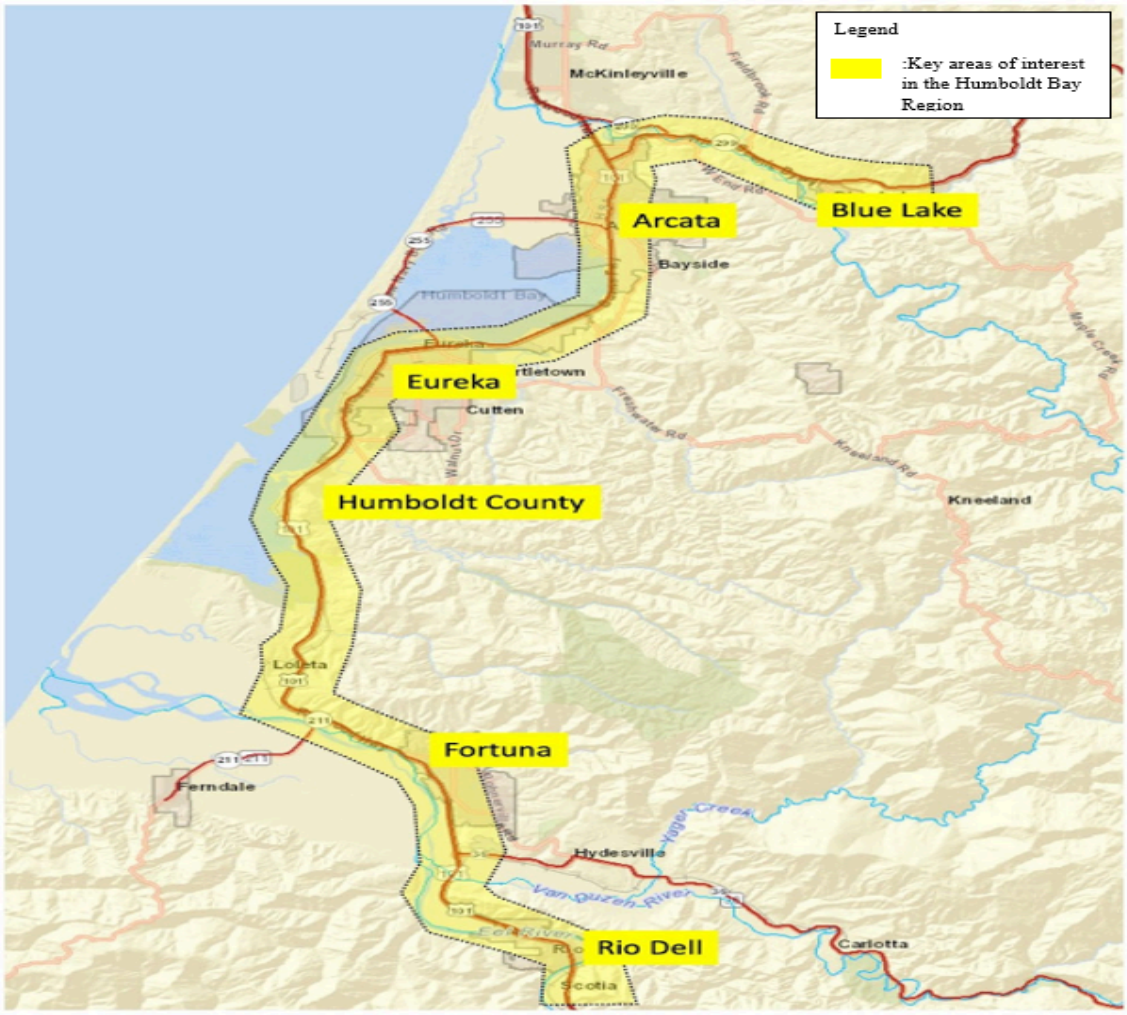


Figure 1. Key areas of interest in the Humboldt Bay region for a potential MD/HD hydrogen fueling station

2. **Determine the appropriate land use zoning classifications in each jurisdiction.**

We obtained land use code and zoning documents for each of the jurisdictions of interest and identified the zones that appeared to be most suitable for MD/HD hydrogen fueling stations. We primarily focused our attention on zones that allowed for fuel and service stations or gasoline and automotive service stations, and to a lesser extent on zones that allowed automotive service and repair or utilities and energy facilities. In Table 1, we list the zoning districts that we identified as appropriate for a hydrogen fueling

station in each jurisdiction. In Appendix A we provide the land use tables we utilized for each of the jurisdictions of interest, and in Appendix B we provide land use maps for each jurisdiction, where available.

Table 1. Likely appropriate zoning classifications within each jurisdiction considered

Jurisdiction	Selected Zoning Classifications
County of Humboldt	Commercial General (CG), Commercial Services (CS), and Industrial General (IG or MG)
City of Eureka	Service Commercial (SC), Limited Industrial (ML), Downtown West (DW)
City of Arcata	Industrial Limited (IL), Commercial General (CG), Commercial Visitor Serving (CVS)
City of Fortuna	Light Industrial (M1), Freeway Commercial (FC), Commercial Thoroughfare (CT)
City of Rio Dell	Industrial/Commercial (IC)

We should also note that hydrogen fueling stations may also incorporate hydrogen generation technologies, such as electrolysis or natural gas reformation, and this could add an additional element of complexity to the permitting process and the appropriate zoning classification. Fuel production and processing may be considered an industrial process and therefore may need to be located in an industrial zoned district. Note that we did not speak with planning staff in these jurisdictions. It is recommended that this action be pursued as a next step to confirm and/or correct the assumptions made in this analysis before moving forward with any additional planning or investigative efforts.

3. Specify a minimum plot plan size of 1.5 acres.

This criterion is based on recommendations from John Chimenti at Air Products and on the footprint of the new MD/HD H2 fueling station that was just opened at the Port of Oakland . We considered single parcels of this size, as well as multiple contiguous parcels of this size. More space may be better and can allow for expansion and additional facilities. Many of the potential sites that were identified have more than 1.5 acres of space available.

4. Look for sites that are vacant or have minimal development.

We used satellite imagery (i.e., Google maps, Google Earth, municipal GIS based maps) along with parcel maps to identify parcels of interest. Parcels needed to meet the criteria listed above, namely to be:

- within the appropriate zone,
- within 0.5 miles of a major highway (Hwy 101 or Hwy 299),
- at least 1.5 acres in size for one or more contiguous parcels, and
- vacant or largely undeveloped.

5. Consider additional criteria for screening potential sites.

We used additional key criteria to evaluate parcels and screen out parcels that had conflicts due to environmental issues, geologic or environmental hazards, or other conflicts. The criteria considered for each parcel included determining if it was located within:

- coastal zone (Note: a MD/HD hydrogen fueling station may be allowed in the coastal zone, but even if it is placement in the Coastal Zone would likely complicate the permitting process),
- wetlands,
- 100 year flood zone,
- tsunami zone,
- earthquake hazard zone (Alquist-Priolo Earthquake Fault Zones),
- significantly sloped land (we focused on flat parcels and screened out anything with slopes greater than 15%).

6. Assess ingress and egress capabilities to and from the adjacent highway.

- For each site we assessed ingress and egress capabilities to and from the highway.
- We focused on whether or not MD/HD vehicle traffic would have to cross lanes of highway traffic to access the H2 station site. We screened out sites that required crossing lanes of traffic to enter and leave the site.
- We also assessed if there were adequate acceleration and deceleration lanes entering and leaving the highway. This typically meant that there needed to be an on and off ramp to the highway, such as a cloverleaf design with an overpass or an underpass to cross the highway.
- We also examined the roads that needed to be traveled to get to and from the highway and screened out locations that required travel through residential areas, or densely developed commercial areas.
- One exception for some sites could be cases where there is a controlled intersection with a traffic light that crosses lanes of traffic. While this may not be ideal, it may be acceptable.
- We also screened out any areas that would require major changes to the existing highway design.

7. Gather and document relevant parcel/site information.

- We obtained site ownership information using the web application called “onX” (see onxmaps.com)
- We evaluated if the sites were within a designated DAC designated census tract using the DAC Mapping Tool.
- We prepared a set of tables for each geographic area that listed the sites identified and included their location, size, ownership status, zoning, notes of interest, ingress/egress capabilities, and DAC status.

III. Results

In this section we provide documentation of 9 sites that were identified for a potential MD/HD hydrogen fueling station in the Humboldt Bay area. First, we show a map of the greater Humboldt Bay area and provide an indication of where each site is located (Figure 2). Next, we present a listing of each site, including location, parcel numbers, parcel sizes, and zoning classifications (Table 2).

Following this information, we provide a satellite image for each location that includes identification of surrounding landmarks (to provide context) and notable site information. In these satellite images, the individual parcels are outlined in yellow. See Figures 3 through 9. For additional information about each site we refer the reader to Appendix C.

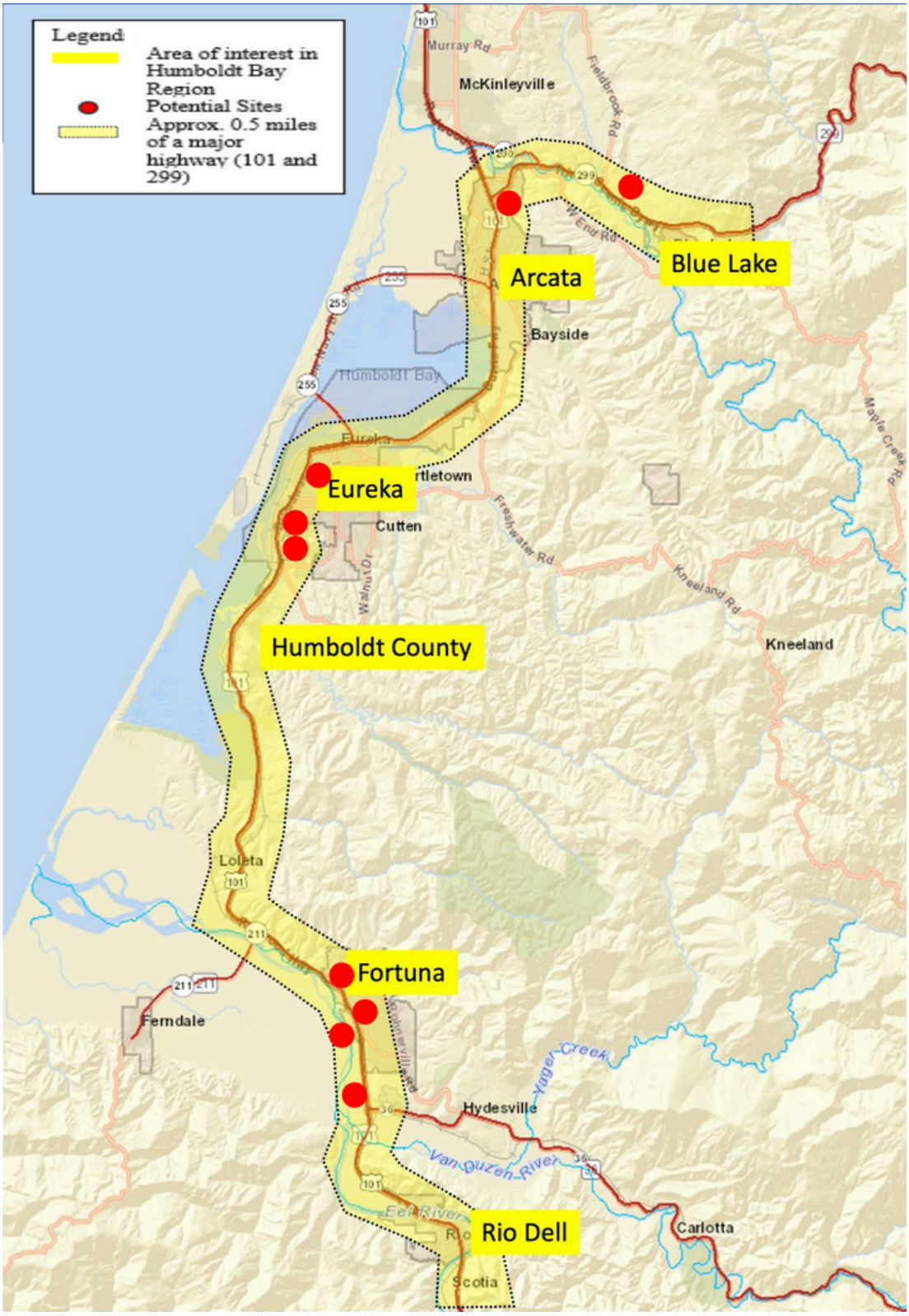


Figure 2. Potential sites in the Humboldt County area that could support a hydrogen fueling station

Table 2. Possible sites for a MD/HD hydrogen fueling station in the Humboldt Bay area

Site#	Jurisdiction	Address	Parcel #'s	Sizes	Zoning Classifications
1	Humboldt County	SANDY PRAIRIE RD, Fortuna	201-211-004 201-221-013	9.42 3.35	Commercial Recreation (CR), Misc Light Industrial (MG)
2	Humboldt County	1740 Glendale Dr.	516-161-003 516-151-018 516-151-003 516-151-004 516-111-066 516-111-064	4.86 3.8 2.22 1.09 2.08 1.77	Commercial Service (CS), Industrial General (IG)
3	City of Eureka	2431 BROADWAY	008-021-004 008-021-002 008-021-003 008-031-007	0.8 1.04 1.02 0.19	Service Commercial (SC)
4	City of Eureka	4311 BROADWAY	019-211-020 019-211-021 019-211-012 019-211-001	2.52 0.41 0.93 1.9	Service Commercial (SC)
5	City of Eureka	4325 BROADWAY	302-171-039 302-171-040 302-171-041	7.64 0.56 0.46	Service Commercial (SC), Service Commercial - Coastal Zone (CS)
6	City of Arcata		507-121-011 507-121-033 507-081-040 507-081-018 507-081-039 507-081-001	1.68 0.29 0.25 0.96 0.53	Industrial Limited (IL)
7	City of Fortuna	400 Main Street, Fortuna	040-152-002 040-152-001 040-162-003	0.98 1.6 3.23	Commercial Thoroughfare (CT), Light Industrial (M1)
8	City of Fortuna	Riverwalk Drive Alamar Way (Riverwalk area)	200-363-050 200-363-055 200-363-034	3.2 2.7 5.7	Freeway Commercial (FC)
9	City of Fortuna	South of Newburg Road between Hwy 101 and South Fortuna Blvd	201-331-013 201-331-008 201-331-009	1.45 0.17 0.27	Heavy Industrial (M2)

Below are the satellite images and the individual parcels are outlined in yellow.

Figure 3. Site #1 (Humboldt County near Fortuna)

Adjacent to City of Fortuna

- Parcel 201-211-004
  - 9.4 acres
  - Commercial Recreation
  - Mostly vacant w/ truck service bldg
  - In 100 yr flood zone
  - Owners: LODESTONE PACIFIC HOLDING COMPANY INC
- Parcel 201-221-013
  - 3.35 acres
  - Light Industrial
  - Mostly vacant, one bldg
  - In 100 yr flood zone
  - Owners: HURST JACK & SHAWNA

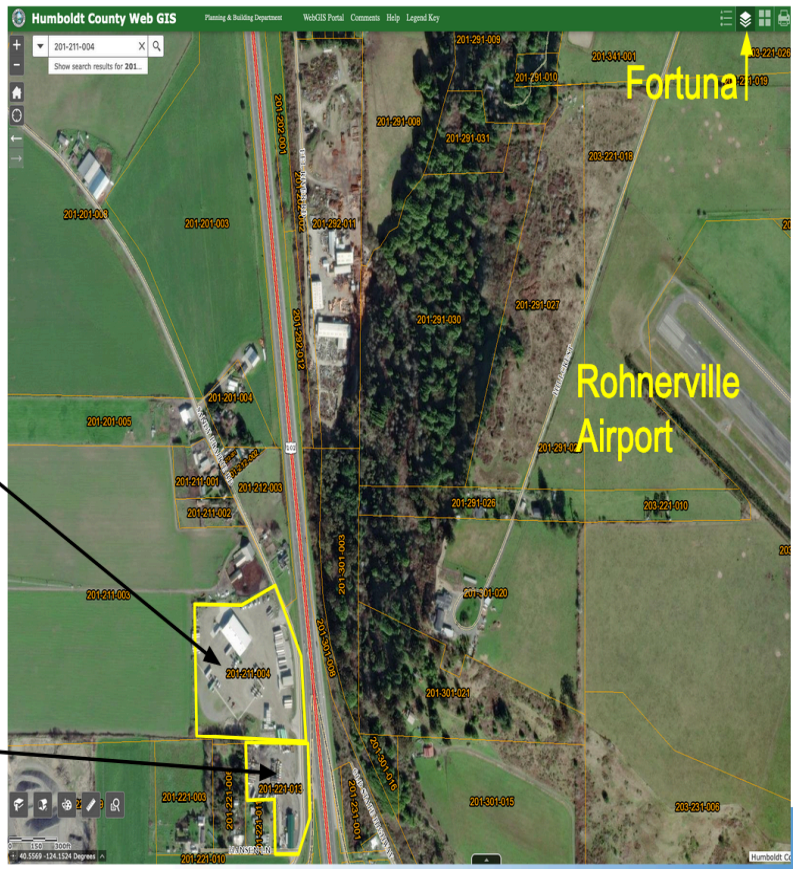


Figure 4. Site #2 (Humboldt County, Glendale)

Adjacent to City of Blue Lake

- 6 Parcels, ~16 acres total
- Largely vacant, some light industrial activity (old mill site)
- Zoned: Commercial Service (CS), Industrial General (IG)
- 4 Owners
- Good ingress and egress via Highway 299 access

Figure 5. Site #3 (Eureka near Bayshore Mall)

Broadway, Eureka

- 4 parcels
- 3 acres
- Zoned: Service Commercial
- Access for southbound traffic is poor
- East edge is sloped, buildable area may be about 50%
- 2 Owners: LRE 2411 LLC CO & CHIANG VICTOR W TR; ABRAHAMSEN ALFRED K & PRYOR ALICE S

Figure 6. Site #4 and Site #5 (Eureka, south end)

North location:

- 4 parcels, 5.7 acres
- Zoned: Service Commercial
- Tetrault Tire, Patriot gas station, Flamingo Motel, residence (3 Owners)

South location (old K-MART):

- 3 parcels, 8.7 acres
- Zoned: Service Commercial, partially in Coastal Zone w/ Categorical Exclusion
- Current cannabis dispensary?

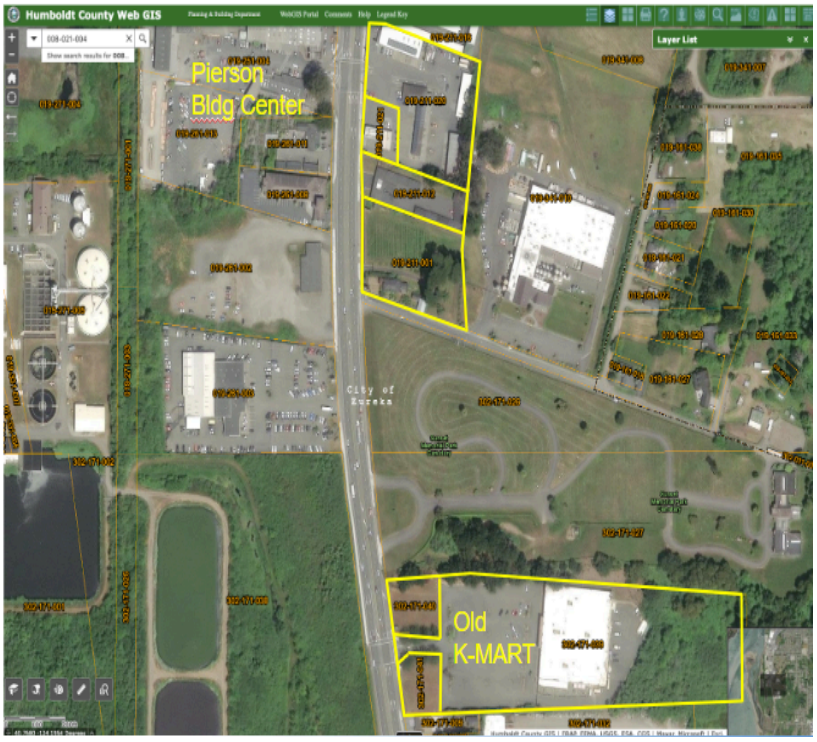


Figure 7. Site #6 (Arcata, West End Rd.)

West End Road, Arcata

- 6 Parcels
- 5.8 acres
- Zoned: Limited Industrial
- Partially active (truck repair and storage, Bettendorf Trucking, Ken's Truck repair)
- Good highway access
- Somewhat vacant
- 4 owners

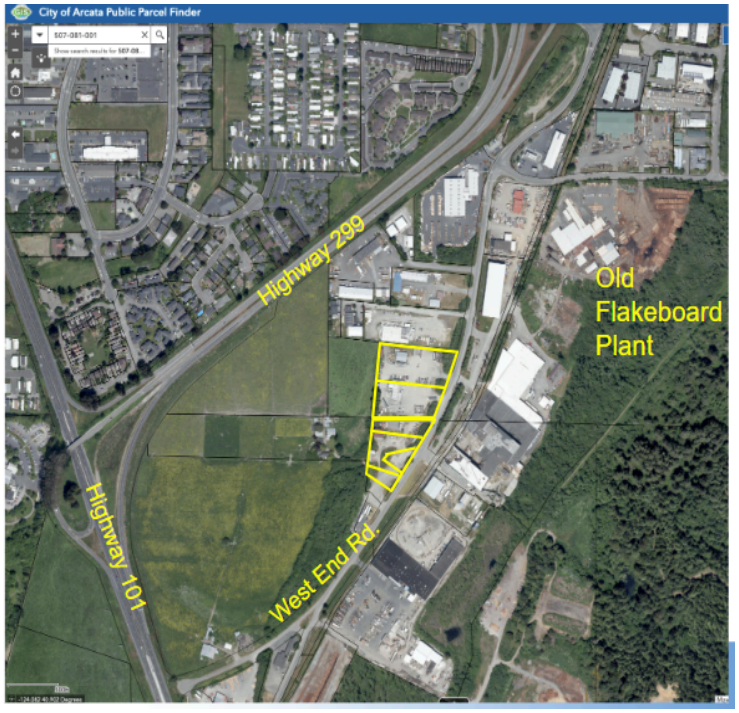


Figure 8. Site #7 (Fortuna, north end)

Main Street, Fortuna

- 3 Parcels (040-152-002, 040-152-001, 040-162-003)
- 5.8 acres
- Zoned: CT/M1 (Commercial Thoroughfare/Light Industrial)
- Vacant site
- Partially in 100 yr flood zone, southbound highway access may be issue
- Two Owners: MONTGOMERY HOMER L & FRANCES M TR; FRIEDENBACH JOHN C

Figure 9. Site #8 and Site #9 (Fortuna, south end/Riverwalk)

North site (#8) - Newburg Road

- 3 Parcels, 1.9 acres, vacant
- Zoned: Heavy Industrial*
- Part of 60 acre area available for heavy industrial development
- Partially in 100 yr flood zone
- Hwy access may be an issue
- Owners: TOWN OF SCOTIA COMPANY LLC

South sites (#9) - Riverwalk Dr. area

- 3 Parcels, 11.6 acres, vacant
- Zoned: Freeway Commercial
- Other parcels available in area, good Hwy access
- In 100 yr flood zone
- 3 Owners

*Heavy Industrial Zone may not allow H2 fueling station

IV. Key Findings and Lessons Learned

The following notes reflect key findings and lessons learned during the hydrogen fueling station micrositing analysis for Humboldt County. These notes should be considered when taking next steps to advance the process of siting a MD/HD hydrogen fueling station in Humboldt County, and when expanding this micrositing analysis to the broader North State region in order to establish a network of hydrogen stations that can support interregional MD/HD vehicle traffic.

- Availability of GIS data and web-based GIS mapping applications varies by jurisdiction. Some jurisdictions offer web-based mapping applications and/or downloadable GIS shape files that are very useful and quickly accessible. Other jurisdictions may require that you request data from them. Some smaller jurisdictions do not offer these features, and instead may simply have land use code documents and maps that provide the necessary information. That said, County GIS sites may have GIS data that covers the cities within their boundaries, and while they will likely not have the city's zoning information, they likely will have GIS layers that do cover important land characteristics such as hazards, natural resources, topography, geology, and environmental data.
- Planners at each jurisdiction of interest should be consulted regarding which zoning classifications are suitable for a MD/HD hydrogen station. It will also be important to explore if hydrogen fuel is generated at the site (i.e., via electrolysis), could that change the zoning classification for the station?
- We used a parcel size of 1.5 acres as a metric for a minimum available land area. This was based on a recommendation from John Chimenti of Air Products, as well as an assessment of the required land area for a newly installed MD/HD hydrogen fueling station at the Port of Oakland. More work on determining the required station footprint will be important before moving forward with a more detailed effort to site a MD/HD hydrogen fueling station. This should include an assessment of the expected use case for the station, the resulting hydrogen throughput, the necessary hydrogen storage capacity and the number of hydrogen dispensers needed.
- Once the desired areas of interest are identified based on proximity to highways and appropriate zoning classifications, using satellite imagery (via Google Earth or various GIS applications) to examine potential parcels and determine if they are vacant and/or very lightly developed is a useful way to assess potential land availability.
- Ingress and egress access to the major highway corridors is an important criteria. It is important that large tractor-trailer trucks will be able to safely navigate the ingress to and egress from sites. They should not have to cross lanes of traffic on highways or major roads. They also should not have to travel through densely developed commercial districts or residential districts to access the station.
- Land ownership information does not seem to be readily publicly available for free. However, the web application called "onX Hunt" (https://www.onxmaps.com/hunt/app) is a subscriber-based service that provides land ownership information.
- While this did not prove to be applicable in Humboldt County, we recommend considering existing truck stops and the possibility of adding hydrogen fueling facilities to these existing stations.

Appendix A - Land Use / Zoning Tables

Humboldt County Zones: Commercial General (CG), Commercial Services (CS), Industrial General (IG, MG)
Data source: Humboldt County General Plan (adopted 10/23/17), Chapter 4. Land Use Element, Section 4.8 Land Use Designations (p. 4-45 to 4-55)

Table 4-C Commercial Land Use Designations

	CG	CS	CR
Commercial			
Automotive Sales, Service, & Repair	X	X	
Bed & Breakfast Inn	X	X	X
Commercial Recreation	X	X	X
Heavy Commercial		X	
Neighborhood Commercial	X	X	X
Office & Professional	X	X	
Private Recreation	X	X	X
Retail Sales	X	X	
Retail Services	X	X	
Transient Habitation	X	X	X
Visitor Serving Facilities			X
Warehousing, Storage, & Distribution		X	
Industrial			
Research/Light Industrial		X	
Civic			
Administrative	X	X	
Community Assembly	X	X	X
Essential Services	X	X	X
Health Care Services	X	X	
Other			
Residential Uses Subordinate to Principal Use	X	X	X
Timber Production			X
Similar Compatible Uses	X	X	X
Development Standards			
Max. Floor Area Ratio	3	3	3
Maximum Structure Height and other development standards	per zoning	per zoning	per zoning

1. Family day care centers are considered an accessory commercial use.

Table 4-E Industrial Land Use Designations

Allowable Use Types	IG or MG	IR	MC	MB
Industrial				
Aquaculture	X	X	X	
Coastal-Dependent Industrial	X		X	
Coastal-Related Industrial	X		X	
Hazardous Industrial	X	X		
Heavy Industrial	X	X	X	
Research/Light Industrial	X	X		X
Surface Mining	X	X	X	
Metallic Mining	X	X		
Timber Products Processing	X	X		
Agricultural				
Agricultural Products Processing	X	X		
Feed Lot/Slaughter House	X	X		
Hog Farming	X	X		
Intensive Agriculture	X	X		
Timber				
Timber Production	X	X	X[1]	
Commercial				
Heavy Commercial	X	X		
Neighborhood Commercial				X
Office & Professional	X		X	X
Warehousing, Storage, & Distribution	X	X	X	X
Retail Services				X
Transient Habitation				X
Civic				
Administrative	X			X
Essential Services	X		X	X
Extensive Impact Civic Uses	X		X	
Solid Waste Disposal	X			
Utilities and Energy Facilities	X	X	X	
Other				
Public Access Facilities	X	X	X	X
Public Recreation	X	X	X	X
Residential Subordinate to Principal Use	X	X	X	X
Similar Compatible Uses	X	X	X	X
Development Standards				
Max. Floor Area Ratio	3	3	3	3
Maximum Structure Height and other development standards	per zoning	per zoning	per zoning	per zoning

1. Conditionally permitted.

City of Eureka Zones: Downtown West (DW), Service Commercial (SC), Hinge Industrial (HN), Light Industrial (LI), Heavy Industrial (HI)
Data Source: City of Eureka Zoning Code: Municipal Code Chapter 155

Table 208-1: Allowed Land Uses in the Mixed-Use Zoning Districts

P = Permitted Use M = Minor Use Permit Required C = Conditional Use Permit Required - = Prohibited Land Use	Zoning District								
	Downtown DT	Downtown West DW	Service Commercial SC	Henderson Center HC	Neighborhood Commercial NC	Wabash Avenue WA	Office Residential OR	Hospital Medical HM	Additional Standards
Residential									155.208.040
Accessory Dwelling Unit (ADU)	P [1]	P [1]	P [1]	P [1]	P [1]	P [1]	P [1]	P [1]	155.316
Medical Care Housing	C [2]	C [2]	C	C [2]	C	C	C	C	
Micro/Shared Housing	P [2]	P [2]	P	P [2]	P	P	P	C	
Multi-family Dwellings	P [2]	P [2]	P	P[2]	P	P	P	C	155.304.100
Non-medical Care Housing, Large	P [2]	P [2]	P	C [2]	P	P	P	C	
Non-medical Care Housing, Small	P [2]	P [2]	P	P [2]	P	P	P	P	
Single Family Attached Home (Townhome)	P [3]	P [3]	P	P [3]	P	P	P	C	
Single Family Detached Home, New [10]	P	P	P	P	P	P	P	C	
Single Family Detached Home, Existing [8]	P	P	P	P	P	P	P	P	
Commercial - Sales									
Bars	P	P	P	M	C	C	-	-	
Drive-Thru Facility, Food-Serving [4]	-	C	P	-	-	-	-	-	
Drive-Thru Facility, Non-Food Serving [4]	C	M	P	C	-	-	-	C	
Fuel and Service Stations	-	M	P	-	-	-	-	-	
General Retail – Indoor, Very Large	-	C	C	-	-	-	-	-	
General Retail – Indoor, Large	C	C	P	-	-	-	-	-	
General Retail – Indoor, Small	P	P	P	P	P	P	C	M [5]	
General Retail-Outdoor [4]	C [6]	C	P	P [6]	C	C	-	-	
Heavy Equipment Sales and Service	-	C	M	-	-	-	-	-	
Mobile Vendors	P	P	P	P	P	P	P	P	155.304.090
Restaurants, Cafes, and Beverage Sales	P	P	P	P	P	P	C	M [5]	
Vehicle Sales and Rental (Indoor)	P	P	P	-	-	-	-	-	

Table 212-1: Allowed Land Uses in the Industrial Zoning Districts

P = Permitted Use M = Minor Use Permit Required C = Use Permit Required - = Prohibited **Land Use**	Zoning Districts			Additional Standards
	Hinge Industrial HN	Light Industrial LI	Heavy Industrial HI	
Residential				
Micro/Shared Housing	C [1]	-	-	
Multi-family Dwellings	C [1]	-	-	
Non-medical Care Housing	C [1]	-	-	
Commercial - Sales				
Bars	C	-	-	
Fuel and Service Stations	C	M	M	
Heavy Equipment Sales and Service	P	P	P	
Mobile Vendors	P	P	P	155.304.090
Commercial - Service and Office				
Adult Entertainment	C [2]	C	-	155.304.030
Business Services and Heavy Commercial	P	P	P	
Fitness, Dance, or Health Facility, Large	C	C	-	
Fitness, Dance, or Health Facility, Small	M	M	-	
Indoor Commercial Recreation	C	C	-	

City of Arcata Zones: Commercial General (CG), Industrial Limited (IL), Commercial Visitor Serving (CV)
Data Source: City of Arcata Municipal Code - Title 9 - Land Use Code, Article 2, Section 9.26.030 Commercial, Industrial, and Public Facility District Allowable Land Uses

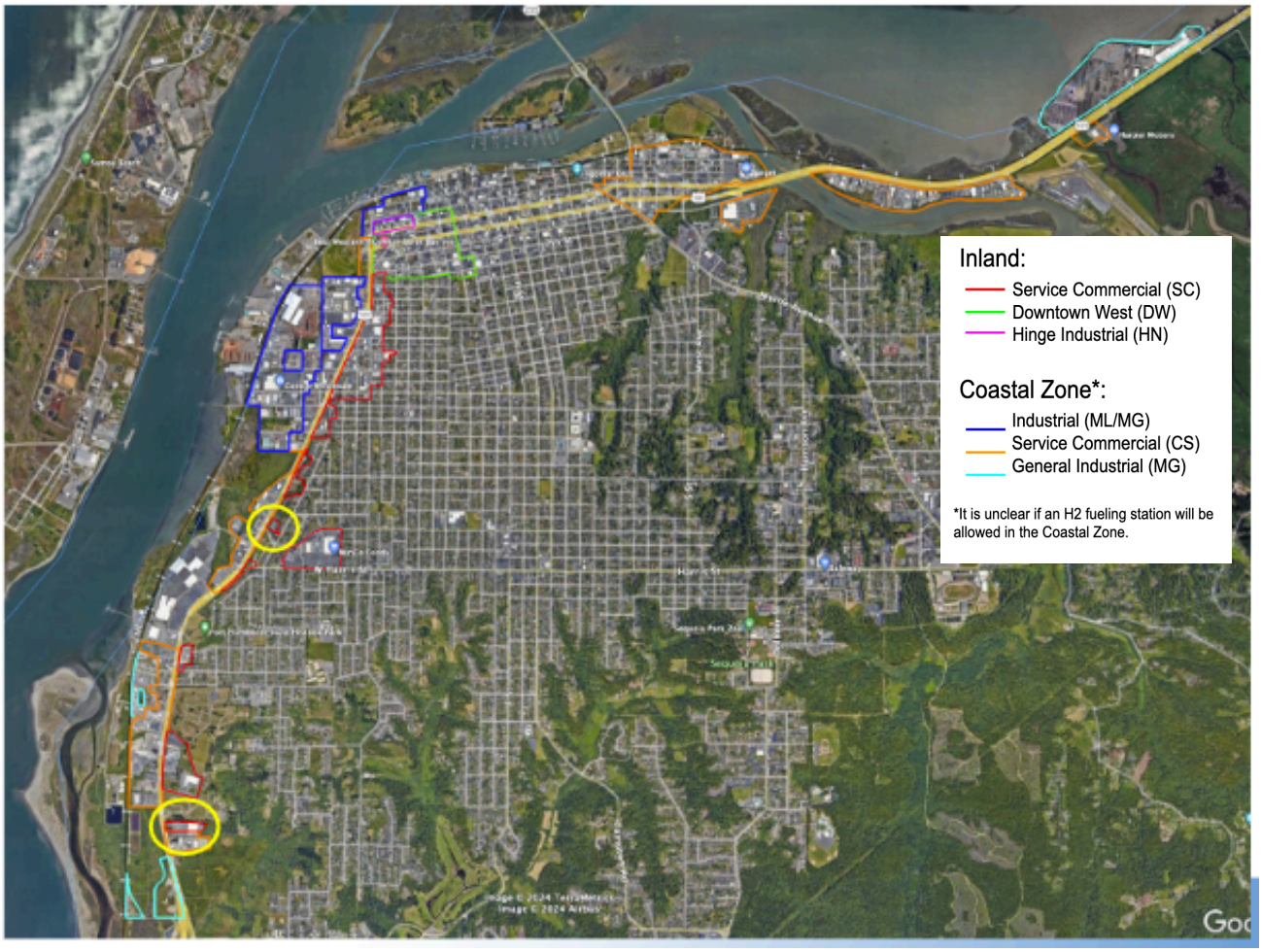
TABLE 2-10 Allowed Land Uses and Permit Requirements for Commercial, Industrial, and Public Facility Zoning Districts	P Permitted Use, Zoning Clearance required MUP Minor Use Permit required UP Use Permit required (2) S Permit determined by specific use regulations — Use not allowed								
	PERMIT REQUIRED BY DISTRICT								Specific Use Regulations
LAND USE (1)	CC	CG	CV	CM	IL	IL-2	IG	PF	
INDUSTRY, MANUFACTURING & PROCESSING, WHOLESALING									
Biodiesel production	—	—	—	—	UP	UP	UP	—	
RETAIL TRADE (2)									
Service station	—	MUP	MUP	MUP	MUP	—	—	—	9.42.180
TRANSPORTATION, COMMUNICATIONS & INFRASTRUCTURE									
Transit station or terminal	MUP	MUP	MUP	MUP	MUP	MUP	MUP	MUP	
Truck or freight terminal	—	—	UP	—	MUP	—	MUP	—	
Truck stop	—	—	UP	—	MUP	—	MUP	—	9.42.164

City of Fortuna Zones: Freeway Commercial (FC), Commercial Throughfare (CT), Retail Commercial (RC), Light Industrial (M1)
Data Source: Fortuna Municipal Code, Chapter 17.03

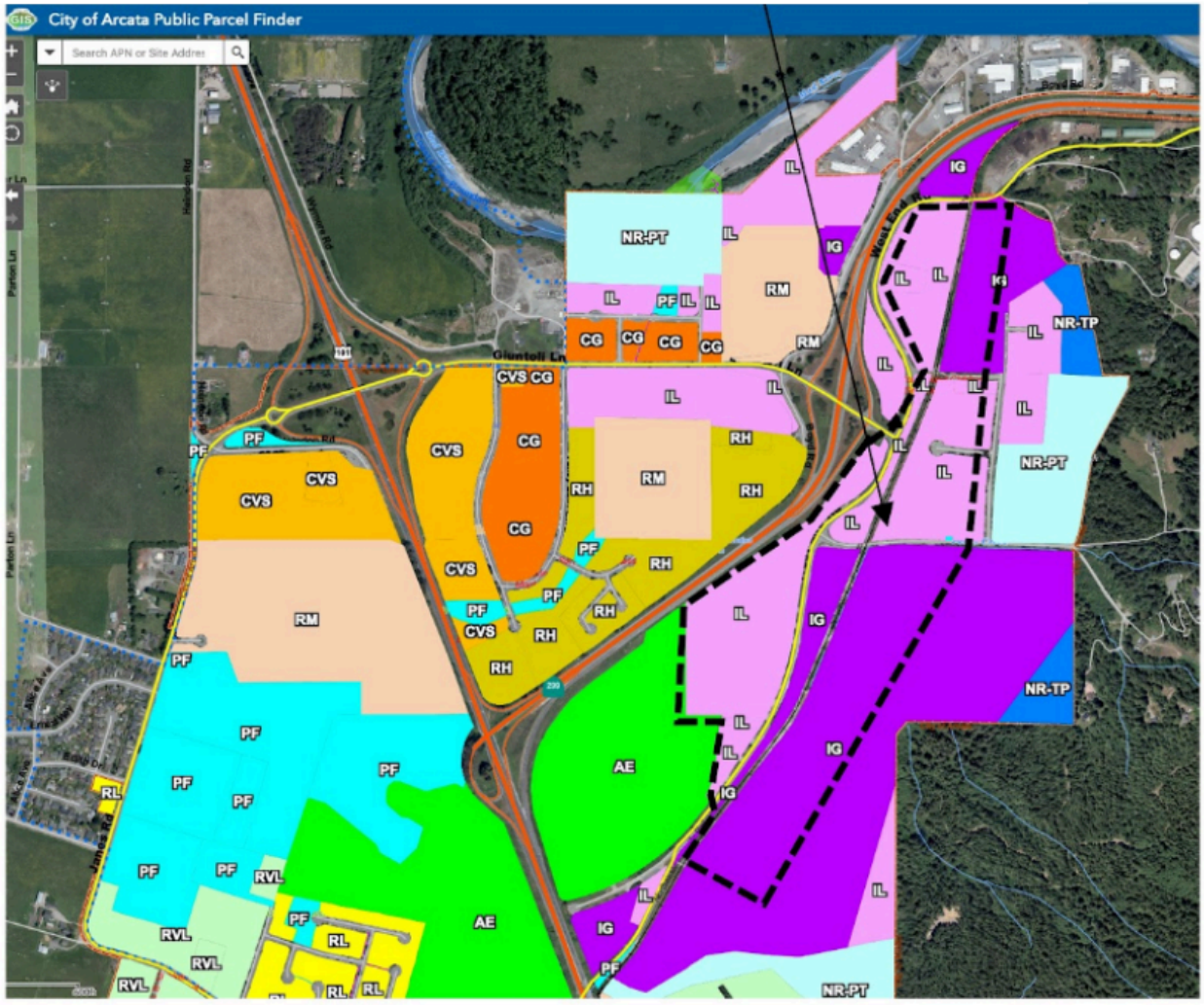
Zones listed are where Gasoline or Automobile Service Stations are a principally or conditionally permitted use.

Appendix B - Land Use / Zoning Maps

1. **High Priority Areas in Eureka**

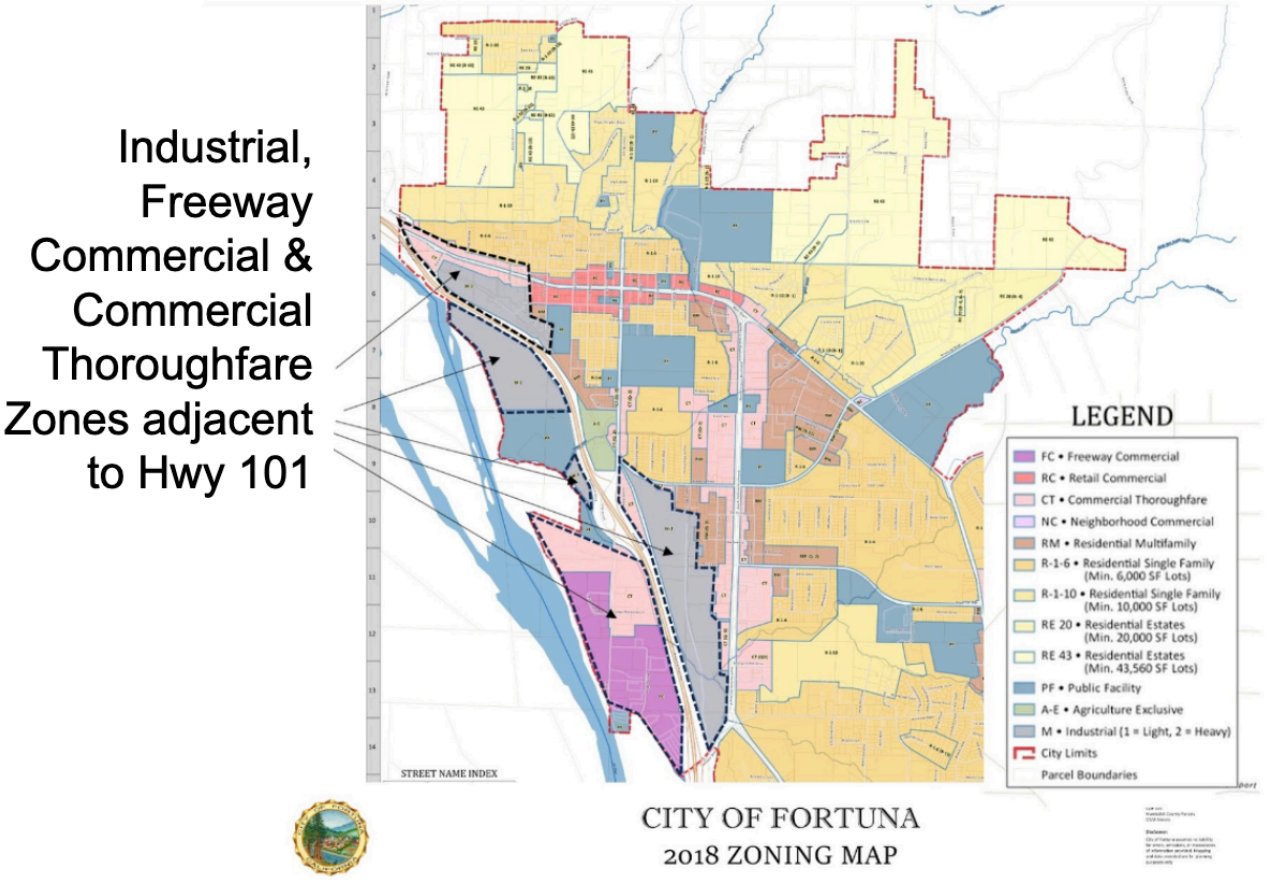


2. High Priority Areas in Arcata



*Note: Zones of interest outlined with black dashed line.

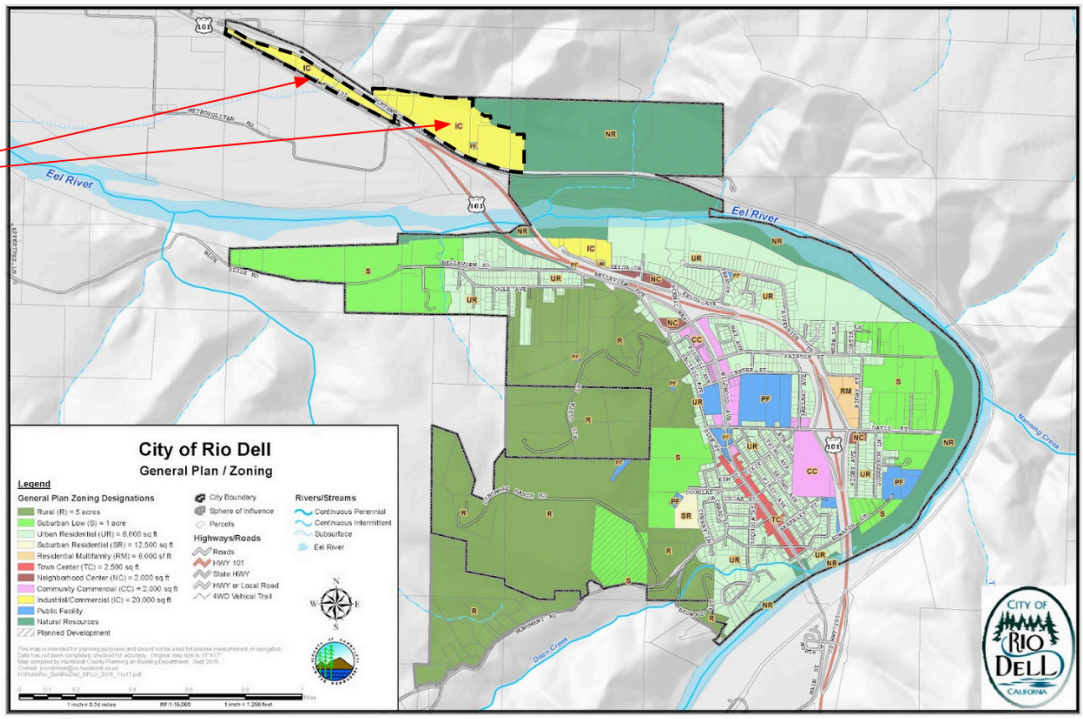
3. High Priority Areas in Fortuna



*Note: Zones of interest outlined with black dashed line.

4. High Priority Areas in Rio Dell

Industrial/ Commercial Zones adjacent to Hwy 101



*Note: Zones of interest outlined with black dashed line.