TENERA Environmental

TECHNICAL MEMORANDUM

April 26, 2017

To: Mr. Jearl Strickland, PG&E
Mr. Mark Krausse, PG&E
Mr. Bryan Cunningham, PG&E

From: John Steinbeck, Tenera Environmental

Subject: Revised Proposed Calculation for Site-Specific Interim Mitigation Fee for Diablo Canyon Power Plant (DCPP)

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This memorandum provides a proposed approach to calculate a site-specific interim mitigation fee to compensate for the effects of entrainment at the DCPP, as allowed under the Once – Through Cooling Policy (SWRCB Resolution 2010-0020) and SWRCB Resolution No. 2015-0057 (2015 Resolution). The first section (Section 1.0) of this technical memorandum provides background on the existing estimates used to calculate the current default average interim mitigation fee of $4.60 per million gallons (MG) of intake flow. This memorandum has been revised from an earlier memorandum dated November 16, 2016 and provided as part of PG&E's December 1, 2016 submittal to the SWRCB. The rationale for the changes made from the previous memorandum is provided in Section 2.0. The basis for adjusting the mitigation fee for the DCPP by incorporating new habitat production foregone (HPF) estimates from a more recent 2008–2009 study is provided in Section 3.0. The final section (Section 4.0) presents the proposed interim mitigation fee for the DCPP based on the information in the other sections.

1.0 Background to Proposed SWRCB Fee

The basis for the proposed entrainment fee is the value of $4.60 per MG provided in the 2015 Resolution. The attachment to the resolution includes a table showing an average estimate of $2.45 per MG. This estimate is lower than $4.60 per MG because it is based on a cost projection using a basis year of 2012, instead of 2016, and a project life of 50 years instead of 30 years. The estimate of $4.60 per MG in the 2015 Resolution can be derived by changing the base year to 2016 and the project life to 30 years.

The Information Sheet for the 2015 Resolution also includes a mitigation fee estimate of $5.17 per MG.[1] That estimate includes an increase of 3% per year for 5 years to account for the time between the start of the mitigation project and the "cost projection year". As pointed out in a

[1] Proposed Resolution Delegating Authority To The Executive Director To Approve Interim Mitigation Measures Under The Once-Through Cooling Policy Information Sheet. State Water Resources Control Board 2015.

report prepared by Dr Stephen Hamilton,[2] there is no economic justification for this increase. If entrainment fees commence in 2015 and were adjusted annually for inflation, the entrainment fees paid in 2015, the year used in the entrainment fee calculation in the 2015 Information Sheet, grow over time to match the escalation in mitigation cost. Escalating costs for 5 years from the base year of the entrainment fee and also adjusting the fee upwards each year to account for inflation amounted to double-counting. An economically accurate entrainment fee is based on 2015 mitigation costs (per MG), adjusted annually for inflation.

The estimate of $4.60 per MG in the 2015 Resolution was calculated from projects at five locations. Although the mitigation costs for all five projects were based on HPF calculations, the target habitat for the mitigation associated with the DCPP was rocky reef, while the mitigation costs for the other four projects were based on wetland habitat. As provided for in the 2015 Resolution (Section 10.a.i.1), site-specific data can be used to calculate HPF values for a facility rather than using the average value. This is especially appropriate for the DCPP where the habitat associated with mitigation is different from four of the five projects used in calculating the average mitigation fee of $4.60 per MG.

Therefore, the basis for the interim mitigation fee at the DCPP should be $3.12 per MG in **Table 1**, which is based on data from an intake assessment study at the DCPP conducted from 1996–1999 (1996–1999 Study) and a draft estimate of mitigation for DCPP that was prepared for the Central Coast Regional Water Quality Control Board (CCRWQCB), the Diablo Canyon Power Plant Independent Scientists Recommendations to the Regional Board Regarding Mitigation for Cooling Water Impacts (2005 Independent Scientists Draft Recommendations).

Table 1. Data from table in the attachment to SWRCB Resolution No. 2015-0057 showing calculation of entrainment mitigation fee of $4.60 per MG based on project life of 30 years and use of 2016 as the basis year for the calculations.

Annual Cost Escalator	3%
Estimated Years of Mitigation	30
Estimated Years of Operation	30
Cost of Management (%)	20%
Basis Year for Fee	2016

Project	Daily Intake Flow (mgd)	Annual Flow (MG)	HPF (acres)	Type*	Project Cost ($)	Cost($) per MG per year	Year of Assessment	Years between Assessment and Basis Year	Cost Escalator	Cost Escalator Factor	Cost in 2016 dollars	Prorated 2016 Costs ($)	Cost ($) per MG
MLPP	360	131,400	840	W	15,100,000	114.92	2000	16	3.00%	1.60	184.41	184.41	6.15
MBPP	371	135,415	760	W	13,661,905	100.89	2001	15	3.00%	1.56	157.18	157.18	5.24
Poseidon	304	110,960	37	W	11,100,000	100.04	2009	7	3.00%	1.23	123.03	123.03	4.10
HBGS	126	45,990	66	W	4,927,560	107.14	2009	7	3.00%	1.23	131.77	131.77	4.39
DCPP	**2670**	**974,550**	**543**	**R**	**67,875,000**	**69.65**	**2006**	**10**	**3.00%**	**1.34**	**93.60**	**93.60**	**3.12**
Averages						**98.53**					**138.00**	**138.00**	**4.60**

* – Mitigation Project Type: W = wetland, R = artificial reef, mgd = millions of gallons per day, MG – million gallons, MLPP – Moss Landing Power Plant, MBPP – Morro Bay Power Plant, Poseidon – Poseidon Carlsbad Desalination Project, HBGS – Huntington Beach Generating Station, DCPP – Based on estimates from 1996–1999 Diablo Canyon Power Plant Intake Study

[2] Memorandum to John Steinbeck, Tenera Environmental from Dr. Stephen F. Hamilton, Ph.D, Cal Poly San Luis Obispo on Economic Assessment of the Proposed SWRCB Entrainment Fee, July 6, 2015.

2.0 Changes from November 16, 2016

The earlier memorandum dated November 16, 2016 presented a proposed interim mitigation fee that was based on information provided in the 2005 Independent Scientists Draft Recommendations. There are two versions of 2005 Independent Scientists Draft Recommendations: an original version dated January 2005, and a revised version dated July 2005. Both drafts include numerous estimates of HPF. The estimate of 543 acres in SWRCB Resolution No. 2015-0057, does not directly match any of the estimates in either version. The HPF estimate in the November 16, 2016 memorandum focused on the January version of the recommendations and provided a rationale for adjusting the HPF estimate as a correction of a possible typographical error (543 should have been 593) based on the HPF estimates provided in that report. However, after further review of the revised July 2005 draft and discussions with the SWRCB staff, a decision was made to use the original estimate of 543 acres included in the SWRCB Resolution No. 2015-0057, since that estimate is reasonably close to the average of the estimates in the revised July 2005 version of the Independent Scientists Draft Recommendations.

3.0 Basis for Proposed DCPP Interim Mitigation Fee

As previously mentioned, the OTC Policy and 2015 Resolution (Section 10.a.i.1) allow for site-specific data to be used to calculate HPF values for a facility for use in the mitigation fee rather than using the average value. This is especially appropriate for the DCPP where the habitat associated with mitigation is different from four of the five projects used in calculating the average mitigation fee of $4.60 per MG. Although the information in the previous section provides background on the source of the DCPP mitigation fee of $3.12 per MG referenced in the appendix to the 2015 Resolution, additional information is presented in this section that is incorporated into the revised DCPP interim mitigation fee presented in Section 4.0.

In addition to the HPF estimates from the 1996–1999 Study in the attachment to the 2015 Resolution (**Table 1**), HPF estimates to compensate for the effects of entrainment at the DCPP were also calculated from data collected during an intake assessment in 2008–2009. The sampling design for the 2008–2009 intake assessment (2008–2009 Study) was consistent with entrainment studies conducted at several other power plants in California since the earlier DCPP study in 1996–1999. Similar to the 1996–1999 Study, a technical advisory group was convened to review the study design and provide comments on the sampling and analysis methods. This Technical Workgroup (TWG) was composed of staff from PG&E and their consultants, Tenera Environmental Inc, Dr. Peter von Langen from the CCRWQCB and Drs. Gregor Cailliet, Michael Foster, John Largier, and Peter Raimondi, who were consultants to the CCRWQCB. The study plan was submitted to the TWG for review, and was approved following a meeting in May 2008. The sampling for the study began in July 2008.

The source water sampling design for the 2008–2009 Study, which was approved by the TWG, was similar to other recent studies but was not as spatially extensive as the sampling grid design used in the 1996–1999 Study. The source water sampling was done monthly in both studies and included six of the original 64 source water stations from the 1996–1999 Study. These six stations were positioned along a transect heading straight offshore from the entrainment sampling locations inside the DCPP Intake Cove.

The estimation of the source water for the empirical transport model (ETM) analysis in the 2008–2009 Study was initially intended to be based on data from two acoustic Doppler current profiler (ADCP) instruments using an approach similar to the 1996–1999 Study. As the study progressed we became aware of the availability of data on surface currents from high frequency radar instruments (CODAR) over a large area of the central coast around the DCPP. The instruments were maintained by scientists and technicians at California Polytechnic State University, San Luis Obispo (Cal Poly). A decision was made to utilize the CODAR data in calculating the source water estimates for the ETM. This decision was made because the CODAR data provided much larger spatial coverage of ocean current data than the ADCPs. This also provided more realistic estimates of the source water due to the use of a combination of ADCP and CODAR data resulting in improved estimates of mortality using the ETM. The final methodology and preliminary results from the study were presented, discussed, and approved by the TWG during a meeting in May 2010.

The improvement due to the addition of CODAR data in the estimates of the source water for the ETM also affected the source water areas used in the calculation of HPF. The 2005 Independent Scientists Recommendations notes that there was a considerable degree of uncertainty associated with the source water estimates used in the ETM estimates for the 1996–1999 Study. The uncertainty was directly related to the resolution provided by the data on ocean currents used to estimate the extent of the source water for each taxon. The other large source of uncertainty associated with the HPF estimates was the data used to estimate the areas of habitat in the source water. Data from aerial photographic surveys of kelp beds were used to estimate the area of nearshore rocky reef habitat for the 1996–1999 Study.

The HPF estimates provided in the 2008–2009 Study were calculated using a more detailed approach that included multiple data sources and adjustments based on the depth distribution of the adults of the seven taxa evaluated (**Table 2**). In addition to the greater resolution provided by the CODAR data, the habitat estimates in the 2008–2009 Study were based on recent GIS data on bottom habitats collected from the Seafloor Mapping Lab at the California State University at Monterey Bay (CSUMB). These data were collected along much of the central California coast as part of the California Department of Fish and Wildlife (CDFW) initiative to develop a network of marine protected areas. The estimates of nearshore rocky reef from CSUMB were combined with data on the surface kelp canopy from CDFW to provide more precise estimates of rocky reef habitat, which, similar to the 1996–1999 Study, was the focus of the HPF estimates for the 2008–2009 Study (**Attachment Table A1**). This approach greatly improved the estimates of HPF for the 2008–2009 Study relative to the estimates provided in the 2005 Independent Scientists Recommendations.

Table 2. Estimates of Habitat Production Foregone (*HPF*) for nearshore rocky reef fish larvae based on nearshore *ETM* estimate of P_M and rocky reef habitat within the source water areas extrapolated from CODAR data. For the taxa with depth limits deeper than 61 m (200 ft), the offshore extrapolated estimates of P_M were used in the *HPF* calculations. From "Draft 2008–2009 DCPP Entrainment Assessment Report."

Taxon	Common Name	Average alongshore distance (km) used in extrapolated source water	CODAR *ETM* P_M (%)	Depth (m) used in determining source water habitat	Estimate of subtidal rocky reef *HPF* (ha [acres])
Cottidae	unid. sculpins	30.7	38.6	91.4	1,331 (3,289)
Artedius spp.	smoothhead sculpins	24.9	20.6	15.0	125 (309)
Orthonopias triacis	snubnose sculpin	20.6	19.8	30.5	251 (621)
S. marmoratus	cabezon	8.4	8.6	91.4	70 (172)
Sebastes spp. V_	KGB rockfish complex	9.1	12.6	86.0	104 (257)
Sebastes spp. V	blue rockfish complex	7.2	5.2	91.4	44 (109)
Rhinogobiops nicholsi	blackeye goby	4.8	18.5	76.2	30 (74)
				Average *HPF* =	**279.3 (690)**

The more accurate source water and habitat estimates used with the data from the 2008–2009 Study result in an HPF estimate of 690 acres, which results in a fee of $3.96 per MG as shown below.

HPF (acres)	2006 Cost ($125,000 per acre)	Cost per MG per year	Cost Escalator	Cost Escalator Factor	Cost in 2016 dollars	Mitigation Years	Annual Mitigation Fee
690	$86,250,000	$88.50	3.00%	1.34	$118.94	30	$3.96

The HPF estimates from the two studies are not dramatically different given the potential for large interannual variation in biological populations and the differences in the design of the two studies. The consistency in the results is an expectation of the ETM, which relies on estimates of proportional loss to the source water that should be less subject to variation among years if the intake volume is constant. This also adds to the confidence in the estimates from both studies.

4.0 Proposed DCPP Interim Mitigation Fee

The information above is used to recalculate the interim mitigation fee for the DCPP. As provided for in the 2015 Resolution, site-specific data can be used in calculating the interim mitigation fee. Using a site-specific interim fee for DCPP is appropriate for the following reasons:

- DCPP has data available from two separate comprehensive entrainment assessments. The study approach and data from both studies have been reviewed by independent technical workgroups;
- The results of the two studies are relatively consistent given the significant interannual variability, which is expected from the ETM approach used in both studies;

- DCPP is the only plant where entrainment impacts are associated with rocky reef habitat and thus, using site-specific data to calculate the fee is reasonable, as it based directly on both the acreage and the type of habitat impacted; and
- Using site-specific data increases the confidence in the estimated interim mitigation fee for the DCPP.

Given that Diablo Canyon has two robust and consistent evaluations of entrainment impacts and determinations of HPF, it is recommended that the DCPP interim mitigation fee be calculated using the average of the two separate studies. As shown in **Table 3**, this would result in an interim mitigation fee of $3.54 per MG, as compared to the $3.12 currently listed in the appendix to the 2015 Resolution.

Table 3. Table showing adjusted mitigation fees for the DCPP using corrections to data presented in the attachment to SWRCB Resolution No. 2015-0057. The data for both the DCPP 1996–1999 and 2008–2009 intake assessments are shown.

* – Mitigation Project Type: W = wetland, R = artificial reef, mgd = millions of gallons per day, MG – million gallons

1996–1999 – Estimates from 1996–1999 Diablo Canyon Power Plant Intake Assessment Study

2008–2009 – Estimates from 2008–2009 Diablo Canyon Power Plant Intake Assessment Study

Annual Cost Escalator	3%
Estimated Years of Mitigation	30
Estimated Years of Operation	30
Cost of Management (%)	20%
Basis Year for Fee	2016

DCPP Study Year	Daily Intake Flow (mgd)	Annual Flow (MG)	HPF (acres)	Type*	Project Cost ($)	Cost($) per MG per year	Year of Assessment	Years between Assessment and Basis Year	Cost Escalator	Cost Escalator Factor	Cost in 2016 dollars	Prorated 2016 Costs ($)	Cost ($) per MG
1996-1999	2670	974,550	543	R	67,875,000	69.65	2006	10	3.00%	1.34	93.60	93.60	3.12
2008-2009	2670	974,550	690	R	86,250,000	88.50	2006	10	3.00%	1.34	118.94	118.94	3.96
												Average for DCPP	**3.54**

Attachment A – Table and maps showing habitat and source water areas for each of the taxa evaluated from the 2008–2009 DCPP Intake Assessment

Table A1. Area estimates from GIS of surface canopy kelp from the California Department of Fish and Wildlife (CDFW) and on hard substrate habitat from nearshore multibean surveys conducted by the California State University of Monterey Bay (CSUMB) habitat mapping group. Area where kelp coverage overlapped hard substrate habitat also presented. Estimates based on data out to depth presented for each taxon.

Taxa	Depth of Source Water Extent (m)	CSUMB Hard Substrate (hectares [acres])	CSUMB Hard and Kelp Overlap (hectares [acres])	Kelp (hectares [acres])	Combined Kelp and Overlap (hectares [acres])	All Hard and Kelp Habitat (hectares [acres])
unidentified sculpins	91	6,429 (15,885)	796 (1,968)	1,007 (2,488)	1,803 (4,456)	8,232 (20,341)
smoothhead sculpin	15	554 (1,369)	380 (939)	485 (1,199)	865 (2,137)	1,419 (3,507)
snubnose sculpin	31	2,108 (5,209)	487 (1,203)	517 (1,277)	1,004 (2,481)	3,112 (7,690)
cabezon	91	2,089 (5,163)	273 (674)	218 (538)	491 (1,213)	2,580 (6,376)
KGB rockfish	86	1,986 (4,908)	298 (736)	223 (551)	521 (1,287)	2,507 (6,195)
blue rockfish	91	2,404 (5,939)	369 (911)	250 (619)	619 (1,530)	3,023 (7,469)
blackeye goby	24	528 (1,304)	256 (632)	212 (524)	468 (1,156)	995 (2,460)

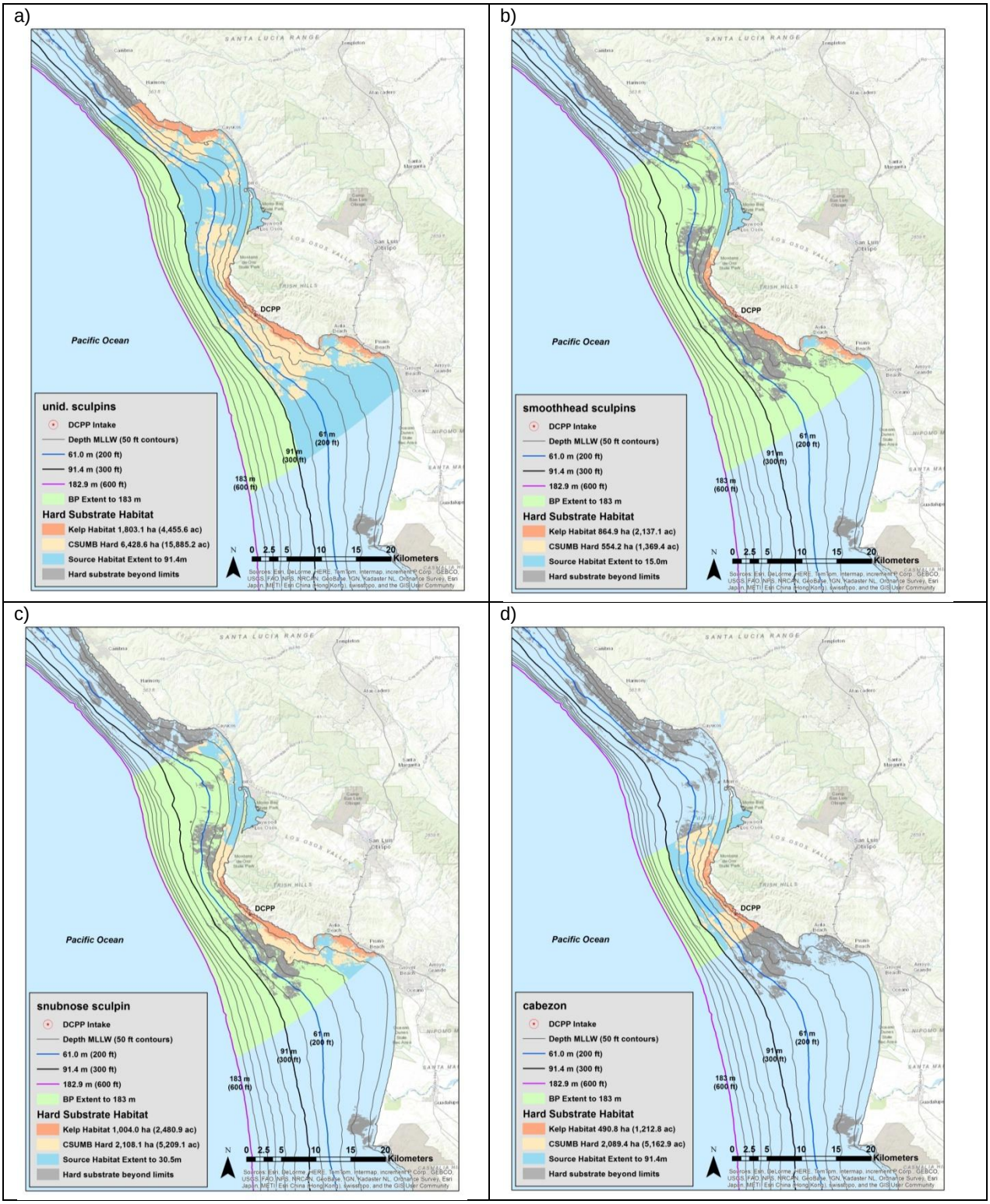

Figure A1. Maps of source water extents and habitat for a) unidentified sculpins, b) smoothhead sculpins, c) snubnose sculpins, d) cabezon, e) KGB rockfish, f) blue rockfish, and g) black eye goby larvae showing habitat areas based on extent of surface canopy kelp cover and hard substrate from multi-beam surveys. Source water extent of back projections (BP) used in ETM shown in blue.

(figure continued)

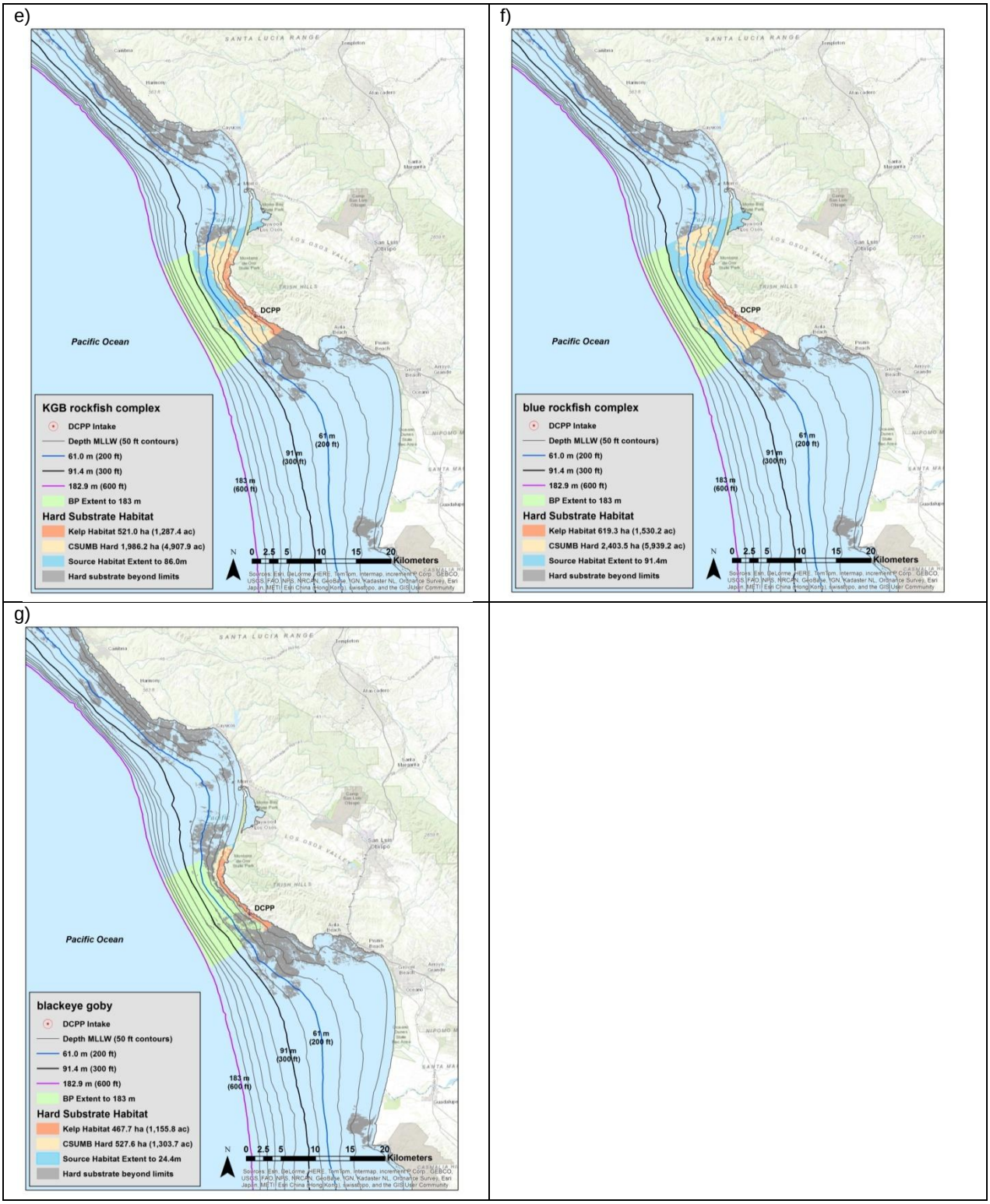

Figure A1 (continued). Maps of source water extents and habitat for a) unidentified sculpins, b) smoothhead sculpins, c) snubnose sculpins, d) cabezon, e) KGB rockfish, f) blue rockfish, and g) black eye goby larvae showing habitat areas based on extent of surface canopy kelp cover and hard substrate from multi-beam surveys. Source water extent used in ETM shown in blue.