



September 16, 2009

SUBJECT: Request for Information (RFI 01-09-BRP)  
WaveConnect Pilot Facility  
Eureka, California, USA

Dear Potential Power Producer:

PG&E is submitting this Request for Information (RFI) about your firm's Wave Energy Converter System (WECS). This RFI solicits pertinent information about your equipment and firm to help PG&E determine the most qualified firms and their WECSs that may be available to the PG&E WaveConnect pilot project. Only qualified firms, as determined by PG&E, will receive a RFP soliciting offers for WECS at PG&E's WaveConnect Pilot Facility in Humboldt County, California (Figure 1). PG&E is also considering a second site.

The outcome of the pilot will likely determine which WECS provider(s) PG&E will deploy for a full scale facility at the end of the pilot phase in 2018. Each supplier must have previously performed an ocean test of a scale prototype for your RFI responses to be considered.

Please provide the information as requested in Attachment 1.

Suppliers should register promptly at <https://www.poweradvocate.com/publicSetupRegistrationEmail.do> to be able to respond to this RFI. Note that all correspondences for this RFI shall go through the Power Advocate website.

For questions about this RFI:

- o All questions will have both the question and answer provided to all firms.
- o Each firm will be allowed one set of questions and shall be received by PG&E no later than noon PT, September 29, 2009.
- o PG&E will make reasonable effort to issue answers no later than October 2, 2009, 5:00 p.m. PT.

Your firm's responses must be received at the <https://www.poweradvocate.com> site no later than noon PT on October 9, 2009. **Information received after that time will not be accepted.**

This RFI including questions and answers will also be available at PG&E's WaveConnect website at <http://www.pge.com/about/environment/pge/cleanenergy/waveconnect/relateddocuments.shtml>.

Subject to final FERC approval, the WaveConnect project will be a five (5) MW (nominal) per site wave energy powered, renewable resource facility from approximately four WEC suppliers for each site and would consist of independent multiple WEC systems including four "home run" electrical transmission lines and associated power conditioners at an onshore substation. These systems will thereafter be joined to the PG&E grid infrastructure (local grid voltage is 60 KV). Figure 2 denotes the gross equipment scope of supply for PG&E and each successful firm.

PG&E will be the sole and exclusive interface for all stakeholder interaction including the environmental and regulatory permitting with support from the successful suppliers. This includes interaction with all pertinent California and Federal agencies, including the California Public Utilities Commission (CPUC). PG&E's efforts will accelerate entry into California's market and should enable the highest probability of business success for PG&E's WECS suppliers.

PG&E will provide the power island (i.e.; WaveConnect interface), transformers, and other utility interconnect equipment. The successful suppliers will provide the required WECS, moorings, and both



the male and female electrical connector at the homerun cable, and the onshore power conditioning required for interconnect to the PG&E system. PG&E will take the lead in the management and the placement of WECS and their moorings through coordination with the WEC supplier and local facilities.

The supplier should keep in mind that this is a pilot facility and its objective is to discern its ability to scale up to a commercial power plant. Therefore, the area that we will be working in may not be representative of a full scale operation. The space requirements that may be needed for a commercial power plant may not be an issue here. A successful pilot project and transparent interaction with the local community is of prime importance and should enable the viability of a longer term wave energy facility.

Safety is a primary consideration for PG&E in all its operations. PG&E will require that each supplier will build, operate and maintain its WECS safely in accordance with PG&E's safety standards and practices and all other governing regulations including those of the U.S. Coast Guard and U.S. OSHA.

PG&E expects to issue the RFP in November 2009 and start negotiations early 2010.

The overall project timeline is:

Date	Activity
2009-2010	PG&E prepares initial permitting, environmental impact, and stakeholder interaction tasks
1Q 2010	PG&E submits final application to FERC
2010-2011	PG&E finalizes contracts with WECS suppliers
1Q 2012	FERC and resource agencies review and grant pilot construction and operation license
2011-2012	Pilot plant construction
2Q 2013	<b>Delivery of WECS. WECS ready for sea</b>
2013-2018	Operation, testing and monitoring

Your responses to the RFI will assist PG&E in setting the functional requirements for the RFP; and in seeking funds from the CPUC, the DOE, and other interested parties.

PG&E looks forward to your response.

Sincerely,

*B. R. Phillips*

B. R. Phillips  
Sr. Contract Administrator

BRP:wgc  
Attachments

CC (via e-mail):  
B. McDonald  
W. Toman  
B. Doohar  
D. Price  
Contract Files

B23J/77 Beale Street

## Request for Information

Item	Category or Specification Section	Submittal Required	Bidder's Response or Reference to Proposal Section Containing the Response
1.	General Description	State the company name, WECS name, and company website, as well as the main company point of contact for future communications. Provide a digital photograph of the most advanced prototype or system and the largest scale the WECS (including its location) has been tested or operated.	
2.	Technology System Description and Characteristics	Describe in general the principal of operation of the WECS. Describe in general the WECS components and how the WECS operates and is maintained.	
3.	Technology System Description and Characteristics	Theoretical or measured power output matrix based on Tp and Hs (Re: Figure 3). What is the WEC's preferred or optimal operating depth, and what is the depth range and ocean characteristics (i.e.; minimum and maximum range, maximum sea state, other ocean factors) that the WECS is designed to work within.	
4.	Technology System Description and Characteristics	Power Take Off (PTO): Describe how power is produced, including any potential hazardous materials that may be used or generated. Provide a description and estimate of the on-board volume of the working fluid(s) including anti-fouling/hazardous materials.	
5.	Technology System Description and Characteristics	Anchoring and Mooring Methods: Describe moorings that would be required including the estimated mass and dimensions including Adobe-formatted .pdf schematics.	

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6.	Technology System Description and Characteristics	Anchoring and Mooring Placement: Describe the amount of sea surface area and sea floor areas that would be required for your proposed WECSs at 45 m depth. Provide a scaled graphical representation using the cross sectional depth-to-seafloor representation as provided in Figure 4 for a 2.5 MW and a 5 MW configuration assuming that the WECS has 1, 2, or 3 rows. Use supplied average yearly sea state (Re: Figures 5 and 6).	
7.	Technology System Description and Characteristics	Provide the expected nameplate rating of the device. Provide the expected production based on 45 m depth and provided sea states (Re: Figure 5). Provide operating capacity factors on an annual basis. Describe downtime events, activities and durations when WECS is operating at less than 100% capacity.	
8.	Technology System Description and Characteristics	Describe WECS mechanical and electrical efficiency and the points in the system at which these efficiencies are determined. State WECS overall wave-to-power conversion ratio at maximum output.	
9.	Technology System Description and Characteristics	Describe the electrical power connection between the WECS and the WaveConnect system. State operational characteristics, and how the WECS will interconnect with each other and the WaveConnect system. Provide an Adobe formatted .pdf schematic based on the earlier configuration assumption of 1, 2, and 3 rows.	
10.	Technology System Description and Characteristics	Power conditioning and grid interconnect characteristics (general type): Describe power conditioning method(s) for on-shore conditioning. State normal system output voltage.	

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11.	Technology System Description and Characteristics	Describe what monitoring is used with the WECS including any safety or locational monitoring. Describe the telemetry methods that your WECS uses for on-shore communication.	
12.	Technology System Description and Characteristics	State the diameter or length/width of WECS on surface and WECS mass. State WECS displacement and draft including an Adobe-formatted .pdf of the cross section schematics in three dimensions (if not symmetric) and show draft line.	
13.	Technology System Description and Characteristics	Describe preferred method for installation and preferred method for maintenance. Describe the shore side logistics requirements for operations, maintenance and decommissioning of WECS during and after the five year period of the pilot.	
14.	Experience	Describe the deployment history or any pilot or operational tests conducted by your firm in the last three years including any commercial efforts that have existed or are planned going forward. Describe any specific permitting or licensing efforts to date. Provide a complete description for each project, including power output, sea state, scale of test and the length of test. Provide details for each test. Describe past and future development milestones. Provide, as applicable, contact information for independent references knowledgeable of your project, including company, name and contact.	
15.	Experience	Describe major lessons learned for installation, operations, maintenance and decommission of WECS.	

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Item	Category or Specification Section	Submittal Required	Bidder's Response or Reference to Proposal Section Containing the Response
16.	Team Qualifications	Provide a description of your corporate organization, identification of business units and identification of the organizations that will support this project.	
17.	Commercial	State your firm's best overall estimate of the costs of an approximate 1.5 MW installation and the uncertainty of your estimate (excluding environmental impact reports and home run cable installation).	
18.	Commercial	Ownership by Others: Provide any ownership or rights of others to proprietary items or any aspect of the work that could impact PG&E's ability to complete a 5+ year pilot project.  Provide description of item(s) and nature of ownership including material terms that could impact PG&E.	
19.	Project Controls & Schedule	Describe material considerations to meet the schedule in the cover letter.	
20.	QA & Safety	Provide a description of your company's quality and safety programs including table of contents for each program's manual.	
21.	Anchoring and Mooring Methods	Describe moorings that would be required including the estimated mass, dimensions, and number, including Adobe-formatted .pdf schematics. State the design yield criteria of the mooring cables and the maximum design force expected on each cable based on depth and sea state. Provide any other considerations you have designed into your mooring criteria.	

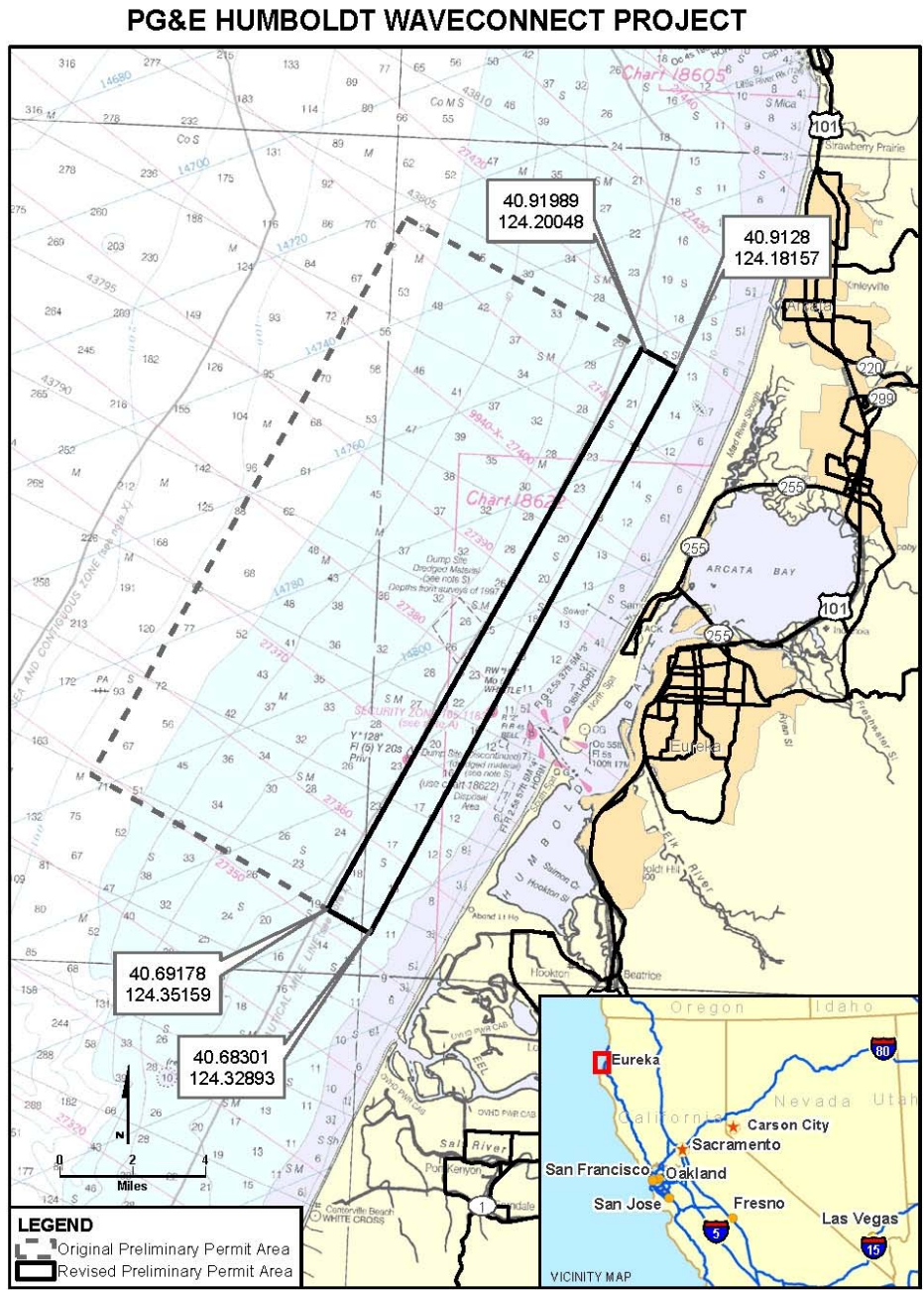


Figure 1: Approximate area of WaveConnect site, Eureka, CA.

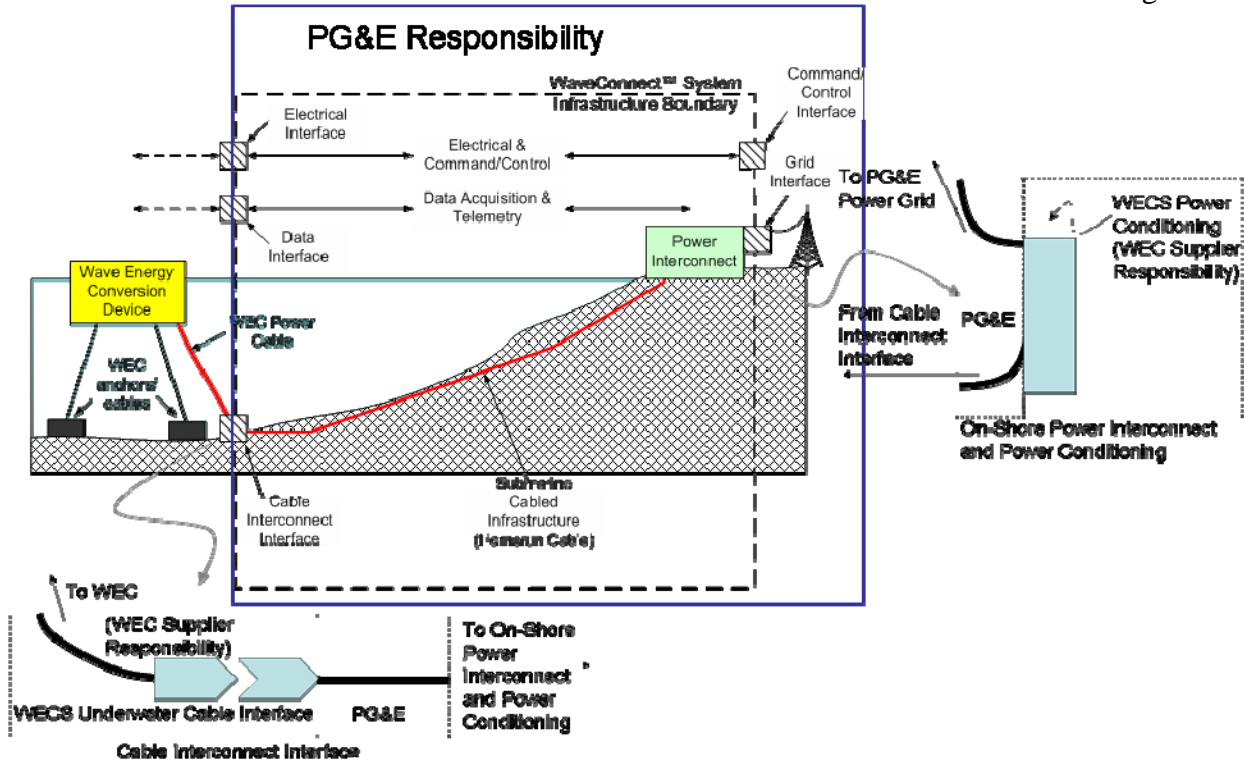


Figure 2: Wave Energy Conversion system schematic and equipment responsibility.

	T <sub>p</sub> (s)																		
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
10	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
9.5	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
9	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
8.5	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
8	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
7.5	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
7	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
6.5	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
6	597	630	663	684	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
5.5	428	497	566	612	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
5	259	364	469	539	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
4.5	94	233	371	467	735	744	738	634	626	520	473	390	382	319	299	250	208	208	208
4	105	216	326	394	632	616	583	585	494	454	374	361	339	283	236	197	153	153	153
3.5	0	86	211	326	484	577	568	502	421	394	330	312	260	216	196	164	140	140	140
3	0	91	180	246	402	424	417	369	343	331	275	229	208	173	144	120	93	93	93
2.5	0	7	93	171	279	342	351	320	274	230	210	174	145	120	100	84	65	65	65
2	0	0	66	109	199	219	225	205	195	162	135	112	93	77	64	54	41	41	41
1.5	0	0	26	62	112	141	143	129	110	91	76	63	52	43	36	30	23	23	23
1	0	0	11	27	50	62	64	57	49	41	34	28	23	0	0	0	0	0	0
0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 3: Wave Energy Conversion Absorption Performance (kW) in each Seastate (Excluding Power Take Off losses). Source: E2I EPRI Global – 006A – SF, 2004.



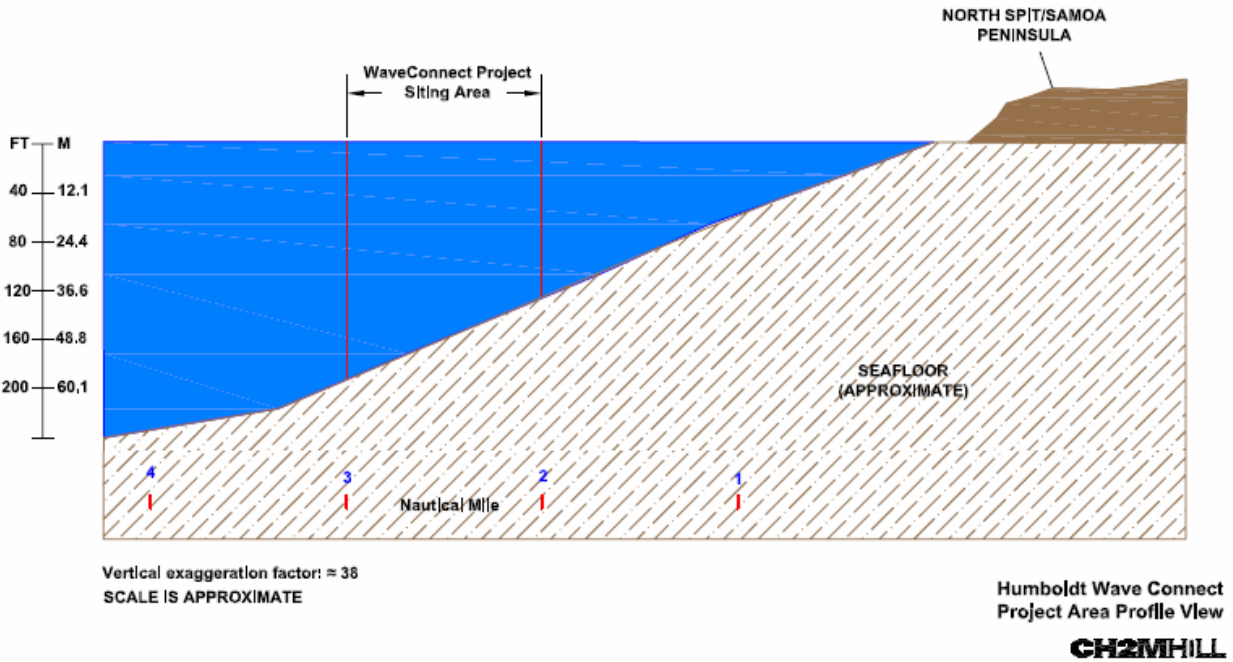


Figure 4: Typical Elevation Cross Section to 3-mile limit at Eureka, CA.

**Average Number of Hours at Particular Wave Height and Period Per Year**

		Wave Period (s)																		
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Wave Height (m)	0.5	0	0	0	0.9	0.3	0	0	0.3	0.4	0	0.2	0.4	0	0	0.1	0	0	0	0
	1	3.9	18	59	126	127	80	40	58	28	13	24	42	27	18	18	0	4.8	0	1.1
	1.5	1.5	26	133	206	288	309	163	178	111	64	57	46	15	29	26	0	4.6	0	0
	2	0.9	6.4	51	215	306	273	175	254	184	110	99	66	12	39	35	0	14	0	0.9
	2.5	0	1.5	10	98	351	218	145	241	240	113	89	68	13	30	26	0	8.5	0	1.2
	3	0	0	2.7	30	164	206	84	168	207	110	85	57	15	23	25	0	7.5	0	0.7
	3.5	0	0	0.4	5.3	41	116	60	102	145	113	79	62	10	25	14	0	3.4	0	2.4
	4	0	0	0	1	7.2	36	25	49	86	65	59	43	5.1	15	11	0	4.1	0	2.9
	4.5	0	0	0	0	0.2	9	9	19	39	35	39	25	4	12	7.4	0	2.6	0	2
	5	0	0	0	0	0	1.2	3.9	8.8	11	14	18	17	0.9	11	6.5	0	2.9	0	0.8
	5.5	0	0	0	0	0.4	0.5	1.2	1.9	3.8	5.5	8.1	12	1.1	5.2	3.9	0	2.5	0	0
	6	0	0	0	0	0	0	0.2	0.8	1.2	1.5	4.3	4.6	1	2.4	1.9	0	0.6	0	0
	6.5	0	0	0	0	0	0	0	0	0.7	1	2.4	3.2	0.5	0.4	0.7	0	0	0	0
	7	0	0	0	0	0	0	0	0	0.5	0.7	0.7	1.8	0.2	1.2	1.2	0	0.3	0	0
	7.5	0	0	0	0	0	0	0	0	0.2	0.2	0.4	0.5	0.1	0.8	0.3	0	0	0	0
	8	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.3	0.3	0.5	0	0	0	0
8.5	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0.3	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	0	0.1	0.3	0	0	0.3	0	0	0	0	

Note: 2008 and 2009 distributions were multiplied by 0.5 to accommodate for half-hourly measurements.  
Certain months with too few of data points were removed from analysis

Figure 5: Average Hourly Sea State Distribution at Humboldt Bay. 2004 – 2009 (NDBC Buoy 46212).

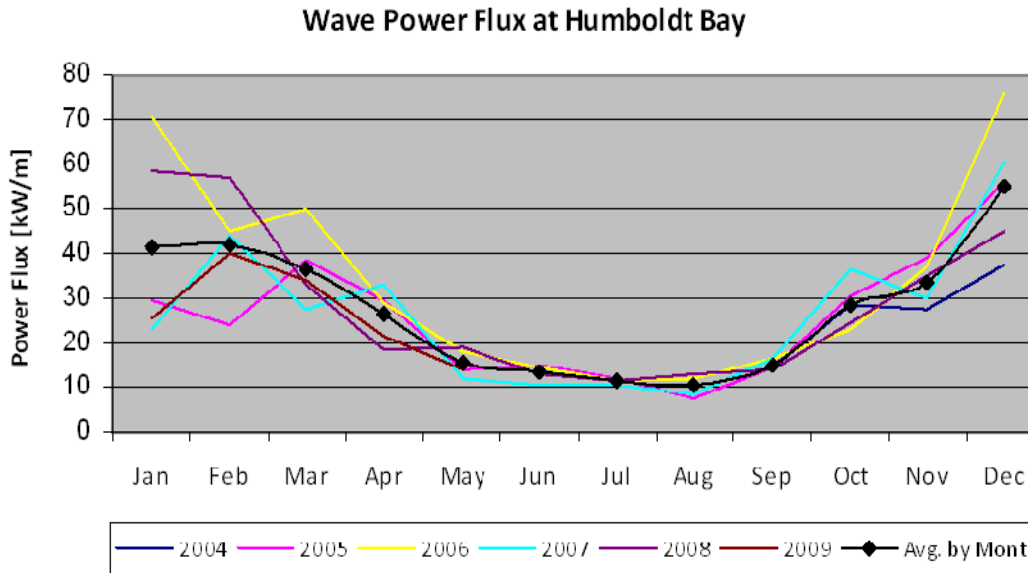


Figure 6: Monthly Estimated Power Flux at Humboldt Bay. 2004 – 2009 (NDBC Buoy 46212).

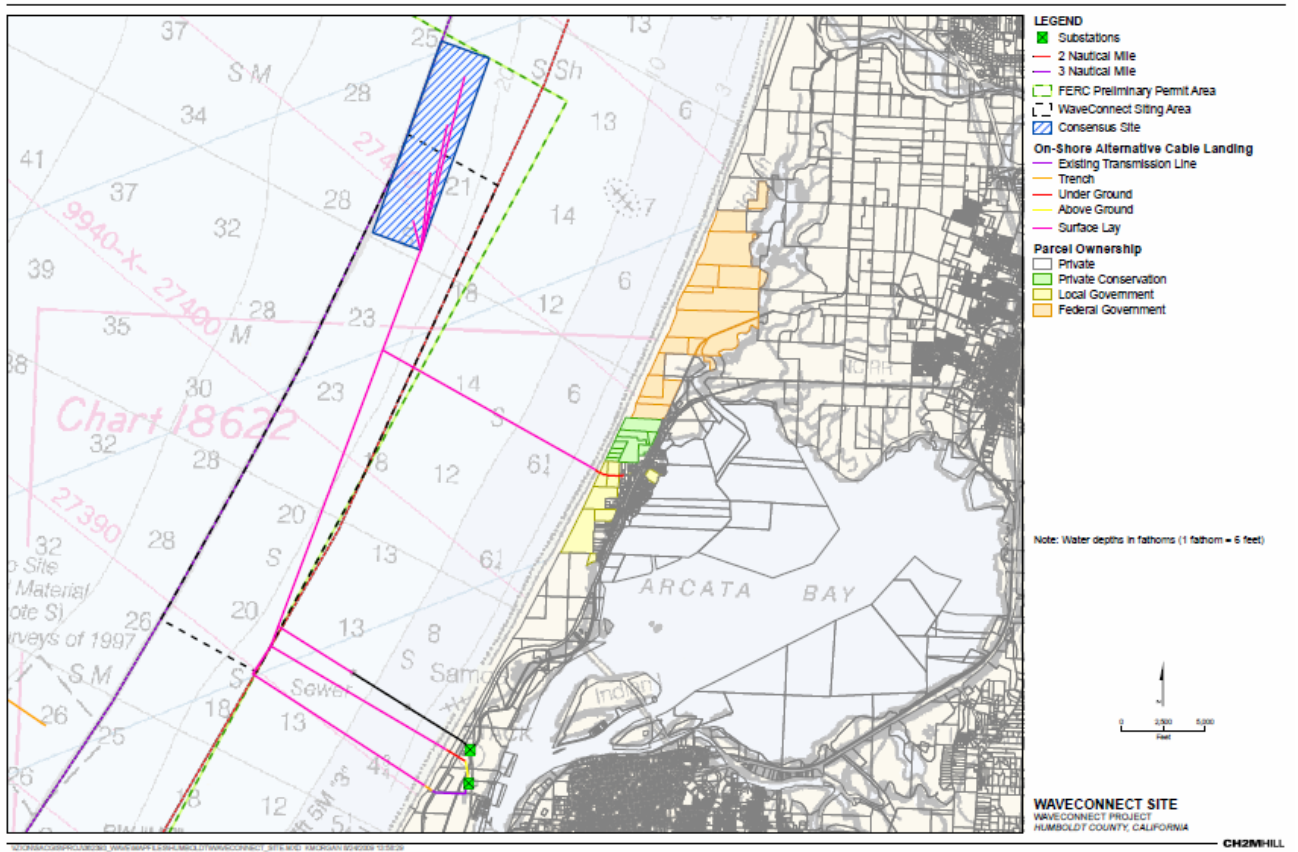


Figure 7: Proposed Pilot area and preliminary cable landing locations (based on discussions with local community groups).

## RFI Protocol

The WaveConnect RFI has been issued to numerous companies. In order to maintain a level and consistent “playing field” in the course of receiving information about their wave systems, please refrain from any discussions or correspondences pertaining to the RFI itself. If the competing companies or other associated parties have question about the RFI, they are to submit such through the RFI website at <https://www.poweradvocate.com>.

## UNOFFICIAL RFI INFORMATION NOTICE

The below statements must be added to all RFI files that are posted or distributed to any party except for PG&E or its project team.

“The information contained herein is for information only and may not be the most current and shall not modify, affect, replace, or supercede the RFI information at <https://www.poweradvocate.com>. The information at this website shall govern. This disclaimer applies to all information provided.”